



**Stellungnahme zum
Leibniz-Institut für Meereswissenschaften (IFM-GEOMAR)
an der Universität Kiel**

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Vorbemerkung

Der Senat der Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz – Leibniz-Gemeinschaft – evaluiert in Abständen von höchstens sieben Jahren die Forschungseinrichtungen und Einrichtungen mit Servicefunktion für die Forschung, die auf der Grundlage der Ausführungsvereinbarung Forschungseinrichtungen¹ von Bund und Ländern gemeinsam gefördert werden. Diese Einrichtungen haben sich in der Leibniz-Gemeinschaft zusammengeschlossen. Die wissenschaftspolitischen Stellungnahmen des Senats werden vom Senatsausschuss Evaluierung vorbereitet, der für die Begutachtung der Einrichtungen Bewertungsgruppen mit unabhängigen Sachverständigen einsetzt. Die Stellungnahme des Senats sowie eine Stellungnahme der zuständigen Fachressorts des Sitzlandes und des Bundes bilden in der Regel die Grundlage, auf der der Ausschuss Forschungsförderung der Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung (BLK) überprüft, ob die Einrichtung die Fördervoraussetzungen weiterhin erfüllt.

Auf der Grundlage der vom Leibniz-Institut für Meereswissenschaften (IFM-GEOMAR) eingereichten Unterlagen wurde eine Darstellung der Einrichtung erstellt, die mit dem Institut sowie den zuständigen Ressorts des Sitzlandes und des Bundes abgestimmt wurde (Anlage A). Die vom Senatsausschuss Evaluierung eingesetzte Bewertungsgruppe hat das IFM-GEOMAR am 15./16. September 2005 besucht und daraufhin einen Bewertungsbericht erstellt (Anlage B). Auf der Grundlage dieses Bewertungsberichts und der vom IFM-GEOMAR eingereichten Stellungnahme zum Bewertungsbericht (Anlage C) erarbeitete der Senatsausschuss den Entwurf einer Senatsstellungnahme. Der Senat der Leibniz-Gemeinschaft hat die Stellungnahme am 23. November 2006 erörtert und verabschiedet. Er dankt den Mitgliedern der Bewertungsgruppe für ihre Arbeit.

1. Beurteilung und Empfehlungen

Der Senat schließt sich der Beurteilung und den Empfehlungen der Bewertungsgruppe an. Das IFM-GEOMAR führt Untersuchungen an physikalischen, chemischen, biologischen und geologischen Prozessen des Meeres und deren Interaktionen mit dem Meeresboden und der Atmosphäre durch. Die wissenschaftliche Arbeit des IFM-GEOMAR ist sehr gut, in Teilen exzellent. Das Institut genießt international ein sehr hohes Ansehen, was auch durch die Reputation vieler Gruppenleiter aus allen vier Forschungsbereichen bedingt ist, die an der Spitze des jeweiligen Forschungsgebietes arbeiten. Zudem üben die Wissenschaftler des IFM-GEOMAR wichtige Koordinierungsfunktionen auf nationaler und internationaler Ebene wie beispielsweise in groß angelegten Schiffsexpeditionen und EU-Projekten aus.

Seit den letzten Evaluierungen 1997 und 1998 sind die beiden ehemals eigenständigen Institute IfM und GEOMAR erfolgreich zusammengewachsen. Der Direktor des IFM-GEOMAR, der nach dem formellen Zusammenschluss 2004 sein Amt übernahm, trug durch seine Führungsqualitäten wesentlich zum Gelingen der Fusion der beiden Institute bei. Seitdem hat sich das Institut in bemerkenswerter Weise positiv entwickelt, was sich an der Entstehung von vier kohärenten Forschungsbereichen und dem signifikanten Anstieg in der interdisziplinären Zusammenarbeit zwischen den verschiedenen Forschungsgruppen zeigt. Innerhalb kurzer Zeit ist das IFM-

¹ Ausführungsvereinbarung zur Rahmenvereinbarung Forschungsförderung über die gemeinsame Förderung von Einrichtungen der wissenschaftlichen Forschung (AV-FE)

GEOMAR nicht nur zu einem der führenden meereswissenschaftlichen Institute in Deutschland geworden, sondern es steht auch auf gleichem Rang mit den führenden Einrichtungen in Europa und den USA.

Neben der Bearbeitung des gesamten Spektrums der Meereswissenschaften weist das Institut mit der erfolgreichen Verflechtung der Bereiche Modellierung und Beobachtung ein zweites Alleinstellungsmerkmal auf. Das IFM-GEOMAR führt gesellschaftlich relevante Forschung durch, wie beispielsweise zur verbesserten Vorhersage von Georisiken (u.a. Tsunamis). Eine besondere Stärke des IFM-GEOMAR ist seine Expertise in der Entwicklung neuer Tiefsee-Ausrüstung wie komplexer Lander-Systeme.

Herauszuheben sind die sehr erfolgreiche Einwerbung kompetitiv vergebener Drittmittel, die sehr gute Publikationstätigkeit in begutachteten Zeitschriften, das extensive Netzwerk sowie die intensive Öffentlichkeitsarbeit, die auf alle für das Institut relevanten Bereiche ausgedehnt werden sollte. Die positive Beziehung zur Kieler Universität spiegelt sich in vielfältigen Forschungs-kooperationen wider, zu denen auch zwei Sonderforschungsbereiche und ein Exzellenzcluster zählen. Das IFM-GEOMAR bietet das in Deutschland führende Doktoranden-Programm in physikalischer Ozeanographie/Meteorologie an, wodurch ihm eine herausragende Rolle bei der Ausbildung auf diesem Gebiet zukommt. Die Beteiligung an der universitären Lehre ist für das Institut vorteilhaft im Hinblick auf die Rekrutierung des wissenschaftlichen Nachwuchses. Dennoch wird den Professoren am Institut empfohlen, ihre Lehrtätigkeit dem für Wissenschaftler an Leibniz-Instituten angemessenen Umfang anzupassen.

Die Qualifikation der Mitarbeiter des IFM-GEOMAR wird dadurch belegt, dass zwischen 2002 und 2004 neunzehn Wissenschaftler Rufe auf Professorenstellen an führenden Einrichtungen weltweit erhalten haben. Die sehr gute und extrem offene Arbeitsatmosphäre sowie das Forschungskonzept lassen erwarten, dass das IFM-GEOMAR seine beeindruckende Leistungsfähigkeit nicht nur erhalten, sondern zukünftig weiter steigern wird. Um diesem Anspruch gerecht werden zu können, sollte das Institut seine interdisziplinären Kooperationen in einigen Forschungsbereichen intensivieren. Empfohlen wird die Etablierung eines Anreizfonds, der die Integration der verschiedenen Gruppen und Disziplinen fördert. Eine Aufstockung der Mittel für Junior-Research-Gruppen wird angeraten. Die derzeit hohe Anzahl drittmittelfinanzierter Projektdauerstellen muss reduziert werden, weil dadurch die konsequente Verfolgung eines kohärenten Forschungsprogramms gefährdet ist.

Das IFM-GEOMAR führt eine relativ hohe Anzahl von Forschungsfahrten durch, ohne dass genügend Wissenschaftler für eine vollständige Auswertung der Daten zur Verfügung stehen. Dies ist ein strukturelles Problem, das zum Teil das Institut zu verantworten hat und zum Teil auf Besonderheiten des deutschen Forschungsfördersystems beruht.

Die Ausstattung des Instituts ist zufriedenstellend, es bestehen allerdings Defizite bei der Anschaffung und Entwicklung großer seetauglicher Ausrüstung und beim Ersatz veralteter Geräte. Die Pläne des Instituts zur räumlichen Zusammenführung aller Institutsteile in einer neuen Anlage auf dem Ost-Campus im Jahre 2010 werden begrüßt. Um den Fusionsprozess weiter zu beschleunigen, sollte das Institut in die Lage versetzt werden, den Umzug um ein Jahr vorzuziehen. Die administrative Unterstützung durch die Verwaltung des IFM-GEOMAR ist verbesserungsfähig.

Der Senat empfiehlt den Zuwendungsgebern, dem Institut nach Einführung von Kosten-Leistungsrechnung und Programmbudgets nun auch die benötigte Flexibilität bei der Bewirtschaftung der Ressourcen zu gewähren, indem die Stellenpläne flexibilisiert werden und eine überjährige Bewirtschaftung des Haushaltes ermöglicht wird.

Die Empfehlungen des Wissenschaftsrates hat das IFM-GEOMAR zum größten Teil erfolgreich umgesetzt. Die Empfehlungen, den Anteil der unbefristeten institutionell finanzierten Arbeitsverhältnisse zu verringern und die Anzahl der Postdoc-Stellen zu erhöhen, gelten weiterhin.

Nach Auffassung des Senats erfüllt das IFM-GEOMAR ohne Einschränkung die Anforderungen, die an Einrichtungen von überregionaler Bedeutung und gesamtstaatlichem wissenschaftspolitischen Interesse zu stellen sind. Eine Eingliederung des IFM-GEOMAR in eine Universität wird nicht empfohlen. Der Arbeitsauftrag des Instituts verlangt neben einem hohen Grad an Interdisziplinarität auch die Infrastruktur zur Durchführung von größeren Schiffsexpeditionen. Diese Voraussetzungen sind nur in entsprechend vernetzten und betriebsförmig organisierten Strukturen erfüllt.

2. Zur Stellungnahme des IFM-GEOMAR

Das IFM-GEOMAR hat zum Bewertungsbericht Stellung genommen (Anlage C). Das Institut bedankt sich für den positiven und ausgewogenen Bewertungsbericht, den es als Bestätigung der bisherigen Arbeiten betrachtet.

Der Senat begrüßt die positive Aufnahme des Bewertungsberichts durch das IFM-GEOMAR. Die Korrekturen des Instituts werden zur Kenntnis genommen und akzeptiert.

3. Förderempfehlung

Der Senat der Leibniz-Gemeinschaft empfiehlt Bund und Ländern, das IFM-GEOMAR als Forschungseinrichtung auf der Grundlage der Ausführungsvereinbarung Forschungseinrichtungen weiter zu fördern.

Annex A: Presentation

Leibniz Institute of Marine Sciences (IFM-GEOMAR)¹ at the University of Kiel

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¹ This presentation, compiled by the Evaluation Office, has been approved by the Institute and the relevant Federal and State departments.

List of Abbreviations

ADCP	Acoustic Doppler Current Profiler
AGU	American Geophysical Union
AMBZV	<i>Zeitschriftenverzeichnis der Arbeitsgemeinschaft Meereskundlicher Bibliotheken</i>
AQUASHIFT	The Impact of Climate Variability on Aquatic Ecosystems
AUV	Autonomous Underwater Vehicle
AWI	Alfred Wegener Institute for Polar and Marine Research
BGR	<i>Bundesanstalt für Geowissenschaften und Rohstoffe</i>
BMBF	Federal Ministry of Education and Research, <i>Bundesministerium für Bildung und Forschung</i>
CAU	<i>Christian-Albrechts-Universität zu Kiel</i>
CAVASSO	Carbon Variability Studies by Ships of Opportunity
CLIVAR	Climate Variability and Predictability Program
CMS	Content Management System
CTD	Conductivity-Temperature-Depth
DFG	German Research Foundation, <i>Deutsche Forschungsgemeinschaft</i>
DKRZ	German Climate Computing Centre; <i>Deutsches Klimarechenzentrum</i>
EDP	Electronic Data Processing
EGU	European Geosciences Union
EU	European Union
FWG	Research Institution of the German Armed Forces, <i>Forschungsanstalt der Bundeswehr für Wasserschall und Geophysik</i>
FP	Framework Programme of the European Union
GAME	Global Approach by Modular Experiments
GEOMAR	Research Center for Marine Geosciences
GLOBEC	Global Ocean Ecosystem Dynamics
GMA	Society for Marine Aquaculture, <i>Gesellschaft für Marine Aquakultur</i>
ICES	International Council for the Exploration of the Sea
ICP-MS	Inductively-Coupled-Plasma Mass Spectrometry
IfM	Institute for Marine Science
IGBP	International Geosphere-Biosphere Programme
IMBER	Integrated Marine Biogeochemistry and Ecosystem Research
IODP	Integrated Ocean Drilling Program
IOW	Leibniz Institute for Baltic Sea Research, Warnemünde; <i>Leibniz-Institut für Ostseeforschung Warnemünde</i>
IPCC	Intergovernmental Panel on Climate Change

ISA	UN International Seabed Authority
JGOFS	Joint Global Ocean Flux Study
KDM	German Marine Research Consortium; <i>Konsortium Deutsche Meeresforschung</i>
KOMEX	<i>Kurilen Ochotskisches Meer Experiment</i>
LOTUS	<i>Langzeit-Observatorium zur Untersuchung der Steuermechanismen bei der Bildung und Destabilisierung von Gashydraten</i>
LSC	Liquid Scintillation Counter
METRO	<i>Methan und Methanhydrat im Schwarzen Meer</i>
MPI	Max Planck Institute
NERC	Natural Environment Research Council
NSERC	Natural Sciences and Engineering Research Council of Canada
NSF	National Science Foundation (US)
OBH	Ocean Bottom Hydrophone
OBS	Ocean Bottom Seismometer
ODP	Ocean Drilling Program
OMEGA	<i>Oberflächennahe Marine Gashydrate</i>
PANGEA	Publishing Network for Geoscientific & Environmental Data
POGO	Partnership for Observation of the Global Oceans
ppm	parts per million
RD	Research Division
R & D	Research and Development
ROV	Remotely Operated Vehicle
RV	Research Vessel
SCOR	Scientific Committee on Oceanic Research
SFB	Collaborative Research Centre; <i>Sonderforschungsbereich</i>
SOLAS	Surface Ocean-Lower Atmosphere Study
TIPTEC	from The Incoming Plate to mega-Thrust Earthquake processes
WCRP	World Climate Research Programme
WOCE	World Ocean Circulation Experiment
WR	German Science Council, <i>Wissenschaftsrat</i>

1. Development and Funding

IFM-GEOMAR was founded in January 2004 through a merger of the former Institute for Marine Science (IfM) and the Research Center for Marine Geosciences (GEOMAR).

In 1968, the increasing importance of marine research led to an agreement between the State of Schleswig-Holstein and the Federal Government enabling the co-financing of the Institute for

Marine Science (IfM) which continued to be associated with the Christian-Albrechts University (CAU) Kiel. From 1997, IfM was included in the so-called “Blaue Liste”, which is financed jointly by the German Federal Government and the community of German Federal States (“Länder”) at an equal ratio.

The GEOMAR Research Center was originally financed by the State of Schleswig-Holstein but applied for admission to the “Blaue Liste”, which was finally granted in 2002, in response to a positive evaluation by the German Science Council (“Wissenschaftsrat”; WR).

The previous evaluation of IfM and GEOMAR respectively by the WR took place in 1997/1998. Based on the evaluation report, a statement by the German Science Council and a joint statement by the State of Schleswig-Holstein and the responsible Ministry, the committee of the Bund-Länder Commission for Educational Planning and Research Promotion subsequently decided to continue funding the IfM. The WR recommended a “Blaue-Liste” membership for GEOMAR.

2. Mission, Tasks, Main Work Areas and Scientific Environment

According to IFM-GEOMAR, the mission of the Institute is to investigate the physical, chemical, biological, and geological processes in the ocean and their interaction with the seafloor and the atmosphere.

IFM-GEOMAR covers the **entire spectrum of marine research** ranging from seafloor geology to the atmosphere above the sea. Aspects, such as global warming, the ocean in a changing environment, over-exploitation of marine resources, and an increasing global population in coastal areas with growing sensitivity to natural hazards, demand a comprehensive approach to marine sciences as an integral part of research into the Earth System and are addressed by IFM-GEOMAR. These topics illustrate the integrated research approach pursued by the Institute. Based on this philosophy, the recently founded Institute is thus integrating physical, chemical and biological oceanography, meteorology and fisheries biology with marine geology, geochemistry and geophysics. Major areas of research at IFM-GEOMAR include i) oceans and marine ecosystems in the context of global change; ii) exploration, exploitation, and protection of marine resources; iii) geodynamics and provision against geohazards, and iv) marine technologies. These research areas are at the interface between basic research and applied science, providing advice to policy and decision makers.

In order to address this task, the Institute comprises four research divisions (RD) that are subject oriented and, together, cover the entire spectrum of marine sciences: Ocean Circulation and Climate Dynamics (RD 1), Marine Biogeochemistry (RD 2), Marine Ecology (RD 3), and Dynamics of the Ocean Floor (RD 4). In addition, there are two major interdisciplinary Collaborative Research Centres (SFBs) funded by the German Research Foundation (DFG).

Research Division 1 – “Ocean Circulation and Climate Dynamics” focuses on the ocean’s role in past, present and future climate variations. Research projects are aimed at advancing the understanding of the key physical processes and phenomena in the ocean and atmosphere which are critical to the large-scale variability of the ocean-atmosphere system. Quantification of current variations in key aspects of this system, together with investigation of marine climate archives in sediments and coral reefs, provide pertinent information on modern and past global changes. Furthermore, the development and application of numerical models is considered to be a powerful prerequisite for assessing past changes on different time scales and exploring the

predictability of climate variability and anthropogenic change. These models are increasingly capable of representing the complex but essential dynamics that allow realistic simulations of ocean variability and its interaction with the atmosphere as well as with marine ecosystems. Key regions of particular interest, due to their important role in interannual to decadal climate variability, are the sub-polar North Atlantic, the tropical Atlantic and the Indian Ocean.

Research Division 2 – “Marine Biogeochemistry” mainly works on interactions between the sediment, oceanic, and atmospheric material reservoirs and the organisms which mediate marine biogeochemical processes. Investigative approaches include field work, laboratory and mesocosm studies as well as modelling and technology development. Major emphasis is placed on the highly dynamic interfaces between i) sediment and ocean and ii) atmosphere and ocean. The investigation of gas hydrates along the continental margins and in marginal seas has been a major research focus in recent years. Processes which drive biogeochemical fluxes at the air-sea interface are also studied. One aspect are the biological processes and key organisms driving the major element cycles (e. g., carbon, nitrogen, phosphorous and iron) and identification of the genetic functions that regulate these processes. Another aspect are those chemical species with close links to the atmosphere, such as oxygen, carbon dioxide and organic trace gases. According to the Institute, the characterisation of the oxygen uptake in the North Atlantic has contributed significantly to the understanding of the ventilation of deep ocean water and opens up new aspects of climate research as this mechanism is closely linked with the atmosphere. An emerging research area – due to increased carbon dioxide input from the atmosphere and resulting acidification of seawater – deals with the future biogeochemical state of the oceans in a high-CO₂ environment (“the 1,000 ppm CO₂ world”).

Research Division 3 – “Marine Ecology” investigates marine ecosystems and their sensitivity to natural and anthropogenic changes with a focus on climate change and over-exploitation of marine bio-resources, including aspects related to sustainable management of the marine environment. This topic aims at understanding the impact load a given local/regional ecosystem is able to tolerate before major structural changes occur and how these changes affect community dynamics as well as the extent to which changes are reversible. Structural changes include outbreaks of harmful organisms, demise of species, collapse of commercially valuable stocks, and a complete re-orientation of biogeochemical cycles. In order to understand the response of ecosystems to natural and anthropogenic changes, specific differences in the response of organisms have to be considered while grouping them into broad categories (e. g., size classes, trophic levels) is not fully adequate in many cases. Since this is especially true for ecosystems influenced by one or a few keystone species, the research encompasses the full range of hierarchical levels from genes to ecosystems; namely, ecophysiology of key species and its genetic basis, dynamics and genetics of individual populations and communities, interactions within and among species, as well as the structure and response of entire food webs. Single-species studies concentrate on those aspects which define the role of a species in interactions with other species or in biogeochemical cycles.

Research Division 4 – “Dynamics of the Ocean Floor” focuses on the investigation of the processes that shape the lithosphere and the impact of these processes on the environment. These research themes are pursued in the following three main geotectonic settings: divergent plate margins (where oceanic lithosphere is created), intraplate (where the lithosphere is modified), and convergent margins (where oceanic lithosphere is destroyed and continental crust is created). These three settings represent critical stages in the life-cycle of the ocean floor. At divergent margins, RD 4 studies how the continents are first pulled apart to form passive mar-

gins leading to new oceanic lithosphere that is created at oceanic spreading centres. Ridge segmentation and tectonics, crustal structure and composition, the interaction between the seafloor and the overlying ocean in terms of hydrothermal systems and associated massive sulfide deposits are investigated. Research interests on the subsequent evolution of the ocean floor include low- and high-temperature alteration, intraplate volcanism, the modification of lithospheric structure, and tectonic processes occurring at or near transform and convergent plate margins prior to subduction. Convergent margins are sites of major hazards such as mega-earthquakes, volcanic eruptions and tsunamis. Therefore, convergent margin tectonics, the dehydration of the subducting plate, fluid and mass transfer between the downgoing and overriding plate, the generation, evolution and eruption of arc magmas, the modification and creation of continental crust through arc volcanism, and the transfer of climate-relevant volatiles into the atmosphere are also investigated. Moreover, RD 4 quantifies hydrate volumes and determines their influence on slope stability and (potentially) on climate because most margins contain gas hydrates and are prone to submarine slides. Methods include acoustic and seismic imaging of the seafloor and the subsurface sampling of the seafloor and field studies of subaerial volcanoes and ancient seafloor presently exposed on land.

IFM-GEOMAR claims that a major reason for conducting **marine research at a non-university establishment** is explained by IFM-GEOMAR's primary mission to conduct integrated and multi-disciplinary research on a highly complex component of the Earth System. This mission is by nature of its research foci and its long-term perspective a task for a non-university establishment. It requires a strategic and integrated organisational structure that allows for cross-disciplinary research units. These structures are not necessarily compatible with the disciplinary orientation of a university. In addition, it also requires a scale of common and specialised infrastructure that is far beyond the dimensions of a normal university. This holds true, in particular, for

- the multidisciplinary strategic mission of IFM-GEOMAR,
- the regular planning and coordination of large-scale research cruises,
- the infrastructure for high-performance computing necessary for ocean and climate modelling,
- extensive state-of-the-art analytical facilities for carrying out analyses of marine samples,
- the collection of marine micro-organisms and cell cultures,
- the maintenance of existing, and development of new, sea-going infrastructure (e. g., research vessels and large-scale instrumentation including landers, Remotely Operated Vehicles (ROVs), Autonomous Underwater Vehicles (AUVs), TV-grabs, deep-tow video system, side scan sonar, pressure chamber, seafloor drilling systems),
- the infrastructure for culture rooms for experimental work with marine eco-systems,
- the development of new marine technologies.

Generally, the research carried out at IFM-GEOMAR is, according to the Institute, embedded in national and international programmes requiring considerable institutional support and long-term commitment; particularly the Institute's extensive international cooperation demands reliable, high capacity partnerships.

In its last evaluation reports of 1998, the “Wissenschaftsrat” asserted the **high national significance** of both predecessor institutes IfM and GEOMAR. Since then, public awareness of the Earth System and concerns about environmental issues such as global climate change, changes in ecosystems and fisheries, and geohazards due to earthquakes and in particular tsunamis have continued to grow as stated by IFM-GEOMAR. Between the use of and dependence on marine resources on the one hand and exposure to environmental change on the other, the importance of marine research is generally acknowledged. IFM-GEOMAR claims that research in marine sciences is of high national and international importance for a better understanding of the scientific basis and to provide advice on relevant issues to society and policy makers; marine research is therefore a national task and of **overall interest with regard to scientific policy throughout Germany**. The interdisciplinary investigation of the physical, chemical, biological and geological processes in the world oceans and their interaction with the seafloor, ocean margins and the atmosphere as conducted at the Leibniz Institute of Marine Sciences, is unique in its comprehensive approach in Germany.

Scientists at IFM-GEOMAR contribute to scientific policy making as reflected by:

- membership in the National Science Council,
- chair of the DFG Senate Commission for Oceanography,
- membership in the DFG Senate Commission for Geosciences,
- membership in the DFG Senate and “Hauptausschuss,“
- chair of the “German Marine Research Consortium“ (KDM e. V.),
- frequent membership in Scientific Advisory Boards of scientific institutions and in national and international committees including the Intergovernmental Panel on Climate Change (IPCC) and the UN International Seabed Authority,
- significant contributions to the IPCC assessments (two lead authors and five contributing authors of the 2001 report, and one convening lead author for the 2007 report),
- Director Maritime Coordinator of the State of Schleswig-Holstein.

IFM-GEOMAR contributes to several national (two DFG Collaborative Research Centres, two DFG Priority Programmes, several BMBF R&D programmes, including GEOTECHNOLOGIEN) and international (CLIVAR, GLOBEC, SCOR/IMAGES, SOLAS, IODP) programmes. Since 2004, the Institute has hosted the offices of the DFG Senate Commission for Oceanography and the international InterRidge Program. IFM-GEOMAR scientists are members of a number of steering committees for large-scale oceanographic projects (IGBP, CLIVAR, SOLAS, IMBER, and IODP). Furthermore, IFM-GEOMAR provides services to the national and international community including the management for two medium sized research vessels (RV POSEIDON, RV ALKOR) and a core repository.

IFM-GEOMAR believes that it enjoys a very high **reputation, nationally and internationally, as well as a leadership** based on

- three Leibniz award winners,
- successful contributions to numerous large-scale international research projects,
- continuous publications in high-quality and high-impact peer-reviewed journals including “Science” and “Nature” (23 in 2002-2004),

- frequent invitations for scientists to hold invited and keynote lectures at international conferences,
- frequent calls on IFM-GEOMAR scientists to give advice to politics as well as national and international committees and organisations,
- invitations to act as reviewers for leading journals and national and international funding agencies,
- major success in acquiring external funding,
- considerable number of scientists who were educated at IFM-GEOMAR and have received offers from leading scientific institutions world-wide.

In the general field of marine sciences, the two **leading institutes nationally** are, in the opinion of the Institute, the Alfred Wegener Institute for Polar and Marine Research (AWI), Bremerhaven, and IFM-GEOMAR, although the focus of AWI is polar marine research rather than marine sciences in general. In addition, i) MPI for Meteorology Hamburg for physical oceanography and meteorology, ii) MPI for Marine Microbiology and MARUM/RCOM Bremen, for sediment biogeochemistry and marine geology at continental margins, iii) Leibniz Institute for Baltic Sea Research Warnemünde (IOW) for the interdisciplinary study of the Baltic Sea and iv) “Bundesanstalt für Geowissenschaften und Rohstoffe” (BGR) in Hanover for marine geophysics with a focus on hydrocarbon exploration and certain aspects of marine geology, are of importance in their respective research areas, but do not cover the full spectrum of marine science fields. Compared to most of these institutions, IFM-GEOMAR considers itself to be much broader and more comprehensive and strongly multidisciplinary in its research capacity, has close links to the University of Kiel and is more significantly engaged in teaching all marine disciplines.

Internationally, the leading multidisciplinary marine science institutions are Scripps Institution of Oceanography (La Jolla, USA) and Woods Hole Oceanographic Institution (Woods Hole, USA). Further important multidisciplinary institutions are the National Oceanography Centre (NOC, Southampton, UK), the French Research Institute for Exploitation of the Sea (Ifremer, Brest, France), Japan's Marine Science and Technology Center (JAMSTEC in Yokohama, Japan) and the Lamont-Doherty Earth Observatory of Columbia University (New York, USA). In its international scientific significance, although smaller than the other institutions, IFM-GEOMAR considers itself equal to Ifremer and the National Oceanography Centre Southampton on the European level.

With regard to the **Institute's future** IFM-GEOMAR has developed a research plan for the next three to five years in joint discussions with its advisory committees. The research plan addresses the major themes of international marine science and aims at providing a framework for internationally recognised work. In short, the following new research objectives are being envisaged:

Research Division 1

- Development of coupled ocean-atmosphere-sea ice models
- Low-latitude climate variability and its impact on ocean biogeochemistry
- Integrated ocean observing technologies and systems
- Paleo-climate modeling

Research Division 2

- Biogeochemical modelling
- Tropical ocean biogeochemistry including redox controls on nutrients
- The high CO₂ Ocean
- Ocean budget of CO₂ and divalent cations
- Ocean biogeochemical observing systems

Research Division 3

- From genes to ecological performance
- Marine ecosystems in a changing climate
- Feeding in the sea and food from the sea
- Chemical interactions in the sea – chemicals from the sea
- Marine biodiversity – patterns, causes and functions

Research Division 4

- Monitoring of the seafloor and hydrothermal systems
- Segmentation and composition of slow and ultraslow ridges
- Plume vs. non-plume models for intraplate volcanism
- Developing new imaging techniques and targets
- Tectonics and hazards of continental margins

These new research objectives are partly collaborative developments of several research units.

Overarching research themes at IFM-GEOMAR include (i) the role of the ocean in global change, (ii) climate impact on marine ecosystems, (iii) marine resources, and (iv) plate boundary processes and natural hazards. In order to facilitate these research approaches, IFM-GEOMAR is about to create a new Technology and Logistic Centre. This measure will join the different groups of technical staff, engineers, and workshops to encompass the technical and instrumentation equipment and is an effort to foster the development of new marine technologies and observing systems (e. g., shallow drilling devices, gliders, Autonomous Underwater Vehicles). The Institute intends to strengthen the marine infrastructure (e. g., Ocean-Bottom-Seismometers; OBS, and Ocean Bottom Hydrophons; OBH pool) not only for its own purposes but also as a service to the scientific community.

Strong development potential is also seen in the biological research fields, namely marine aquaculture and blue biotechnology as well as gas hydrate research. Due to its acknowledged expertise in closed circuit aquaculture systems with advanced biological filter technologies, IFM-GEOMAR is about to become a shareholder in the “Society for Marine Aquaculture (GMA)” in order to study and develop environmentally friendly techniques in aquaculture.

3. Structural Features und Organisation

The Institute is an independent foundation under public law, supervised by a **Board of Governors** (“Stiftungsrat”) representing the supervisory authority of the Institute and being responsible for making strategic decisions about the development of the Institute. It consists of representa-

tives of State and Federal Governments, the University of Kiel, of the chair of the Institute's **Scientific Advisory Board** ("Wissenschaftlicher Beirat"; WB), as well as of a representative from another research institution and a representative of private industry. The **Director** of the Institute has the right to propose the latter two. The final decision is made by the **Board of Governors**. The WB of IFM-GEOMAR is an internationally constituted advisory group of leading scientists representing all major research disciplines found at the Institute. It provides advice to the Board of Governors and the director and makes recommendations on the research programme and the establishment of temporary interdisciplinary project groups. It consists of up to 12 internationally acknowledged scientists who are nominated by the Board of Governors and serve for a term of four years. The director is appointed by the Board of Governors for a period up to five years. Reappointments are possible.

The **internal Scientific Council** ("Wissenschaftlicher Rat") provides advice to the director on the mid-term research programme and other issues of scientific relevance. It consists of 20 scientists from IFM-GEOMAR who are elected by their colleagues for a term of three years.

All committees were newly established after the foundation of the merged Institute. An overview of the organisational structure of the new Institute is shown in Appendix 1.

According to the Institute, the **quality of research** conducted at IFM-GEOMAR is demonstrated by the publication record and the acquisition of third-party research funding, both of which are dependant on a peer-review procedure. Over the period covered by this report, scientists published 700 papers in peer-reviewed journals, a large number of which are in highest profile journals (e. g., "Nature", "Science"). Publications are internally reviewed prior to submission. Third-party funding (about 15 Mio € in 2004) accounts for about 60 % of the institutional budget. This includes the two DFG Collaborative Research Centres. In 2005, IFM-GEOMAR has implemented a performance-based allocation of funds to acknowledge and further encourage scientific quality. Furthermore, the Institute will commence testing tools for internal evaluation that will start in late 2005 with a pilot procedure in RD 2 and the Computing Centre. This will involve voluntary and internal annual goal-definition and performance evaluation procedure to be conducted jointly by staff members and supervisors.

Laboratory analyses and measurements in the field as well as on-board analyses are based on international standards. Analytical instruments are calibrated against international standards and context analyses are also conducted.

More generally, IFM-GEOMAR adopted the DFG Rules of Good Scientific Practice and appointed a "DFG-Ombudsman" for internal conflict management.

In order to assure **quality in higher education**, IFM-GEOMAR offers i) full curricula in physical oceanography and meteorology, ii) courses in biological marine science and fisheries as major subjects of the curriculum in biology, as well as courses in marine chemistry, and iii) marine geosciences as a minor subject for other degrees (e. g. geology, geophysics, and mineralogy). All these courses presently contribute towards a "Diploma" degree. It is planned to establish Bachelor and Master study programmes in the next two years. Teaching quality is regularly evaluated by students' questionnaires and the results and recommendations are published. Additionally, consultations with lecturers from IFM-GEOMAR are available for students any time.

IFM-GEOMAR has nominated two representatives to enforce the law on **equal status of women** with regard to all organisational, structural and personnel questions. The distribution of men and women holding positions in December 2004 is given in Appendix 6. After the merger of the two former institutes (IfM and GEOMAR) the total number of employees at IFM-GEOMAR

increased to 390 (end of 2004), with women holding 38.5 % of the positions. The proportion of women in non-scientific fields (BAT III to VIII) is 51.5 %. The percentage of women in academic and higher management positions (BAT IIa and above, excluding doctoral candidates) is 19.2 %, a quarter of which are permanent positions.

IFM-GEOMAR released the statistics on the ratio of women and men in applications and appointments for all positions in 2003 and 2004. As compared to 2003, the number of applications by women considerably increased in 2004, in particular with respect to scientists. 43 open positions (incl. 22 permanent positions) were announced in 2004, for which 583 men and 400 women applied. The ratio of women to men appointments corresponded to the application statistics. Each employment is accompanied by a representative of the staff council as well as by the equal rights representative.

4. Resources and Personnel

In 2004, the Institute's annual **budget** amounted to a total of 41.8 Mio. € (see Appendix 2). The institutional support in 2004 totalled 26.6 Mio. €²(63.6 %). The rise in institutional funding in 2004 compared to 2003 is due to greater financial commitment by the Federal Government. The proportion of third-party funding in relation to total financial resources reached 36.4 % in 2004. The most important sources of third-party funds are the German Research Foundation (DFG), the Federal Government, and to a smaller extent, EU-project funding. In 2002 and 2003, IFM-GEOMAR received 2.4 Mio. € funding from the German Research Foundation (DFG). In addition, two DFG Collaborative Research Centres ("Sonderforschungsbereiche; SFBs") were funded with 3.1 (2002), 3.5 (2003), and 4.4 Mio. €³ in 2004. IFM-GEOMAR had proceeds from other third party sources in 2004, such as contracts with private enterprises or public authorities, cooperation with industry, and chartering of research vessels amounting to about 1 Mio. € .

In 2004, 17 Mio. € were provided for **personnel** and 15 Mio. € for materials, supplies, and equipment. Investments, not including building investments, accounted for 2.5 Mio. €. On the report date 31.12.2004, the Institute had 390 employees (see Appendix 6). Among these were 167 positions for academic and higher management staff and 163 staff members. Excluding 60 doctoral candidates, 43 % of the academic staff were paid according to BAT Ib or higher. Around 55 % of the total number of academic staff were financed by institutional resources. 56 % of the academic personnel were employed on temporary contracts. At the end of 2004, 135 out of 227 scientists were paid by third-party funds whereas 92 scientists were financed by the Institute, with 80% of them (equiv. 73 persons) under permanent and 20% (equiv. 19 persons) under temporary contracts. In 2004, approximately 50 % of the academic staff were aged 39 or younger, 32 % were 40 - 49, and 18 % were 50 or older. Approximately 62 % have worked at the establishment for less than five years and 6.6 % have worked there for more than 20 years.

Doctoral candidates are generally paid according to the rules prevailing in Germany's public sector (BAT IIa/2). They are employed on a temporary basis.

² This includes a total income of approx. 0.2 Mio. € from entrance fees (Aquarium) as well as additional funding by the Federal Government (not yet approved).

³ Grant accountancy is at the Christian-Albrechts University, Kiel. The SFB spokespersons are employed at the IFM-GEOMAR and are professors at the CAU.

The Institute competes with international institutions. Its workforce, therefore, comprises a high percentage of foreign employees, some of them in leading positions, such as, for example, two professors who hold positions as assistant directors. In addition, two of the research division heads and the speaker of one SFB are of foreign nationality.

In general, the Institute considers its resources to be adequate except for the purchase and development of large-scale seagoing instrumentation (e. g. ROV, AUV, submersible, deep-sea drilling equipment), the replacement of outdated equipment (mass spectrometer, electron microprobe) and new acquisitions in connection with chair appointments (Multi-Collector ICP-MS [Inductively-Coupled-Plasma Mass Spectrometry], AUV, deep-sea drilling equipment etc.) As further appointments are pending, additional demand is to be expected in this respect in order to be internationally competitive. Additional personnel is needed for technical support.

Both predecessor institutes had to manage on fixed budgets, which were occasionally further limited by across-the-board savings in expenditure. As a result of the "Pact for Research and Innovation", a continuous increase of 3 % per year is to be expected for the next few years. This percentage is considered as positive by IFM-GEOMAR not only because of the rate but also because the increase can be considered stable. But even if this increase is fully available to the Institute, IFM-GEOMAR states that it would not suffice, e. g., to cover the investments deemed necessary from 2006 onwards.

The annual EDP budget comprises approximately 60,000 € for material and equipment and approximately 100,000 € for investments, and 1 Mio. € charges for high-performance computing at the University of Kiel. The IFM-GEOMAR computer centre is responsible for a whole suite of IT-Services including the administration and operation of the central server and personal computers, the network as well as user training and support. Computer and file servers are based at both institute locations and the two sites are connected via a gigabit ethernet. In the medium term, it is planned to concentrate the computer centre in one location. The staff of the computer centre comprises five system administrators, three operators, one trainee, and an external employee on a temporary basis. Despite the fact that the staff has grown by two employees as a consequence of the merger, the computer centre is still short-staffed with respect to the implementation of its requirements which have also increased due to the merger and general technological developments, e. g., further development of the PC-Linux concept and the CMS (Content Management System) for the website, replacement of the out-of-date central ALPHA Unix servers and PCs with modern Linux systems, and upgrading of existing memory resources for model calculations and analyses. In addition, the computing centre has to ensure access to high-performance computing facilities, e. g., at the University of Kiel, the German Climate Computing Centre (DKRZ) in Hamburg and other facilities in Hanover or Stuttgart required by the theoretical groups active in ocean and climate modelling within RD 1 and SFB 460. In 2005, the IFM-GEOMAR computer centre has been evaluated by a group of reviewers.

5. Promotion of Junior Academics and Cooperation

According to its statutes, IFM-GEOMAR contributes to **teaching and education** at the Faculty of Mathematics and Natural Sciences of the Christian-Albrechts University of Kiel by providing personnel and facilities. While the full-time director has no teaching load, the heads of sections, the deputy director as well as the leader of the SFB 574 and the chair of the Senate Commission for Oceanography have experienced a reduction of the teaching load (4 h). As a balance for teaching at the CAU, the Institute receives an extra 8.7% state funding.

IFM-GEOMAR is responsible for the curricula in i) Physical Oceanography (full curriculum), ii) Meteorology (full curriculum), iii) Biological Oceanography (advanced courses), iv) Fishery Biology (advanced courses), v) Marine Chemistry (minor in natural sciences), vi) Geophysics (part of advanced courses), and vii) Geology (part of advanced courses). In addition, substantial contributions are made to teaching in Microbiology (Biology).

IFM-GEOMAR states that Diploma and PhD students are frequently attracted by these curricula and their contribution to the Institute's research work is substantial throughout all research divisions. During 2002 - 2004, the following qualifications were completed in the respective research divisions: 7 "Habilitationen", 73 PhD theses, and 125 diploma theses.

IFM-GEOMAR scientists also participate actively in a number of **international educational programmes**, e. g. an EU-funded international study programme in Biological Oceanography (BioOcean), a DAAD-funded international Master Course at the St. Petersburg State University (POMOR), the BMBF-funded Otto-Schmidt-Laboratory for Polar and Marine Research in St. Petersburg, an international programme financed by the "Mercator Foundation", Essen, called Global Approach by Modular Experiments (GAME), an international Surface Ocean-Lower Atmosphere Study (SOLAS) summer school, co-sponsored by the International Geosphere-Biosphere Program (IGBP) and the World Climate Research Programme (WCRP), as well as cooperation with the Ocean University of China in Qingdao with the aim of establishing a joint Sino-German Master Degree Programme in Marine Sciences.

Special **training programmes for young scientists** are offered by IFM-GEOMAR. This includes interdisciplinary working groups headed by young scientists fostering cooperation within the divisions and developing a stimulating research environment for PhD students and Post-docs. In order to support excellent young scientists, the Institute has four Post-doc positions in addition to positions financed by project funding. Starting in 2005, two additional positions will become available. The funding is limited to three years.

The SFBs 460 (Dynamics of Thermohaline Circulation Variability in the North Atlantic) and 574 (Volatiles and Fluids in Subduction Zones) established in 1996 and 2000, respectively, are both offering a series of seminars with national and international participation as well as the specialised annual short course "Pyroclastic Rocks".

IFM-GEOMAR is an Institute at the Christian-Albrechts University (CAU) Kiel and has close **cooperation** with many CAU institutes. All members of faculty (C1-C4 positions, W1-W3, respectively) at IFM-GEOMAR have regular university appointments according to the regular procedures at CAU Kiel. Two DFG-funded SFBs at CAU Kiel are mainly led and two DFG-Priority Programmes coordinated by IFM-GEOMAR scientists. In various BMBF-funded networks they participate or have a coordinating function in cooperation with several **national partners**. In addition, IFM-GEOMAR scientists were the principal coordinators of more than 100 large-scale ship expeditions during the period 2002 - 2004.

IFM-GEOMAR states that it has important coordination functions at **national, European and international** level.

The Institute is a member of the recently founded **German Marine Research Consortium** (KDM) which includes ten German research institutes and universities with substantial activities in marine sciences. The Consortium represents a total of about 2,200 marine scientists in Germany and is currently chaired by the **director** (Prof. Herzig) with Prof. Suess running the KDM Office in the "Wissenschaftsforum" in Berlin. Since 2004, IFM-GEOMAR hosts the office of the DFG Senate Commission for Oceanography. The Commission plans and coordinates the activi-

ties of the DFG in the area of marine research and oversees the key programmes and collaborative research grants concerned. The Senate Commission also functions as the German national committee for the affairs of the International Council for Science (ICSU) and the Scientific Committee on Oceanic Research (SCOR).

At **European** level, IFM-GEOMAR has contributed substantially to a number of projects within the 5th and 6th Framework Programmes (FP) of the European Union. In total, the Institute was involved in 43 projects, at the end of 2004 coordinating two of them, with a total funding of more than 6 Mio. €.

Internationally, the Institute is actively involved in the planning and coordination of research in the context of large-scale international programmes such as the World Climate Research Programme (WCRP), the International Geosphere-Biosphere Programme (IGBP), and the Integrated Ocean Drilling Program (IODP, previously ODP). IFM-GEOMAR contributes to the Intergovernmental Panel on Climate Change (IPCC) and the Partnership for Observation of the Global Oceans (POGO) programmes. In particular, IFM-GEOMAR is an associated member of the InterMARGINS programme and coordinates the international InterRidge initiative. The latter has 2,700 active scientists and more than 100 institutes involved and comprises 27 member nations. InterRidge acts as the nerve centre for spreading axes research globally.

As a future avenue, IFM-GEOMAR is trying to establish a self-sustaining Science Logistics Centre in Cape Verde to support world-class research in the tropical Atlantic region and link West African nations to the international scientific community in the fields of marine and atmospheric science and geology. As a first step, IFM-GEOMAR organised an international workshop entitled; "Towards a West African Science Logistics Centre in Cape Verde" in Mindelo (Cape Verde) with financial support of the Volkswagen Foundation.

Various cooperation with **industry** has been established in order to develop new instruments and observation technologies for the purpose of scientific investigations. Several former employees and students of IFM-GEOMAR have either founded their own companies or are now employed by these partner companies. Engineering and construction of complex deep-sea instrumentation for long-term measurements and specific experiments have been and will be conducted in close cooperation with numerous small and medium-sized companies in northern Germany.

According to IFM-GEOMAR, the Institute colloquia and the SFB seminars are a main route for attracting a regular stream of **visiting academics**. The Institute's budget provides limited support for guest scientists and funding for colloquium speakers. In addition, both SFB 460 and SFB 574 have a budget for visitors. Other visitors are funded by projects or have their own funding. During the period covered by this report, IFM-GEOMAR hosted two Marie Curie Post-doctoral Fellows, six Humboldt Fellows, one Fulbright Scholar, and one Emmy-Noether-Fellow. In the period 2002 - 2004, IFM-GEOMAR welcomed 144 guest researches who were staying over a two-week period. All visitors came from abroad, about 35 % of them from central and eastern European countries, 27 % from Asia, and about 19 % from the EU and other western European countries. 81 scientists visited IFM-GEOMAR for less than one month, 38 stayed for a period of one to three months and 25 conducted their research at IFM-GEOMAR for more than three months. About half of them came from Asia, seven from the USA/Canada, Australia or New Zealand, four from Europe and one from Latin America.

During the reporting period, 31 of the Institute's academic staff members visited other establishments. About 65 % of the guest visits lasted less than one month but always exceeded two

weeks. About 35% of the guests visits exceeded one month. A quarter of the short-term visits were to European institutions and 75 % to non-European institutions. Most of the mid-term stays (1 - 3 months) were to non-European research establishments whereas the three long-term stays (longer 3 months) were shared equally. It is an important part of the Institute's human resources strategy to encourage its staff members to visit other research establishments in order to enhance their knowledge in their respective work field and to foster cooperation.

During the last three years, 19 academic members of the Institute's staff were offered a professorship; three of them declined the offer.

6. Results – Research, Development and Services

IFM-GEOMAR's mission is to investigate the physical, chemical, biological, and geological processes in the ocean and their interaction with the seafloor and the atmosphere.

Much of the Institute's research work, according to IFM-GEOMAR, contributes to international research efforts, such as WCRP, the IGBP or the IODP. Emphasis is on a better understanding of the ocean's past and present role for climate variations and air-sea interactions, the role of biogeochemical transport and transformations in global change, the response and sensitivity of marine ecosystems to external forcing, gashydrate research and risk assessment of natural hazards due to plate tectonics.

In this context, IFM-GEOMAR considers the two Collaborative Research Centers ("SFBs"), in which it plays a leading role, to be the highlights. The DFG has supported SFB 460 on "Dynamics of Thermohaline Circulation Variability" that links the physical and chemical groups at IfM with the CAU. SFB 574 on "Volatiles and Fluids in Subduction Zones" was implemented within the groups of the former GEOMAR and investigates the "subduction factory" and its role in climate feedbacks and natural disasters. A successful mit-term review took place in 2004.

Major scientific highlights within the past three years were accomplished in the following topics:

- The physical mechanisms and paleo-analysis of Tropical Atlantic variability
- Dynamics and predictability of North Atlantic / European Climate variability
- Millennial-scale variability of global ocean circulation
- Physical controls on oceanic biogeochemical cycling
- Monitoring the ocean's breathing – Development of new techniques to measure oxygen
- Interaction of oxygen and marine productivity
- Geophysical and biogeochemical research on marine gas hydrates
- Dust fertilisation of the Tropical North Atlantic stimulates nitrogen fixation
- Predator diversity hotspots in the Blue Ocean
- Detection of new natural products from marine microorganisms
- New approaches to the dynamics of fish and squid populations
- The Hikurangi oceanic plateau: A fragment of the largest volcanic event on Earth
- Third dimensions of seafloor hydrothermal systems

The goal of **RD 1 (Ocean Circulation and Climate Dynamics)** is a better understanding of past, present, and future climate changes, with a special focus on the role of the ocean. A major venue for the research is the SFB 460 “Dynamics of Thermohaline Circulation Variability”, which has a focus on the subpolar North Atlantic. The SFB was reviewed by the DFG in 2002 and a third extension was granted until the end of 2006, at which time the SFB will come to an end. An international workshop on “North Atlantic Thermohaline Circulation Variability” was organised in September 2004 under the auspices of the Climate Variability and Predictability (CLIVAR) programme of the WCRP in Kiel with significant participation by the SFB. Workshop participants discussed the mechanisms of North Atlantic climate variability analyzing both observations and results from numerical models and the potential for abrupt climate change in the North Atlantic in response to greenhouse warming. Additionally, RD 1 participated in numerous EU-projects which focused on climate modelling, ocean observing systems, and the geobiology of continental margins, including deepwater coral reefs.

Several North, Tropical and South Atlantic locations have been identified where sustained observations of circulation and water mass properties (e.g. salinity, nitrogen, oxygen) variability and change will provide the key to understand the role of the ocean in the climate system. Flows over the sills between Greenland and Europe as well as the western boundary current exiting the Labrador Sea, respectively the Labrador Basin have been instrumented (SFB 460, CLIVAR). Further south, the transport near Guadeloupe and parts of the tropical Atlantic are also gauged (German CLIVAR-marine2). IFM-GEOMAR claims to be the lead institution for the German contribution to a global network of currently 2000 profiling floats under the international ARGO programme, with the tropical Atlantic as focus area. New technologies have been developed and applied to enable cutting edge oceanographic research. For example, in 2004 IFM-GEOMAR successfully performed the first European ‘glider’ missions. A fleet of gliders, profiling floats with wings that can be navigated, is envisioned for the near future to observe the upper oceans physical and biogeochemical properties.

RD 1 was involved in two ODP (Ocean Drilling Program) Legs in the southern Ocean as well as in the eastern Pacific, including the leadership as co-chief scientist. Major research programmes focus on high resolution time series covering Holocene, Pleistocene and Tertiary times scales in order to reconstruct ocean and atmospheric variability. Here, key areas of interest are the tropical Atlantic, the Caribbean, the Pacific, as part of the Ocean Gateways DFG-research group, and the western and central Indian Ocean. Moreover, large-scale projects were conducted and are still going on in the Arctic region of the Laptev Sea and the Sea of Ochotsk, as part of the German-Russian cooperation in which scientists from RD 1 took over a leading role. Together with scientists from the research unit marine geosystems (formerly marine environmental geology) new proxies in paleo-oceanography were developed, mainly to reconstruct paleo-temperature and paleo-salinity of different water masses, a goal which will be of prime interest in the future.

Research Division 2 (Marine Biogeochemistry) notes that the impact of an earlier major reorganisation, namely the founding of IfM’s Marine Biogeochemistry Research Division in 2000, was clearly felt. The Meteor 55 expedition to the tropical Atlantic in 2002 was the first major collaborative activity of the new research division. To-date this cruise has resulted in 13 published peer-reviewed articles (including one in “Nature”) and an additional two submitted manuscripts. RD 2 views this as partly a result of scientific stimulation arising from the new, interdisciplinary organisational structure hoping for similar benefits from the fusion be-

tween IfM and GEOMAR. In the meantime, the RD's three research units report the following activity from their individual research programmes.

The Marine Geosystems unit made major contributions to several large BMBF-supported projects related to gas hydrates (LOTUS, OMEGA and most recently METRO). LOTUS (2001-2004) involved the development of new deep-sea observatories based on benthic lander technology as well as application of new technologies to the examination of the methane distribution in sediment and bottom water. Isotopic investigation was conducted into the life span and the ambient temperature of fluid and gas discharge sites. The OMEGA project investigated modes and mechanisms of gas hydrate formation and dissociation in marine surface sediments. This involved sampling of hydrates under in-situ pressure conditions using autoclave technology and their structural analysis by tomography as well as pore water studies and numerical modelling. METRO started in October 2004 as a follow-up of the OMEGA project. Within the KOMEX project, the largest modern barite deposit was discovered in the Sea of Okhotsk and was shown to be formed by the ascent of barium-charged fluids. The Marine Geosystems unit also played a major role in the development and conduct of SFB 574 and was involved in four sub-projects. Notably, the capabilities and applications of isotope geochemistry to a range of marine science questions were built-up.

In addition to the previously mentioned Meteor expedition, the Chemical Oceanography unit contributed to the EU project CAVASSOO through the establishment of year-round observations of $p\text{CO}_2$ and other biogeochemical properties on board the Swedish Car Carrier Falstaff, criss-crossing the mid-latitude North Atlantic. Within the EU ANIMATE project, fixed-point, time-series measurements of $p\text{CO}_2$ were collected from moorings using newly-developed technologies. Within SFB 460, work continued on the uptake of anthropogenic CO_2 by the North Atlantic. A new sub-project was added to develop and apply the capability of autonomous profiling floats to measure the ocean's oxygen inventory.

Within both Biological Oceanography and Chemical Oceanography, a major focus has been the study of effects of iron supply (via dust) on phytoplankton growth in the ocean. Research unit members participated in two large-scale iron fertilisation experiments in the Southern Ocean. The limitation of primary production and, especially, nitrogen fixation by macronutrients or iron was assessed in the tropical and mid-latitude Atlantic (Meteor 55, Meteor 60). This work was complemented by molecular biological investigations into the diversity of nitrogen-fixing organisms. The effects of high concentrations of CO_2 on plankton development were studied in mesocosm experiments to analyse potential future changes in marine ecosystems and biogeochemical cycling.

The research division as a whole invested significant effort in scientific infrastructure and support. Four separate infrastructure units are managed by the research division on behalf of the Institute as a whole: the molecular biology laboratory, the deep-sea instrumentation group, the isotope analysis laboratory and the radio-isotope laboratory. The first three of these, in particular, have been heavily involved in supporting the scientific projects of the research division.

RD 3 research (Marine Ecology) comprises all food web components from primary producers to top predators. With the appointment of a C3-professor for "Biological Oceanography – Benthos Ecology" in 2002, RD 3 was able to overcome the interim shortage of expertise in zoobenthos which had been mentioned in the IfM Report 1999 - 2001. According to IFM-GEOMAR, two

new projects, coordinated by RD 3 scientists, have intensified international and national cooperation with other institutes: the international GAME project (“Global Approach by Modular Experiments”), funded by the Mercator Foundation, and the DFG-Priority Programme AQUASHIFT (“Impact of climate variability on aquatic ecosystems”).

Global change research has gained momentum through the establishment of the DFG priority programme AQUASHIFT (started in November 2004) which includes five projects established at IFM-GEOMAR (four at RD 3, one at RD 2). They concentrate on the impact of climate change on plankton communities and larval fish. The impact of temperature and salinity changes on benthic interactions within the Baltic Sea are being studied in additional projects and in agreement with the IOW. Within GAME, a series of experiments on the influence of elevated UV-radiation on the succession of littoral benthos have been completed.

Ecological genetics has maintained its traditional focus on marine bacteria and archaea but new research foci have been added: Molecular genetic analyses of fish-stock differentiation, the relationships between fish biogeography and speciation, and the role of intraspecific genetic diversity for the resistance of seagrass populations to environmental perturbations.

Experimental and field-centred food web research was an ongoing activity during the reporting period. RD 3 states that they successfully finished the experimental projects comparing marine and limnetic food webs in 2003. Thereafter, they have initiated a series of experimental and field studies on the trophic level of marine mesozooplankton (trophic level 2 when feeding on phytoplankton, trophic level 3 when feeding on Protozoa) and its dependence on phytoplankton size structure and food supply. Studies on the upper compartments of the marine food-web (primarily fish) are predominantly field-centred and contribute to the scientific goals of the IGBP-core programme GLOBEC.

Aquaculture research is an applied spin-off of research in feeding ecology and has been maintained through a number of projects associated with IFM-GEOMAR’s Aquarium. Chemical ecology has become a new research focus in marine microbiology and in benthos ecology. Major current topics are the chemical regulation of macroalgae-herbivore interactions and sponge-microbial interactions. The latter is part of a BMBF-funded national centre of excellence (BIOTECCmarin) and has led to the foundation of a company for commercial use of natural substances for potential medical applications.

Biodiversity research has comprised the analysis of global patterns of biodiversity and their correlations with environmental factors, the experimental analysis of the role of disturbances for maintaining diversity and preventing single-species dominance and the experimental analysis of the role of species diversity and within-species genetic diversity for ecosystem functions and recovery from environmental stress.

The major current areas of investigation in **RD 4 (Dynamics of the Ocean Floor)** are: i) break-up of the continents and the onset of seafloor spreading, ii) formation of the ocean floor and the ocean basins at spreading centres, iii) composition and structure of the deeper convecting mantle based on studies of intraplate “hotspot” volcanism, iv) destruction of the oceanic lithosphere through subduction at convergent margins and the structure of such margins, v) marine gateways and land-bridges, vi) geo-hazards including earthquakes, volcanic eruptions, submarine land-slides and tsunamis, and vii) marine resources associated with hydrothermal systems and gas hydrates.

Research Division 4 reports that it is heavily involved in several large-scale projects, such as the GEOTECHNOLOGIEN programme and DFG Priority Programme 1144. The leadership of the

Priority Programme is based in RD 4, as is the leadership of the international InterRidge initiative, both of whom study mid-ocean ridge processes. Within the GEOTECHNOLOGIEN Gas Hydrate Initiative, RD 4 was involved with RD 2 in the OMEGA project, contributing to the development of a side-scan sonar system to image the seafloor and, in particular, hydrate and carbonate outcrops and cold vents. The INGGAS project (2001 - 2004), with partners in Kiel, Hamburg and Bremen, was coordinated by RD 4, leading to the development of a deep-tow streamer and positioning system, also to be used with the side-scan sonar from OMEGA. These deep-tow systems can be deployed together or separately and, together with the expertise in swath-bathymetry and seismic methods, provide seafloor and subsea floor imaging over a broad range of scales. RD 4 is also involved in more recent gas hydrate projects such as METRO (again with RD 2: started 2004) and jointly coordinates the TIPTEQ project (started 2004) within the Continental Margins Initiative of the GEOTECHNOLOGIEN programme. RD 4 is very heavily involved in SFB 574: Volatiles and Fluids in Subduction Zones: Climate Feedback and Trigger Mechanisms for Natural Disasters. Members of the division fill three of the major positions in SFB 574. It runs or jointly runs eight of the 12 scientific subprojects within SFB 574 investigating fluid flow and volatile recycling in the incoming plate, in the forearc and through the arc to the atmosphere, and assessing the impact of these volatiles on the hazards associated with convergent margins. SFB 574 is an example of close collaboration with RD 2 in particular. Highlights in terms of technical developments within the RD included the acquisition and successful testing of a deep-tow seismic streamer and side-scan sonar (funded by the Gas Hydrate Initiative of the GEOTECHNOLOGIEN programme), the acquisition of new high resolution seismic sources, and the development laser-based age dating technique, and isotope and volatile analyses. The seismic processing facility and ocean bottom seismometer pool are the only German geoscience "large-scale facility" funded by the European Union, now for a fourth term under successive framework programmes.

The results of the Institute's research work are generally made available through a wide range of **publications**. The main emphasis is on peer-reviewed and leading international journals and books. IFM-GEOMAR uses peer review as the main mechanism of quality control. Participation in the review process by most IFM-GEOMAR scientists also contributes to quality control within the scientific community. In addition, several scientists serve as editors or on the editorial boards of leading journals, amongst others: "Biogeosciences", "Deep-Sea Research", "Geochemistry", "Geophysics", "Geosystems (G³)", "International Journal of Earth Sciences", "Marine Ecology", and "Marine Geology".

In the period 2002 - 2004, 23 publications in "Nature" and "Science" were authored by IFM-GEOMAR scientists with 13 as the first author. 170 out of 711 papers are ranked in the upper 10 % of the journals and 64 publications in the top 5 % of leading journals with IFM-GEOMAR lead authorship (both measured by impact factor). Some publications have become standard books that serve as reference sources for the scientific community in a particular scientific field (e. g., "Bergey's Manual of Systematic Bacteriology", "The Prokaryotes").

IfM and GEOMAR, as well as the merged institute, sustain a report series ("IFM-GEOMAR Reports") in order to document technical aspects of research, achievements of specific projects, and reports of major expeditions. These reports are also available to scientific libraries worldwide. Statistics of all publications are provided in Appendix 7.

Increasingly, information is disseminated in electronic form through the internet portal of IFM-GEOMAR (www.ifm-geomar.de).

It was recognised that the merger of both institutions would only be efficient and successful if the entire Institute could be united in one location. Pre-planning for a relocation of the IfM part of the Institute to the East Shore Campus on the “Seefischmarkt” started in 2004. First results of the merging process are the relocation of the entire administration in Building 4 and the preparation for a new Technology and Logistic Centre in Building 14 on the East Shore Campus. The latter will be implemented in 2006. In addition, the development of a concept for the IfM building as an international facility for teaching and education in Marine Sciences is under way.

On the scientific side, IFM-GEOMAR states that there have been a number of successful proposals for new research projects or successful extensions of ongoing activities. Most notable are the successful extensions of both SFBs (SFB 460 to 2006, SFB 574 to 2008) but also the two new DFG Priority Programmes “AQUASHIFT” and “From the Mantle to the Ocean” that will be important research foci for the next few years. In addition, a number of proposals for large projects funded by BMBF or EU with coordination by IFM-GEOMAR were granted in the reporting period. In 2005, the EU project INCOFISH coordinated by IFM-GEOMAR started with scientific institutions from 35 partner countries. Overall, the total project funding of about 15 Mio € in 2004 (13 Mio. € in 2003), in comparison to 26 Mio. € institutional funds, highlights the success and excellent reputation of IFM-GEOMAR scientists.

The number of major seagoing expeditions with chief scientists and principal investigators from IFM-GEOMAR is another indicator of the Institute’s research activities. During the reporting period, more than 30 of these cruises were organised every year on different research vessels. Working areas are virtually all ocean basins from high latitudes to the tropics.

IFM-GEOMAR generates and supplies **working materials and information for external users**. IFM-GEOMAR’s two mid-size and two smaller **research vessels** are basic large-scale facilities for research. They are also made available to external users on European, national and regional levels, both on barter and charter basis. The laboratory’s support of IFM-GEOMAR research vessels includes: high quality calibrations of CTD (Conductivity-Temperature-Depth) temperature and pressure sensors up to WOCE (World Ocean Circulation Experiment) standards, maintenance and documentation of CTD/rosette systems, shipborne thermosalinographs, ADCPs (Acoustic Doppler Current Profiler), and under-way data acquisitions systems. On request, in-port set-up service for the above mentioned physical sensors and systems and technical support with personnel during barter cruises is available.

In 2003, an agreement on technical cooperation was signed by the company “L3-ELAC” and IFM-GEOMAR. Within this framework, RV LITTORINA has become the platform for a shallow-water multi-beam echo sounding system. It is available for general scientific use, including student courses, in exchange for commercial demonstrations for several days per year.

For the first time, the “Federal Armed Forces Underwater Acoustic and Marine Geophysics Research Institute” (FWG) located in Kiel used RV ALKOR for two weeks on a barter basis in autumn 2004. A general agreement on ship time exchange between FWG and IFM-GEOMAR has been proposed and will probably be signed early 2005.

As a result of the recent merger, the newly created **IFM-GEOMAR Library** has now become, according to the Institute, one of the largest marine science libraries in Germany with about 110,000 media items. Currently, there are 794 open serial titles. The majority is obtained through exchange agreements with other research institutions. The library is a founding member of the German Organisation of Marine Science Libraries and has been editing the “Organisation’s Journals’ Catalogue” (AMBZV) for the last several years. To date, 283 libraries and

research institutions make use of this service in their daily work. A selection of electronic journals adapted to the respective library's requirements is generated for each participating institution.

IFM-GEOMAR provides a number of widely used **data sets** for several fields within marine sciences and hosts data centres for internationally operated programmes, such as FishBase. In addition, IFM-GEOMAR claims to make substantial contributions to data management efforts for international programmes, e. g., the WOCE/CLIVAR system of data centres. Paleooceanographic data, as well as the JGOFS (Joint Global Ocean Flux Study) data base, previously located at IfM, are entered into the PANGAEA (**Publishing Network for Geoscientific & Environmental Data**) data base (www.pangaea.de) which serves as a national and international data centre for paleo-oceanographic, geo-scientific, and environmental data.

IFM-GEOMAR has a wide range of clean room and mass spectrometer facilities (RD 1, 2 and 4) for stable **isotope measurements**. These include several gas mass spectrometers (DELTA and Finnigan MAT253), two thermal ionisation mass spectrometers (MAT262 RPQ+ and TRITON) and a multi-collector ICP-MS (AXIOM). In addition, the **radio-isotope laboratory** provides measurement facilities for γ - and β -ray emitters. The most frequently used substances are β -emitters that are also administered by the laboratory's personnel. The laboratory contains two Liquid Scintillation Counters (LSC), with data provided via the Institute's intranet, and a portable LSC for application on board the research vessels.

The **IFM-GEOMAR Lithothek** holds a collection of more than 8,700 m of split sediment core samples. Additionally, samples of hard rocks, massive sulfides, corals, sediment traps, seawater and pore waters are stored. These samples are available for current and future research projects. Cold storage is available for sections of box cores in particular to preserve the Holocene sediment record. Samples are provided for research as well as for educational purposes and museum displays in limited quantities. All available samples are documented in the PANGAEA data bank.

The **culture collections** of the Marine Ecology division contain 10,000 strains of heterotrophic bacteria, photosynthetic bacteria, and fungi. The collection of phototrophic bacteria has grown steadily over many years and is now one of the largest world-wide, according to IFM-GEOMAR. The collection of marine bacteria is supported by all past and ongoing projects, recently mostly by projects on the search for new natural products. The collection of marine-derived fungi was established in 2003 and now represents a collection of major relevance due to the inclusion of strains isolated and collected by the Alfred Wegener Institute. All collections are used to support in-house research and strains are supplied to other researchers world-wide, as far as possible.

IFM-GEOMAR reports that it is involved in **knowledge transfer and consultation** in various ways. It is actively engaged in national and international scientific planning and coordination. A number of the Institute's scientists are members of planning and steering committees for large-scale international programs such as the World Climate Research Programme (WCRP), the International Geosphere-Biosphere Program (IGBP), the Integrated Ocean Drilling Program (IODP) and the Inter-Ridge Program. They are also actively involved in the strategic development of EU and national programmes. This involvement includes significant contributions to the science plans, leadership in national and international steering committees, participation in international implementation activities as well as plenary lectures at planning conferences. Through these activities IFM-GEOMAR has a major influence on the development of marine research programmes at international and national level.

In 2004, the **Director** of IFM-GEOMAR was appointed Maritime Coordinator of the State of Schleswig-Holstein. He will, through close interaction with partners in politics, economics, and science, foster the position and visibility of maritime activities in Schleswig-Holstein. An office for the Maritime Coordinator ("Stabsstelle") to coordinate these activities has been established at the Schleswig-Holstein⁴ Prime Ministers' Office ("Staatskanzlei") that also takes care of maritime affairs at national and European level.

IFM-GEOMAR states that many scientists contribute their expertise to the evaluation of research proposals for national (DFG, BMBF) and international (e. g., EU, NERC, NSERC, NSF, ARC) agencies. Policy-relevant information is given by individual scientists by participating in various national advisory groups and, internationally, by advising agencies such as the Intergovernmental Panel on Climate Change (IPCC), the International Council for the Exploration of the Sea (ICES), which plays an important role in the management of North Atlantic, North Sea and Baltic Sea fish stocks, and the UN International Seabed Authority (ISA).

According to IFM-GEOMAR, results of its research projects are **influencing decision makers**. As an example, the European Research Projects ECOMOUND and ACES had an impact on EU decisions to protect some of Europe's unique deepwater coral reefs. Furthermore, contributions to assessments such as those performed by IPCC, with substantial contributions by IFM-GEOMAR scientists, give guidance to policy makers world-wide.

Due to its potential as a future energy source, gas hydrate research is attracting interest from major gas **companies**. The expertise at IFM-GEOMAR led to a consulting contract with "E.ON-Ruhrgas", who are searching for information about new findings in this field, in particular with respect to reservoir size and the hazard risks associated with gas hydrates. In 2005, a 10-year research contract on gas hydrates was signed with the **Republic of South Korea**.

IFM-GEOMAR states that it **disseminates its results** to various communities and is very actively involved in **public relations**. The communication of results to the **scientific community** mainly takes the form of peer-reviewed publications in scientific journals, books, presentations and posters at conferences and workshops. Preprints of publications and detailed technical information are made available via the Internet where most research projects have their own web pages.

The communication with **politicians, public administration and commerce** takes place through various channels, including advisory work in government committees and public foundations as well as lecturing at meetings organised by government or companies. In addition, several information visits by groups from Federal and State Parliaments and Governments to the Institute have been organised.

Communication with the **general public** is of increasing importance, in the opinion of IFM-GEOMAR, in particular for an Institute like IFM-GEOMAR with its primary focus on basic research. Several media channels (e. g., TV, radio stations, newspapers, Internet, exhibitions, public lectures) are used to convey information about actual research topics, such as results from scientific expeditions, which are regularly presented to the press. The IFM-GEOMAR Aquarium and the outdoor sea facility are visited by about 85,000 people per year. The interaction with schools plays an important role in the area of public relations and education at IFM-GEOMAR. An important cooperation partner with respect to school projects is the "Leibniz Institute for Science Education at the University of Kiel".

⁴ As of May 2005 at the Ministry of Science, Trade & Commerce, and Transportation

A highlight of **public outreach** at IFM-GEOMAR was an exhibition on marine research in Kiel during the “Volvo Ocean Race” and “Kieler Woche 2002” which attracted about 60,000 visitors in six weeks. IFM-GEOMAR also contributed to exhibitions on a coaster for the Year of Geosciences in 2002, the Year of Chemistry in 2003, and the Year of Technology in 2004.

Exploitation and technology transfer is translated into action from the point of view of IFM-GEOMAR by i) making applications resulting from scientific projects available to the public, ii) filing patents, and iii) founding start-up companies. This is also an objective of the Maritime Coordinator of Schleswig-Holstein.

Examples for **applications from scientific projects** include:

- a model for radiative transport which has had more than 500 downloads world-wide since 2002,
- the development of circulating zero-emission aquaculture systems – this project has received special funding in the order of 3.5 Mio. € partially financed by the state of Schleswig-Holstein and is planned to result in a large-scale R&D facility in Büsum – “Society for Marine Aquaculture GmbH”,
- advice for fisheries management through ICES (International Council for the Exploration of the Seas),
- development of pharmaceutically active natural substances from sponge microorganism associations (this project will receive special funding from the Government of Schleswig-Holstein to be transformed into a start-up company after an additional R&D programme phase).

During the reporting period six patents were filed in Germany.

Examples of **start-up companies** founded by former students and employees during the reporting period include:

- BIOTECmarin GmbH, founded in 2002, was established at the request of the Federal Ministry of Education and Research which asked the principal investigators (including an IFM-GEOMAR scientist) of the project BIOTECmarin to apply results from this centre directly. This company specifically develops new natural products from marine organisms into medical/pharmaceutical applications (www.biotecmarin.de).
- Marianda – marine analytics and data – is engaged in the field of marine inorganic chemistry. Expertise in the high accuracy measurement of total alkalinity and dissolved inorganic carbon, including technology that was developed at the IfM, is now being marketed world-wide by a former employee of IfM (www.marianda.com).
- Tethys Geoconsulting GmbH: since May 2001, “Tethys Geoconsulting GmbH” has been operating as a spin-off company founded by two former GEOMAR scientists, with currently 6 contracted employees (www.tethysgeoconsulting.de).
- WetterWelt GmbH: a former student of IfM founded a private weather service delivering local forecasts and consulting with regular TV-services (www.wetterwelt.de).

The Institute has hosted a considerable number of **conferences and workshops**, including the international conference “Climate Drivers of the North” (May 2002), and the “CLIVAR North Atlantic Workshop” (September 2004). Furthermore, IFM-GEOMAR scientists have organised or contributed to several large **external events**. Examples are the International CLIVAR Conference Baltimore (June 2004), the Cape Verde Workshop (May 2004) and the annual General

Assemblies of the European Geosciences Union (EGU) and American Geophysical Union (AGU), where a number of sessions have been organised.

Scientists from the Institute regularly receive invitations to speak at international conferences and at leading foreign institutions. As an example, all of the four invited keynote lectures by German authors at the Final Conference of the World Ocean Circulation Experiment in San Antonio, USA, in November 2002 came from IFM-GEOMAR. At the joint Open Science Conference "Connectivities in the Earth System", convened by all international Global Change Programs in Banff, Canada, 2003, the plenary keynote lecture on the ocean system was given by an IFM-GEOMAR scientist. During the recent SOLAS Open Science Conference in Halifax, Canada (October 2004), IFM-GEOMAR scientists presented one of the plenary lectures and acted as rapporteurs and discussion group leaders.

During the past years, IFM-GEOMAR has hosted **important offices** such as the InterRidge Office (since 2004) or the JGOFS data centre (1995-2004) and contributed to the International CLIVAR Project Office (external staff at IFM-GEOMAR). Due to their scientific expertise, a number of IFM-GEOMAR staff members fulfilled important functions on an honorary basis. The most important in this context are the Maritime Coordinator of the State of Schleswig-Holstein (since 2004), the Chair of the German Marine Research Consortium KDM (since 2004), the Senate of the DFG (since 2003), the DFG's "Senate Commission for Geosciences" (since 2002), membership of the "Wissenschaftsrat" (since 2004), the Chair of the DFG's "Senate Commission for Oceanography" (since 2004), and the Senate of the DFG (1997-2003, and since 2004).

Apart from publications and funded research proposals, prizes, awards and honorary titles reflect the success of IFM-GEOMAR staff members over the past years, e. g., three Leibniz award-winners are staff members of IFM-GEOMAR.

7. Implementation of German Science Council's Recommendations

The "Wissenschaftsrat" evaluated both the Institute for Marine Science (IfM) and the Research Center for Marine Geosciences (GEOMAR) in 1998. Specific recommendations were for:

i) the IfM

a) In order to strengthen the IfM's future status as an internationally outstanding research institute yet further, the coherence of the research programme, which is currently missing, should be re-established. In the near future, the programme should be brought into line with modern developments in the field of marine research and coordinated with the programmes of other non-university marine research institutions.

Along with a thorough restructuring of IfM a new research strategy was developed along the major themes: i) ocean's role in climate, ii) biogeochemical cycling and iii) marine ecosystems. Subsequently, a major reallocation of vacant professorships took place. The biological groups in marine ecology, in particular, defined an overarching research objective and five cross-sectional research themes.

The German Marine Research Consortium (KDM) founded in 2004 with membership of all major marine research institutions now facilitates the coordination of marine sciences amongst all partners.

b) In order to develop a new conceptual design and structure and integrate the various departments on an interdisciplinary basis, a body of external experts should be established to work

together with the Scientific Advisory Board, Kiel University and GEOMAR. The biological departments should be promoted so that they achieve the same internationally competitive level as the physical-chemical departments.

An external advisory group was set up in 1998. Following the specific recommendations of this group, the Institute was restructured in 2000 into three research divisions (Ocean Circulation and Climate, Marine Biogeochemistry and Marine Ecology). The biological groups were strengthened by the appointment of two professors for Biological Oceanography and one for Experimental Ecology since 1999.

c) The fact that positions will have to be re-filled can and should be used to develop a new, interdisciplinary research concept, building on the international importance the IfM has already gained. The goal of restructuring should be to dispense with the explicit division of the Institute into the fields of physical oceanography and biology, which currently work on a comparatively unrelated basis, and integrate the work of the various departments into joint, interdisciplinary research work. To achieve this, new, cross-disciplinary focus areas must be identified and established. Suitable instruments might include creating fixed-term interdisciplinary working groups and a pool of institutional positions filled on a fixed-term basis. Greater coordination and cooperation with other German marine research institutions, especially GEOMAR, is both necessary and urgent.

In 2001, the first interdisciplinary research group (on nutrient cycling in the Atlantic) was established, after internal competition, for a period of three years. This was headed by a junior scientist, supported by institutional funds and increasingly by third-party funds, and involved all three research divisions. The recommendation that cooperation between the IfM and GEOMAR should be increased (see *also GEOMAR d*) was a driving force for the merger of both institutions into the Leibniz Institute of Marine Sciences.

d) The fields of work which are of particular relevance to the future, marine chemistry (including geochemistry) and marine micro- and molecular biology, should receive special attention in the new research programme.

A new professorship for Chemical Oceanography was created using a vacant C3 position (formerly in Marine Biology). Marine Chemistry was also strengthened by linking it explicitly to Marine Biology in a new Research Division "Marine Biogeochemistry". In 2002, a new "Laboratory for Molecular Biology" was established and molecular biological research is now conducted in both RD 2 and RD 3.

In addition, a C4 professorship (formerly in Marine Zoology) has been advertised as a position in Biogeochemical Modelling. The application and appointment procedure is still ongoing.

e) The IfM's publication record is very good in some departments and could be improved in others. All in all, the number of publications in internationally reviewed specialist journals should be increased. The institute should also examine the opportunities for registering patents.

According to its statutes, the Institute is mainly engaged in basic research and development. Thus only few patents were registered. The publication activity in peer-reviewed journals is continued on a high level with increasing emphasis on high-impact journals such as "Science" and "Nature". Since 2005, part of the institutional budget for the research divisions depends on the publication record and the project funding acquired by the divisions.

In detail, the performance-oriented allocation of funds is determined as described: of the total available funds 10% will be assigned to teaching performance while 50% of the remaining funds

will be allocated by the performance-oriented allocation of funds. The assignment to the areas of research is calculated on the basis of fund raising of third party funds over the last two years (one third) as well as on the basis of publication records, measured by the journal impact factors (two thirds).

f) The IfM should examine whether it can use its potential for developing or continuing the development of marine technology better in future and conceivably even build up a focus area in the field; it should, in any case, cooperate more closely with industry.

A group in the Physical Oceanography unit is dealing with the new development of observing systems. This is done in close cooperation with marine technology companies. Examples are the developments of float technology, including new sensors.

g) In order to achieve greater flexibility, a job pool should be created comprising vacancies for scientists; these positions should be assigned on the basis of achievement to support current research.

According to the statutes of IfM and also IFM-GEOMAR since 2000 all vacancies of scientific positions which are not automatically reoccupied are returned to the Director who decides, in consultation with the leaders of the research divisions, on their future research topic.

h) The current leadership structure, which is unable to decide on or make any serious changes, should be included in the restructuring.

The revised organisational structure also included major changes of the management structure. The former "Kollegium" was abolished, the positions of the director and the heads of the research divisions were strengthened.

i) The two positions in higher education which have been vacant since 1997 should be filled by a scientist from ecosystem modelling (though it is not yet clear to which department he or she should be assigned) and an expert for remote sensing who should work in one of the physical oceanography departments.

After an unsuccessful attempt to fill the C3 position in Ecosystem Modelling, this position was changed to a C4 post in Biogeochemical Modelling, following a recommendation of the external advisory group. This position is still vacant. The expert in remote sensing was appointed a position in the marine meteorology group.

j) The small-unit sub-division of the Institute into ten departments should come to an end.

On recommendation of the external advisory group, the ten independent departments were abolished in 2000, and three research divisions were created (see also b).

k) The IfM's and GEOMAR's plans to develop molecular biological know-how should be coordinated so that, in future, greater cooperation at the Kiel base is possible.

Along with the new Molecular Biology Laboratory, a senior scientist position was created. Furthermore, scientists of the microbiology group within RD 3 and marine geologists of GEOMAR (now RD 4) cooperated in joint expeditions.

l) The existing mechanical and electronic workshop and laboratory potential is essential for the IfM and should be retained.

This will even be strengthened in future through the creation of the Technology and Logistic Centre at IFM-GEOMAR.

m) The number of post-docs employed at the IfM should be increased.

Funding resources for Post-docs are mainly sustained through project funding. The support through institutional funding is very limited but IFM-GEOMAR tries to expand its internal post-doc programme. Since the project funding is very vital, Post-doc positions are open on a regular basis. Another route was the research group for young scientists established under the auspices of SFB 460.

ii) the GEOMAR

a) The newly founded, high-powered, biologically-oriented working group is essential for the work of the Marine Environmental Geology Department. In order to understand the material cycle in the deep oceans and the early diagenesis of sediments of pelagic origin, it is essential to consider microbiological aspects. However, cooperation with the Marine Microbiology Department at the IfM in Kiel should be intensified.

The merger of IfM and GEOMAR in January 2004 was accompanied by the reorganisation of the research division and research unit structure. Two geo-scientific research groups have been integrated into former oceanographic research divisions where the joint research objectives were compatible. The research group in Paleo-Oceanography became a research unit in the division "Ocean Circulation and Climate Dynamics" thus allowing studies of modern and past ocean climate and circulation. The research group in Marine Environmental Geology joined the units of Chemical and Biological Oceanography to form the Research Division "Marine Biogeochemistry" thus allowing the Division to encompass biogeochemical research from the seafloor to the atmosphere. The new division pursues joint research objectives including joint research with marine microbiologists and responds thus to the respective recommendation of the "Wissenschaftsrat".

The remaining two GEOMAR departments (Geodynamics and Volcanology & Petrology) have merged to form the Research Division 4 (Dynamics of the Ocean Floor). A new focus on hydrothermal systems has emerged in RD 4 along with a new appointment of a C4 professorship in volcanology and hydrothermal systems.

The cooperation with the University of Kiel in particular has been intensified in the joint "Sonderforschungsbereich" 574 which started in 2001.

b) The GEOMAR-model, by which the Research Center was supposed to be supported technically by the commercially-run GTG (GEOMAR Technologie GmbH), did not fulfill expectations. For economic reasons, in future it will be necessary for GEOMAR to make much greater use of services offered by other competing companies. To this end, the "Land" (Schleswig-Holstein) is requested to examine the GEOMAR-model. The equipment pool is of major use to other establishments, too, and should be made much more available in future in the framework of a GEOMAR service function.

After bankruptcy of the GTG, GEOMAR cooperated with different companies in the field of marine sciences. Equipment is used by different institutions, e.g. the Universities of Hamburg, Erlangen, Tübingen, Munich, etc.

c) Due to its cooperation with GTG, GEOMAR has so far restricted the number of positions for technicians at the Institute and will, therefore, urgently need a larger number of positions for technicians in future. It is considered necessary to increase the number of positions for technicians from the present 12 by at least 10 in order to ensure efficient use of equipment as well as the care and maintenance of the equipment pool.

The budget of the merged Institute allocated nine additional positions for technicians. Furthermore, in autumn 2005, a new Technology and Logistics Centre will house different groups of technical staff and engineers to service the technical and instrumentation equipment, which is an additional measure responding to this recommendation.

d) The GEOMAR Research Center is involved in higher education on a large scale. The current teaching load of eight hours per week and semester carried out by the heads of department is very large; should GEOMAR receive support as a "Blaue Liste" Institute, it should be considered whether this should be modified. GEOMAR's manifold relations to Kiel University's geo-science institutes should continue to be intensified.

Because of its character as a non-university research institute, the teaching commitment of professors at IFM-GEOMAR has generally been reduced from eight to six hours per week and semester ("Semesterwochenstunden") or to four hours per week and semester for professors with additional management duties (e. g., heads of research divisions).

e) GEOMAR's board structure should be examined. In future, the Scientific Council should meet at least once a year to guarantee continuous counselling and evaluation of work at the Institute. The Board of Trustees should be responsible, above all, for supervisory and control functions and be composed accordingly.

As a result of the merger of IfM and GEOMAR in January 2004, all of the joint Institute's advisory committees have been restructured and new members appointed.

f) The modelling group should be integrated into the related fields of the IfM and Hamburg institutions (especially the MPI for Meteorology, The German High Performance Computing Centre for Climate- and Earth System Research, The Institute of Geophysics at the university). Any additional scientific positions should be financed from third-party funding.

During the reporting period, a junior research group on paleoclimate modelling, integrated in the SFB 460, was built up at IfM with strong cooperation with the paleo group at GEOMAR. Unfortunately, the leader of this group (Dr. Timmerman) received an offer for a professorship and left IFM-GEOMAR in 2004. The scientific programme was subsequently finished by the group members.

g) The registration of one patent and one property right in 1996 are insufficient in relation to the large amount of equipment developed and the number should be increased.

The primary mission of IFM-GEOMAR is basic research although, over the past years, a couple of protection of patterns and design (Gebrauchsmusterschutz) and patents were registered.

h) The proportion of fixed-term, basically-financed positions for scientists is 21% and should be increased in future.

IFM-GEOMAR is currently expanding its Post-doc programme but there is only very limited leeway for a substantial change.

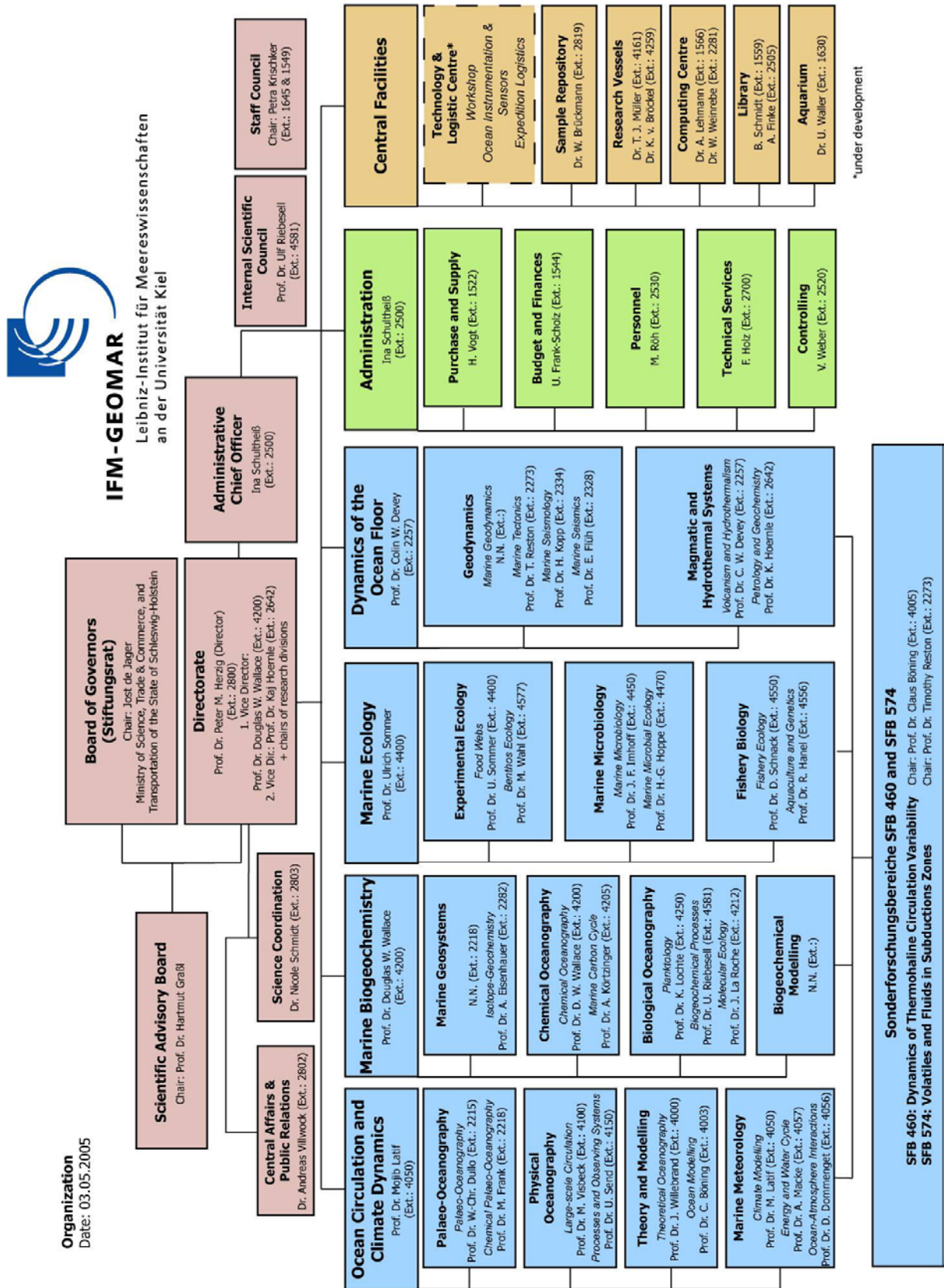
i) In future, GEOMAR should increase the proportion of third-party funding from industry and, in so doing, intensify contacts to industry.

At present, there is a cooperation with the gas company E-ON and from 2000-2002 the Institute had contacts with Total Fina. Furthermore, negotiations with NorskHydro and Sych. Petroleum are ongoing.

j) Prof. Graf, who had a professorship in the Marine Environmental Geology Group, has taken up a position elsewhere. When refilling the post, care should be taken to choose a successor who has a specialisation in isotope-chemistry and will work on an integrating basis in order to ensure that this group does not become disconnected from the other GEOMAR working groups.

The vacant professorship in the department Marine Environmental Geology was filled beginning 1999 with a specialist in isotope chemistry (Prof. A. Eisenhauer) according to the recommendations of the WR.

Appendix 1



Appendix 2

Financial resources and allocation of resources

(Figures in € 1,000)

	2004	2003 ⁷	2002 ⁷
I. Financial resources (income)²	41,826	37,457	41,169
1.1 Institutional funding	26,614	23,606	24,734
- Federal States ³	14,626	15,641	16,408
- Federal Government ³	11,988	7,965	8,326
- Other institutional funding ⁴	0	0	0
<i>Institutional funding as a proportion of total financial resources</i>	63.6 %	63.0 %	60.1 %
1.2 Research support	14,223	12,296	14,796
<i>As a proportion of total financial resources</i>	34.0 %	32.8 %	35.9 %
1.3 Services, contracts, licences, publications	793	902	547
<i>As a proportion of total financial resources</i>	1.9 %	2.4 %	1.3 %
1.4 Other third-party resources	196	653	1,092
<i>As a proportion of total financial resources</i>	0.5 %	1.7 %	2.7 %
II. Expenditures	39,799	44,770	47,175
2.1 Personnel	17,020	15,697	15,328
2.2 Materials, supplies, equipment	15,298	23,373	24,208
2.3 Investments (not incl. building investments)	2,505	1,444	3,053
2.4 Building investments ⁵	525	691	1,357
2.5 Special positions (where applicable)	0	0	0
2.6 Allocations to reserves (where applicable)	0	0	0
2.7 DFG-SFB 460 & 574 ⁸	4,419	3,498	3,118
2.8 Joint projects with the University of Kiel (CAU) ⁸	32	67	111
2.9 For information only: DFG charges	572	371	378

Note: Numbering according to Evaluation Report, Footnotes 1 & 6 deleted because not applicable

² Actual revenues in each year classified by financial resource; incl. money in transit only from DFG-SFB 460 & 574

³ Support according to BLK decision

⁴ Special financing, EU funds

⁵ Building investments, multi-annual measures for building maintenance, land acquisition incl. demolition

⁷ Total sums excluding charter costs RV "Sonne" in the years 2003 (8,031.0 T€) and 2002 (5,934.1 T€)

⁸ Grant/accountancy: Christian-Albrechts University (CAU), Kiel

Appendix 3

Third-party resources classified by organisational unit¹

(Figures in € 1,000)

	2004	2003	2002
I. Total	15,211	13,851	16,435
- DFG (German Research Foundation)	3,527	2,380	2,425
- DFG-SFB 460 and 574 (CAU) ²	4,419	3,498	3,118
- Federal Government	4,174	3,837	6,248
- Federal States (German Länder)	193	162	170
- EU project funding	1,513	2,092	2,504
- Foundations, other research support	365	260	220
- Joint projects with the University of Kiel (CAU) ²	32	67	111
- Services, contracts, licenses, publications	793	902	547
- Other third-party resources ³	195	653	1,092
II. By organizational unit			
RD 1: Ocean Circulation and Climate Dynamics	6,813	5,600	6,275
- DFG (German Research Foundation)	969	909	1,113
- DFG-SFB 460 and 574 (CAU) ²	2,668	1,592	1,117
- Federal Government ⁴	2,703	1,810	2,733
- Federal States	41	33	66
- EU project funding	303	1,028	1,067
- Foundations, other research support	74	84	33
- Joint projects with the University of Kiel (CAU) ²	0	0	0
- Services, contracts, licenses, publications	55	144	146
- Other third-party resources ³	0	0	0
RD 2: Marine Biogeochemistry	2,326	3,159	4,027
- DFG (German Research Foundation)	637	385	537
- DFG-SFB 460 and 574 (CAU) ²	1,001	1,235	1,174
- Federal Government ⁵	305	1,083	1,885
- Federal States	0	0	-8
- EU project funding	166	271	361

¹ Actual expenditure in each year classified by financial resource; not incl. money in transit, only if explicitly specified

² Grant/accountancy: Christian-Albrechts University (CAU), Kiel. The SFB spokespersons are employed at IFM-GEOMAR and are professors at CAU. The figures represent not the total volume of the SFB as third party funding. In SFB 460 all of the 13 subprojects and in SFB 574 10 out of 13 are led by IFM-GEOMAR professors.

³ Contracts from private enterprises or public authorities, co-operation with industry

⁴ Total sums excluding charter costs RV "Sonne" in the years 2002 (1,404 T€) and 2003 (2,878 T€)

⁵ Total sums excluding charter costs RV "Sonne" in the years 2002 (2,041 T€) and 2003 (902 T€)

⁶ Total sums excluding charter costs RV "Sonne" in the years 2002 (2,489 T€) and 2003 (4,252 T€)

	2004	2003	2002
- Foundations, other research support	53	1	8
- Joint projects with the University of Kiel (CAU) ²	0	0	0
- Services, contracts, licenses, publications	164	184	70
- Other third-party resources ³	0	0	0
RD 3: Marine Ecology	2,448	2,261	1,868
- DFG (German Research Foundation)	369	380	248
- DFG-SFB 460 and 574 (CAU) ²	0	0	0
- Federal Government	769	634	639
- Federal States	141	128	103
- EU project funding	581	650	496
- Foundations, other research support	238	175	179
- Joint projects with the University of Kiel (CAU) ²	32	67	111
- Services, contracts, licenses, publications	318	227	92
- Other third-party resources ³	0	0	0
RD 4: Dynamics of the Ocean Floor	3,228	2,171	3,165
- DFG (German Research Foundation)	1,384	707	528
- DFG-SFB 460 and 574 (CAU) ²	750	671	827
- Federal Government ⁶	374	310	990
- Federal States	0	0	0
- EU project funding	463	144	581
- Foundations, other research support	0	0	0
- Joint projects with the University of Kiel (CAU) ²	0	0	0
- Services, contracts, licenses, publications	257	339	239
- Other third-party resources ³	0	0	0
Central Facilities	398	663	1,102
- DFG (German Research Foundation)	168	0	0
- DFG-SFB 460 and 574 (CAU) ²	0	0	0
- Federal Government	25	0	0
- Federal States	11	10	10
- EU project funding	0	0	0
- Foundations, other research support	0	0	0
- Joint projects with the University of Kiel (CAU) ²	0	0	0
- Services, contracts, licenses, publications	-1	9	0
- Other third-party resources ³	195	653	1,092

Appendix 4

Staffing acc. to sources of funding and pay scale¹

- Personnel (financed by institutional and third-party resources) in terms of full-time equivalents [reporting date 31.12.2004] -

	Total number ^{2,3}	Number financed by	
		Institutional resources ²	Third-party resources ²
Total	328.3	216.2	112.1
1. Academic and higher management staff	153.8	89.3	64.5
- S (C3, C4 and above)	21	21	0
- S (W1, C1, C2)	8.5	8.5	0
- I, A 16	1	1	0
- Ia, A 15	7	6	1
- Ib, A 14	32.5	32.5	0
- IIa, A 13	83.8	20.3	63.5
2. Doctoral candidates	30.5	0	30.5
3. Other staff	144	126.9	17.1
- III, IV, A 12, A 11, A 10	42	37	5
- V, A 9, A 8	58.3	52.2	6.1
- VI, A7	19.1	16.1	3
- VII, VIII, A 6, A 5	4	4	0
- Wage brackets, other staff	18.6	15.6	3
- Trainees	2	2	0

¹ Employment positions acc. BAT or other collective pay agreements for staff which is financed by institutional or third-party resources (incl. trainees and guest scientists, but excluding diploma students, student assistants and contracts for work and services)

² In full time equivalent

³ Values in column 2 ("Total number") for "Total", "1. Academic and management staff", "2. Doctoral candidates" and "3. Other staff" correspond to the respective values in Appendix 5.

Appendix 5**Staffing acc. to organisational unit**

- Personnel (financed by institutional and third-party resources) in terms of full-time equivalents [reporting date 31.12.2004] -

	Total	Academic and higher management staff¹	Doctoral candidates²	Other staff, trainees
Entire Institute	328.3	153.8	30.5	144.0
Research Division 1	93.8	61.7	8.5	23.6
Research Division 2	54.3	28.5	6.0	19.8
Research Division 3	45	22.6	8.0	14.4
Research Division 4	50	35.0	8.0	7.0
Interdisciplinary Project Groups	0	0.0	0.0	0.0
Central Facilities (without administration)	42.6	5.0	0.0	37.6
Administration	42.6	1.0	0.0	41.6

¹ BAT IIa and above (not incl. doctoral candidates)

² If financed by institutional or third-party resources

Appendix 6

Personnel

- In persons (financed by institutional and third-party resources) acc. to pay scale [reporting date 31.12.2004] -

	Total number	Financed by third-party resources		Temporary contracts		Women		Women on temporary contracts ¹	
		Number	%	Number	%	Number	%	Number	%
I. Total	390	153	39.2	181	46.4	150	38.5	75	50.0
1. Academic and higher management staff	167	75	44.9	94	56.3	32	19.2	24	75.0
- S (C3, C4 and above)	21	0	0.0	0	0.0	1	4.8	0	0.0
- S (W1, C1, C2)	9	0	0.0	8	88.9	3	33.3	3	100.0
- I, A16	1	0	0.0	0	0.0	0	0.0	0	0.0
- Ia, A 15	8	1	12.5	1	12.5	2	25.0	0	0.0
- Ib, A 14	33	0	0.0	0	0.0	3	9.1	0	0.0
- IIa, A 13, III ²	95	74	77.9	85	89.4	23	24.2	21	91.3
2. Doctoral candidates	60	60	100.0	60	100.0	34	56.7	34	100.0
3. Other staff	163	18	11.0	27	16.6	84	51.5	17	20.2
- III, IV, A 12, A 11, A 10	5	-	-	-	-	-	-	-	-
- V, A 9, A 8	7	-	-	-	-	-	-	-	-
- VI, A7	3	-	-	-	-	-	-	-	-
- VII, VIII, A 6, A 5	0	-	-	-	-	-	-	-	-
- Wage groups, other staff	3	-	-	-	-	-	-	-	-
- Trainees	0	-	-	-	-	-	-	-	-

¹ Women on temporary contracts / number of women² One position paid according to BAT III until "Diplom" degree was conferred

Appendix 7

Publications

- Total number and classification by organisational unit¹ -

	2004	2003	2002
I. Total number of publications	358	357	310
- Monographs (authorship)	2	4	0
- Monographs (editorship)	0	2	5
- Contributions to collective works	69	36	25
- Papers in peer-reviewed journals	240	262	215
- Papers in other journals	40	49	60
- Working Papers / Discussion Papers ²	4	3	1
- Electronic publications ³	3	1	4
II. By organisational unit			
RD 1: Ocean Circulation and Climate Dynamics	89	107	117
- Monographs (authorship)	1	1	0
- Monographs (editorship)	0	2	3
- Contributions to collective works	7	10	5
- Papers in peer-reviewed journals	65	67	73
- Papers in other journals	10	24	35
- Working Papers / Discussion Papers ²	4	3	1
- Electronic publications ³	2	0	0
RD 2: Marine Biogeochemistry	63	75	54
- Monographs (authorship)	0	0	0
- Monographs (editorship)	0	0	0
- Contributions to collective works	2	10	9
- Papers in peer-reviewed journals	58	62	39
- Papers in other journals	3	3	6
- Working Papers / Discussion Papers ²	0	0	0
- Electronic publications ³	0	0	0
RD 3: Marine Ecology	144	86	70
- Monographs (authorship)	0	2	0
- Monographs (editorship)	0	0	1
- Contributions to collective works	58	10	8
- Papers in peer-reviewed journals	62	61	48
- Papers in other journals	23	12	9
- Working Papers / Discussion Papers ²	0	0	0
- Electronic publications ³	1	1	4

¹ Each publication is counted only once and has been assigned to one organisational unit.

² Only if published by the Institute or another institution

³ Only electronic publications which have not been published in printed form, e. g. CDs, electronic manuals

	2004	2003	2002
RD 4: Dynamics of the Ocean Floor	59	82	65
- Monographs (authorship)	1	1	0
- Monographs (editorship)	0	0	0
- Contributions to collective works	2	6	3
- Papers in peer-reviewed journals	52	69	54
- Papers in other journals	4	6	8
- Working Papers / Discussion Papers ²	0	0	0
- Electronic publications ³	0	0	0
Directorate	3	7	4
- Monographs (authorship)	0	0	0
- Monographs (editorship)	0	0	1
- Contributions to collective works	0	0	0
- Papers in peer-reviewed journals	3	3	1
- Papers in other journals	0	4	2
- Working Papers / Discussion Papers ²	0	0	0
- Electronic publications ³	0	0	0

Appendix 8

Documents submitted by IFM-GEOMAR

- Evaluation report according to the Evaluation Questionnaire for the Leibniz Association Research and Service Facilities (including tables)
- Organisation chart
- Statutes of the IFM-GEOMAR ("Satzung", only in German)
- Research Plan 2010
- Annual Report 2002 - 2004
- List of members of the Scientific Advisory Board
- Reports made by the Scientific Advisory Board on the internal audit 2002, 2004, and 2005
- Visits to the Institute, Visits by the Institute's staff to other establishments
- List of lectures/courses
- Overview and detailed list of publications in the last three years, List of the ten most significant publications, List of impact factors (2003) of relevant journals
- Patents
- Conferences and workshops hosted by the IFM-GEOMAR, organisation of external conferences and workshops (Events)
- External conferences in which the Institute's scientists participated in 2002 - 2004
- Expert activities
- Awards and Honors
- List of third-party projects (EU, BMBF, DFG, and others)
- Major expeditions 2002 - 2004

Annex B: Evaluation Report

Leibniz Institute of Marine Sciences (IFM-GEOMAR) at the University of Kiel

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Appendix: Participants in the Evaluation Committee; Representatives of Cooperating Institutions

List of Abbreviations

AUV	Autonomous Underwater Vehicle
BMBF	Federal Ministry of Education and Research, <i>Bundesministerium für Bildung und Forschung</i>
DFG	German Research Foundation, <i>Deutsche Forschungsgemeinschaft</i>
EU	European Union
GEOMAR	Research Center for Marine Geosciences
IfM	Institute for Marine Science
IPCC	Intergovernmental Panel on Climate Change
KLR	Efficiency-Related Cost Calculation System
KDM	German Marine Research Consortium, <i>Konsortium Deutsche Meeresforschung</i>
MC-ICP-MS	Multi-Collector Inductively-Coupled-Plasma Mass Spectrometry
RD	Research Division
ROV	Remotely Operated Vehicle
SFB	Collaborative Research Centre
SPP	Priority Programme (of the German Research Foundation)
TLC	Technology & Logistic Centre

1. Summarised Evaluation and Relevance of the Institute

The foundation Leibniz Institute of Marine Sciences (IFM-GEOMAR) investigates physical, chemical, biological, and geological processes in the ocean and their interaction with the sea floor and the atmosphere. The Institute enjoys a very high reputation both nationally and internationally. Besides the observation and coverage of the entire spectrum of marine research from the sea floor to the atmosphere above the ocean its other unique selling point is the comprehensive amalgamation of the fields of modelling and observation.

Since the last evaluation in 1998 the former Institute for Marine Science (IfM) and the Research Center for Marine Geosciences (GEOMAR) have successfully grown together. The formal merger of the two original institutes took place early in 2004. Two notable positive developments are the emergence of four coherent research divisions and the significant increase in interdisciplinary collaboration between the various research groups. Within a short time, IFM-GEOMAR has become one of the leading marine institutes in Germany and is on a par with leading research institutes elsewhere in Europe and in the USA. This new institute covers the field of marine science in a breadth and depth that is unequalled in Germany. In the year 2010, the administrative offices and scientific facilities of both origin institutes are to be merged and expanded in state-of-the-art facilities on the East Campus. These plans are strongly supported, as this will have a positive impact on the unification of the Institute.

The first director of IFM-GEOMAR was appointed in 2004. His leadership has undoubtedly had a very positive influence on the fusion of the two institutes.

The scientific work carried out by IFM-GEOMAR is very good, in part even excellent, and the Institute enjoys a remarkable level of prestige on the international scene. This can be seen in the international reputation enjoyed by many of the group leaders in all four research divisions as well as in the high quality of work in various areas at the forefront of their fields world-wide. This high-level science has the potential to develop new interdisciplinary fields of research. Further factors underlying the merits of IFM-GEOMAR are its successful competitive third-party funding, its very good publication record in peer-reviewed journals, its extensive networking, its significant activities in the teaching of all disciplines of marine sciences, as well as its intensive public relations activities. In addition, IFM-GEOMAR plays a unique educational role in Germany by offering the leading German PhD-programme in physical oceanography/meteorology.

IFM-GEOMAR performs appropriate and socially relevant research, for example in the improvement of geo-hazard forecasting and the development of deep-sea analytical technology to the benefit of local and national industry, and constitutes a repository of useful knowledge to Germany in marine matters. One of IFM-GEOMAR's strengths is its expertise in the development of new equipment such as the complex Lander systems. The rapid development of new equipment for tsunami monitoring constitutes IFM-GEOMAR as a flexible institute that is able to respond with fast reactions to pressing socially relevant issues from foreign countries. Owing to its high degree of networking and its high-quality science, the Institute has gained a nationwide impact on marine sciences. These demanding projects could not be performed by a university; likewise, a university would be unable to provide the infrastructure required for sea-going expeditions and longer research trips.

The current positive relationship with the University of Kiel is reflected in partnerships in various fields, not only in the ongoing cooperation in two Collaborative Research Centres (SFB) but also in a number of upcoming proposals such as for the establishment of an excellence cluster.

The teaching cooperation with Kiel University, which is highly beneficial to the Institute in terms of recruiting PhD candidates, should be maintained. However, professors at the Institute should not exceed their teaching loads beyond that which is deemed appropriate for professors of institutes of the Leibniz Association.

IFM-GEOMAR has important coordination functions at national, European and international level. IFM-GEOMAR scientists are principal coordinators of a large number of large-scale ship expeditions and are involved in numerous high-ranking cooperation projects.

The very good and extremely open working atmosphere at IFM-GEOMAR as well as its future research concept give good reason to expect that IFM-GEOMAR will not only maintain but rather increase its impressive efficiency in the future. In order to meet these expectations, IFM-GEOMAR should intensify the interdisciplinary cooperation in some fields of its research divisions. Thus, the establishment of an incentive fund that promotes further integration of groups and disciplines between the merged institutes is recommended. Moreover, a raise in the fund for existing interdisciplinary junior research groups as well as an increase in the capacity for post-doc positions are recommended.

The Institute's basic resources are adequate with the exception of the purchase and development of large-scale seagoing instrumentation and the replacement of outdated equipment. In order to remain competitive internationally, funding for advanced tools for multidisciplinary ocean observations such as a deep-water Remotely Operated Vehicle (ROV) and an actively propelled Autonomous Underwater Vehicle (AUV) are recommended by one expert.

To accelerate the fusion process, the funding agencies of the IFM-GEOMAR are encouraged to enable the Institute to move one year earlier from the west to the east shore, in 2009. The teaching should be kept at the IfM site on the west shore close to the university campus.

Although the Institute has already been very successful in the rise of third-party money and publications, further space for improvements is seen by the Evaluation Committee.

2. Mission, Tasks, Main Work Areas

The 2004 **merger** of the Institute for Marine Science (IfM), which had a long established reputation in oceanography, marine biology and meteorology, with the Research Center for Marine Geosciences (GEOMAR), which had long since enjoyed very strong international presence in the field of marine geo-scientific research, led to what is now the Leibniz Institute of Marine Sciences IFM-GEOMAR. This new institute has a breadth and depth of coverage of the field that is unequalled in Germany and on a par with leading research institutes elsewhere in Europe and in the USA. In itself, the merger has created a very large and powerful marine research organisation presenting high-level science with very good international exposure which has the potential to develop new interdisciplinary fields of research. The merger is welcomed by the Evaluation Committee, since it is considered instrumental in boosting the field of marine science within Germany.

The **mission** of the new institute consists in the investigation of the chemical, physical, biological and geological processes in the ocean and their interaction with the sea floor and the atmosphere and is pursued by way of clearly defined goals and objectives. IFM-GEOMAR performs up-to-date and socially relevant research. In contrast to other leading national institutes, IFM-GEOMAR covers all marine science fields and is much broader and more comprehensive in its research programme and more significantly involved in the teaching of all marine relevant

disciplines. The Institute has another unique selling point in the comprehensive amalgamation of the fields of modelling and observation.

The **future research plan** of IFM-GEOMAR envisages the coverage of the entire field of marine science, including all disciplines from the sea floor to the atmosphere. The unification of the Institute within one new joint building in the new central campus on the east shore will help to reach this goal. This research concept as well as the decision to move the entire Institute to the east shore is strongly supported by the Evaluation Committee.

Research is performed within four newly established research divisions (RD). Each RD comprises two to four groups which in turn consist of several subgroups. Internal support services are provided by various units of the Central Facilities. These include the Sample Repository, the Research Vessels, the Computing Centre, the Library, the Aquarium, and the Technology & Logistic Centre, the latter of which is currently under development.

The potential for cooperation between the different research divisions is vast but was up to now only partially exploited. In this respect, a higher level of cooperation of groups working on microbes would be desirable and also cooperation in the field of molecular biology could be intensified. The compartmentalisation of the Microbiology field into three research divisions (RD2, 3, and 4) seems artificial and should be reconsidered.

The overarching theme for **Research Division 1 (RD1)** — “**Ocean Circulation and Climate Dynamics**” is the ocean’s role in the climate system. The general research objectives of RD1 aim at achieving a better understanding of past, present and future climate variations. The scientific groups of RD1 are specialised in climate dynamics, atmospheric radiation, air-sea interaction, observational large-scale oceanography, ocean mixing, palaeo-oceanography, and ocean modelling. RD1 combines the physical sciences departments of the former IfM with the palaeo-oceanography department of the former GEOMAR.

RD1, as it stands now, is small but focussed. The five recent new appointments in its leading fields complement the existing expertise in Oceanography, Ocean Modelling and Palaeo-Oceanography ideally. In its key areas, the division’s research is considered to have outstanding and world class quality. This can be seen not only in the large number of invited talks at conferences and other events, but also in the numerous awards that the leaders and staff of the division have received, as well as in the role of RD1 scientists in international panels and projects. The research of RD1 scientists has also been instrumental in the formulation of international research programmes as, for example, related to present, future and past global change and climate variability. The success of this division can also be seen in its publication record in leading journals and the citation rate of key papers. While adequate, it is the lowest output of peer-reviewed papers per scientist when compared to the other research divisions, which the peers believe to be a consequence of the major personnel turnover and series of new projects in this division. Here, the peers see room for improvement. On the other hand, RD1 has been highly successful in raising extramural funds from the German Research Foundation (DFG), while EU project funding has fallen to one-third.

The contribution to IFM-GEOMAR’s research by RD1 is particularly strong with respect to the role of the thermohaline circulation in the Atlantic. Research by members of this division has isolated decadal modes of natural climate variability in the Atlantic, contributed towards the simulation of such modes in ocean and climate models, and demonstrated that the system provides some potentially useful predictability. The contributions of the Palaeo-Oceanography

group are highly relevant in this area of climate change with lead times of several decades to centuries, as observing whole cycles of the slow modes of variability calls for long-term observations and proxies.

The strengthening of RD1's involvement in tropical oceanography and associated modes of climate variability in the future, as foreseen by the Institute, is not only advisable but is regarded as the logical consequence. The extension of its expertise in ocean observing systems as well as the exploitation of the latest technological developments including satellites and remote-controlled observing platforms meets the approval of the peers. In building up this expertise, the peers see the potential to strengthen the overall experimental capability of the entire Institute.

The **Palaeo-Oceanography** group could benefit from better integration if their proxy work was integrated into the work of the Physical Oceanography group as well as in circulation modelling approaches. Such synergies are strongly encouraged. In this regard, the merger of IfM and GEOMAR provides enormous potential.

The **Physical Oceanography** group is one of the strongest research groups, most adept to raising external funds, and definitely the strongest educational component in IFM-GEOMAR.

The **Theoretical Oceanography** subgroup of the **Theory and Modelling** group has a very strong leading scientist with expertise in climate variability, ocean circulation and forecasting who is also a highly respected convenor of the IPCC report (Intergovernmental Panel on Climate Change).

The leader of RD1, who is also the leader of the **Climate Modelling** subgroup of the **Marine Meteorology** group, has an excellent reputation as one of the key leaders on predictability of thermohaline circulation and performs promising and ambitious world-class research with respect to seasonal forecasting and centennial scale climate change, thus adding a global perspective to the department. The research in the fields of thermohaline circulation in the Atlantic Ocean is of key importance in the current discussion on climate prediction since it addresses the decadal time-range between the period for well-established seasonal forecasting and for the climate change scenarios. The Marine Meteorology group is, as a very young group, one of the strongest research groups and most skilful in raising external funds.

The peers rate the educational programme of RD1 in physical oceanography/meteorology as the preeminent programme in Germany which has produced many of the senior professors in the country.

Currently the extent to which collaboration within RD1 has been implemented is difficult to assess, because its structure and composition has only recently emerged. Nevertheless, the Evaluation Committee sees evidence of growing collaboration work between the different groups, for instance the interdisciplinary work on palaeo-modelling, which has considerably improved. The Climate Modelling subgroup's switch to the numeric OPA model, which is an ocean general circulation modelling system shared by projects in oceanography and climate change studies, is appreciated by the peers as a very encouraging approach resulting in new collaboration between the Modelling and the Palaeo-Oceanography group. For the next years, the peers recommend a further reinforcement of the links between the different groups within RD1 with high-priority. The interaction between RD1 and RD2 (Marine Biogeochemistry) has clearly improved.

Research Division 2 (RD2) — “Marine Biogeochemistry” addresses the material exchanges between the oceanic, the sediment, and the atmospheric reservoirs and the organisms including humans that mediate chemical transformations and material transport in the ocean. The major emphasis is on the highly dynamic interfaces between atmosphere and ocean and sediment and ocean. RD2 combines the chemical and biological oceanography departments of the former IfM with the marine environmental geology department of the former GEOMAR.

RD2 is esteemed as a world-class division. The quality of the science conducted by the majority of the RD2 staff is extremely high and can be regarded as being the forefront of biological oceanography world-wide. Based on the number of publications per scientist, the publication record of RD2 in peer-reviewed journals, like its extramural funding, is very good but still has room for improvement.

A **strength** of IFM-GEOMAR is its expertise in the development of new equipment to operate on or near the seabed, a fact which is exemplified by the **Marine Geosystems** group which has built Landers for benthic *in-situ* biogeochemical observations. This capability has been used with great success in studies of methane hydrate. The former GEOMAR group was originally responsible for introducing gas hydrates onto the agenda, resulting in a leading position in both Germany and Europe. The on-going gas hydrate research is excellent with respect to the development of new equipment, and the *in-situ* laboratories are at the forefront of this field. The work of the **Isotope-Geochemistry** subgroup of Marine Geosystems is cutting-edge, object-based geochemical and biogeochemical proxy development. It is impressive that much of the mass-spectrometric equipment has been obtained on third-party funds. Their work on metal and biogeochemical cycling is attested an even stronger future potential if more use is made of scientifically motivated cooperation with the Chemical Oceanography and Biological Oceanography of RD2, as well as to the Marine Microbiology group of RD3. Thus, the process-based understanding of the links between metal cycling from molecular biology and isotope fractionation harbours the potential of a high innovation level. These opportunities have emerged only now since the merger of the two institutes.

The leader of RD2, who is also the leader of the **Chemical Oceanography** subgroup, performs work of international significance. As a world-known expert in the field of chemical tracers and air-sea exchange, he has contributed substantially to this area. Collaboration potential with the leader of the Marine Carbon Cycle subgroup is evident, and these strong connections are enforced in the planned SFB “Climate-Biogeochemistry Interactions in the Tropical Oceans”.

Amongst the most outstanding projects of RD2 are those dealing with carbon and the carbon dioxide-budget of the ocean and atmosphere, performed by the **Planktology** and **Biogeochemical Processes** subgroups of the **Biological Oceanography** group. The research into gas regeneration performed by the Biogeochemical Processes subgroup is regarded as a very exciting field and considered cutting edge science. The Planktology and Biogeochemical Processes subgroups both show extremely good publication records for peer-reviewed articles, are very successful in attracting external funding, are known and respected world-wide, and generally contribute to the high scientific reputation of IFM-GEOMAR. In addition, their projects also attract a large number of high-potential PhD students and postdoctoral researchers and are also deemed very attractive with regards to teaching. The Planktology subgroup has an excellent leader whose research work is on a par with top academic standards. Her results of the last few years on carbon and nitrogen cycles as well as on the fixation of these elements in the benthos of the ocean are very up-to-date and enjoy international acceptance, especially in light of the carbon dioxide problem.

The leaders of the Planktology and the Molecular Ecology subgroups represent a powerful team that attracts undergraduates as well as PhD students and post-docs. These very good biological groups might contemplate establishing a Research Training Group funded by the DFG.

The leader of the Molecular Ecology subgroup, who is already well reputed in the scientific world, is conducting very good to excellent science. She not only established the all-important molecular biology laboratory of RD2, but also masterminded the state-of-the-art and seminal project on ferric-limited nitrogen fixation by the phytoplankton of the oceans of the southern hemisphere. This project deals with the pressing question of the physiological and biochemical connection between geno- and phenotypes. Although collaboration does exist, for instance with the Experimental Ecology subgroup of RD3 on a project in the Southern Pacific concerning the differentiation of diatoms, as well as with four other groups, a higher degree of cooperation with groups working on microbes would be desirable in order to improve the integration of this subgroup within the Institute.

The cooperation between the groups of RD2 and RD3 in the project on the nitrogen cycle is convincing and has the potential to become a model for other Institute divisions due to its interdisciplinary and straightforwardness in scientific terms. In order to achieve this goal, the peers request further horizontal connections.

The newly appointed chairs in RD1 and RD2 are highly appreciated by the peers, whereby the biology field has gained support in a way that enables it to participate in international competition and to deal with excellent projects.

Research Division 3 (RD3) — “Marine Ecology” has its primary focus on the understanding of the sensitivity of marine ecosystems to anthropogenic and natural change, with a mid-term focus on climate change and the overexploitation of marine bio-resources. RD3 consists of three research units of the former IfM which are mainly defined by their focal organisms and the methodology required to study them.

The quality of science conducted by the majority of these groups is extremely high and can be regarded as being at the forefront of biological oceanography world-wide. Members of RD3 have been very successful in raising third party funding, and grants for future extramural funding have already been positively rated. The publication record, based on the number of publications per scientist, is very good, rating better than any of the other divisions. In addition to this, RD3 is very popular among the students, a fact which might be due to the combination of state-of-the-art research with an attractive teaching programme. This popularity should be sustained.

The most outstanding projects of RD3 concern those dealing with the ecology and biodiversity of pelagic and benthic marine organisms performed by the **Food Webs** and **Benthos Ecology** subgroups of the **Experimental Ecology** group. These groups show an extremely good publication record for peer-reviewed articles, are very successful in attracting external funding, are known and respected world-wide, and generally contribute to the IFM-GEOMAR's high scientific reputation. In addition, their projects attract a large number of high-potential PhD students and postdoctoral researchers and are also very attractive with regards to teaching. The members of the Food Webs subgroup are particularly productive, which is reflected not only in the publications in high-ranking journals (*Nature*), but also in six appointments to external chairs. The Benthos Ecology subgroup works, among other things, on the growth-inhibiting substances pro-

duced by specific animals and plants. These substances have gained the interest of the industry as an alternative to tributyl tin, which is no longer for sale. In cooperation with the Planktology and Molecular Ecology subgroups from RD2, these two subgroups have developed positively. The leader of the Experimental Ecology group, who is also the leader of the Food Webs subgroup, coordinates the DFG priority research programme 1162 "Aquashift" with great success.

The **Marine Microbiology** group has experienced a very positive development over the last few years and conducts good to excellent science. These research projects are regarded as high ranking in national and international terms. The goal of all these projects is to investigate the ecological functions of the relevant micro-organisms using diverse methods. The research in the field of microbiology of hydrothermal springs and deep sea sediments should be more clearly defined, possibly by focussing on specific questions or on clearly defined biotopes such as cold seeps. At present, this group is showing a relatively low level of integration within the Institute. A higher level of cooperation would therefore be desirable, for example with the geologists in RD4.

Acting on a project-guideline from the BMBF focus "*Marine Naturstoffforschung*", a new research area on the analysis of microbial secondary metabolites from marine organisms has been established. The discovery of the first active anti-fouling substances that harbour potential medical relevance is considered promising in both scientific and commercial terms, and the possible patenting of these substances is currently being looked into. This new research area is focussed in a Centre for Marine Active Substances (*Zentrum für Marine Wirkstoffforschung*) which started funding as a lighthouse-project of the State of Schleswig-Holstein at the end of 2005. This centre is located at IFM-GEOMAR and the leader of the Marine Microbiology group is the coordinator of this project, which is appreciated by the peers. While some peers see the commercialisation of the anti-fouling project in a rather positive light, others are worried that doing so will mean that research will be orientated too much towards direct commercialisation. The peers assume that one of the reasons for the rather low publication record of this group may be traced back to the time involved in the patenting process. Thus, some peers urge that publication of the basic science research results should not be delayed for the sole benefit of economic interests (patenting).

The time-consuming work on bacterial taxonomy carried out by the group leader of Marine Microbiology is highly appreciated because it is highly important work for microbiology research. His high publication record in non peer-reviewed taxonomic journals is duly acknowledged. Nevertheless, for the future more attention should be placed on publishing non-taxonomic results in international microbiology journals, as well as on achieving a better publication output in general.

The Marine Microbiology group also has a culture collection of phototrophic and heterotrophic micro-organisms and fungi of irreplaceable cultivable diversity, which is of the utmost value and which further boosts the reputation of IFM-GEOMAR. These organisms could be systematically investigated with respect to marine active substances.

The **Fishery Biology** group has improved considerably since the last evaluation in 1998. The major areas covered by the fisheries scientists are up-to-date, pursued using state-of-the-art methodology, and the results are appreciated by the scientific community. The incorporation of molecular genetics through the appointment of a junior professor into the study of fish populations and biodiversity is highly appreciated since a scientist with a background in genetics was required in this division. The publication record is good, and some recent publications have had a high impact; a higher publication output would, however, be desirable. Compared to the other

research groups of the Institute, the Fishery Biology group lags behind, but the great potential in this group for a move towards a more coherent research plan, which would be desirable, and new concepts within few years time is evident. In addition to this, huge potential is also seen in the younger scientists. The intensified cooperation with other groups compared to the time before the merger is greatly appreciated; the potential for further interdisciplinary research should, however, be pursued. Collaboration with microbiologists is recommended; further, it is expected that the fisheries scientists will continue with their international cooperation, while expanding their participation in future projects of IFM-GEOMAR. In addition, an increased number of grant applications from this group for the DFG priority research programme “*Aquashift*” would be welcomed. Aquaculture, which was formerly one of the central research fields and which continues to be part of the research agenda, has been shifted from top to normal priority, a move which is considered to be a further positive development. The work on fish aquacultures, especially those in the African and Indonesian areas, is acknowledged; nevertheless, research based on both fundamental and scientific approaches is required in this area.

Research Division 4 (RD4) — “Dynamics of the Ocean Floor” focusses on the geodynamic, tectonic, magmatic and hydrothermal processes that shape the sea floor and the impact of these processes on the environment, e.g. climate and natural hazards. Scientists of RD4 are specialised in hydrothermalism, volcanology, geochemistry, petrology, hydroacoustics, seismic imaging, wide-angle seismics, and geodynamic modelling. RD4 combines the volcanology and geodynamics departments of the former GEOMAR.

RD4 is at the top of its field, performing up-to-date and socially relevant research, for example in the improvement of geo-hazards forecasting (e.g. the tsunami warning system for the Indian Ocean) and the development of deep-sea analytical technology to the benefit of local and national industry, and constitutes the repository of useful knowledge to Germany in marine matters such as ocean mining, gas hydrates, Law of the Sea, the Kyoto Accord and sequestration of carbon dioxide in the deep sea.

RD4 has a strong, international research profile and is known world-wide. The newly hired professors are excellent and the scientists of RD4 are very successful in obtaining external funding and have published several papers that have attracted widespread international interest. RD4 should try to keep this high level of publication. The fusion of the geochemical and geophysical fields has been successful, and the traditional strengths, Volcanology and Seismic Imaging, have been successfully integrated over the past seven years into a new, world-class research division that attracts excellent PhD candidates and post-docs from around the world. The work within RD4 is innovative in the field of marine technology, as well as in science leadership. The recent recognition of serpentine as a critical earth material was spawned from GEOMAR science.

The **Marine Seismology** subgroup of the **Geodynamics** group is a particularly strong research group, entailing the development of new equipment and processing techniques in addition to the design and interpretation of the results of experiments to discover the structure and properties of the earth beneath the seabed. Current activities in Plate Boundary Science are largely observational and would benefit highly from theoretical and/or experimental approaches. Future positions should strategically target theoretical/experimental scientists, particularly from the field of geodynamics.

The **Volcanism and Hydrothermalism** subgroup of **Magmatic and Hydrothermal Systems** is a young group which publishes its results in reviewed journals and is known world-wide. The leader of this subgroup was appointed only recently and his leadership in the proposed Graduate School in Plate Evolution will help to secure a strong future. Recent innovations in the seismic imaging of the water column demonstrate this group's successful efforts to reach across divisions.

The value of strong interdisciplinary collaboration with other members of RD4 who have expertise in volcanism, hydrothermalism and igneous geochemistry and with members of RD2 who have expertise in fluid and gas venting from the seabed becomes evident in research on convergent margins, currently supported by SFB 574 on "Volatiles and Fluids in Subduction Zones". A new field of collaboration is also developing between RD4 and RD1 with the use of seismic techniques to study fine-scale lateral variability in temperature and salinity in the water column.

The current imbalance of technical positions across the Institute is an impediment to the science of RD4, which has many analytical facilities that require dedicated technical support. In this respect, greater technical support should be given to RD4. RD4 would be the major user of a ROV and an AUV if IFM-GEOMAR managed to acquire these tools for deep sea research.

3. Structural Features and Organisation

After the merger of the former institutes IfM and GEOMAR into the Leibniz Institute of Marine Sciences, the closure of the ten departments of IfM and their incorporation into four coherent research divisions has led to a significant increase in collaboration between the various research groups. The great efforts to build up these functional and well equipped divisions which involve the modification and update of research topics as well as the reallocation of personnel are duly acknowledged. The plans to unify and expand the Institute in state-of-the-art facilities on the east shore in the year 2010 are strongly supported by the Evaluation Committee, since such steps are essential in order to improve synergies across disciplines and to improve the cooperation between the research divisions. This physical unification of the Institute on the east site is seen as a necessary condition for the Institute to achieve front rank status at international level. The funding agencies of the IFM-GEOMAR are encouraged to enable the Institute to move one year earlier from the west to the east shore, in 2009. This move will mean that it will still be necessary to teach on the former IfM site on the west shore, which is in close proximity to the university campus.

The **directorate** of IFM-GEOMAR comprises the director, two deputy directors and the heads of the research divisions. This newly established structure guarantees solid leadership and has the potential to favour those decisions which are beneficial to science. Today, the required fast reaction in project strategy is possible, meaning that the resources required can be transferred immediately and such that individual needs are met. The first **director** of IFM-GEOMAR, appointed in 2004, enjoys an excellent international reputation, is on the board of several high-level local, national and international bodies and is the maritime coordinator of the State of Schleswig-Holstein. His leadership has clearly had a very positive influence on the fusion of the two institutes. Due to the spatial separation of the two sites of the Institute, the communication between the director and the staff is suboptimal and should be improved now, in advance of the physical unification of the two research sites. The peers are in favour of the kind of project development that gives all scientists in all divisions the opportunity to contribute their ideas and

allows equal access to all shared resources rather than pursuing a too pronounced top-down approach.

The **Scientific Advisory Board** of IFM-GEOMAR comprises international leading scientists who fulfil their duties in a highly competent and committed manner. The Scientific Advisory Board is actively involved in the development of IFM-GEOMAR, especially by way of close and regular follow-up checks on science quality.

Internal **quality management** is ensured at IFM-GEOMAR through the establishment of a scientist job pool and performance-oriented funding for all groups based on their successful third-party fundraising as well as their publication activity. These quality management tools are appreciated by the Evaluation Committee. Furthermore, the peers also recommend treating the matter of space resources in the same way as financial and personnel resources by using the tool of performance-oriented space distribution. The implementation of an additional incentive fund is suggested to promote the integration of groups and disciplines.

The **female scientists** at IFM-GEOMAR comprise 19% of the total academic staff with two-thirds of them on temporary contracts. The difficult situation of graduate students having a family during their doctoral thesis period could be alleviated by offering financial support for a fourth year.

The efficiency-related cost calculation system (**KLR**) and the programme budget were introduced at the beginning of 2004 and have been up and running since January 2005 without any problems. Before the appointment of the new director of IFM-GEOMAR, a new head of administration was employed. These circumstances led to unacceptable delays in some administrative procedures such as travel expense reimbursement as well as the loss or misplacement of paperwork. Thus, with respect to administrative support there is room for improvement that should be addressed quickly.

4. Resources, Expenditures and Personnel

The peers rate the resources of IFM-GEOMAR as sufficient for fulfilling its mission, with the exception of the purchase and development of large-scale seagoing equipment and the replacement of outdated equipment. The Institute has plans to establish a larger range of submersible robotic systems such as a deep-water Remotely Operated Vehicle (ROV) and an actively propelled Autonomous Underwater Vehicle (AUV). One expert recommends funds for a ROV and an AUV. The funding of these ocean observation tools should not be at the expense of the institutional budget.

The work of Marine Geosystems (RD2) and Palaeo-Oceanography (RD1) is heavily equipment-based. The peers recommend acquiring a new Multi-Collector Inductively-Coupled-Plasma Mass Spectrometer (MC-ICP-MS) including laser ablation and appropriate technical support in order to perform future research on an equally high level. Backed with solid technical support, this device would provide a bridge between the geochemical research activities of RD2 (Marine Biogeochemistry) and RD4 (Dynamics of the Ocean Floor).

A **molecular laboratory** has been established at the Institute in support of new molecular biology projects. Since the requirements for this method and, hence, for the devices have increased remarkably, the establishment of a second laboratory with suitable equipment is recommended. The director should be able to transform an existing laboratory from another area

which has not heavily been used into a molecular laboratory following consultation with those concerned.

One criterion of the efficiency of IFM-GEOMAR is its successful **third-party funding**, which is appreciated by the Evaluation Committee and should be maintained. Between 2002 and 2004 the total third-party funding recovered from a slump and on average is considered as very high. On the whole, the Institute's share of competitively acquired third party funding from the DFG and the EU has continuously increased. In total, the Institute was involved in 43 EU-Projects at the end of 2004 and was coordinating two of them, with a total funding of more than 6 Mio. €. This is highly appreciated by the peers who encourage the Institute to try maintaining this level. If compatible with its equity ratio, the Institute could try to enhance its funding from the EU even more. In addition, IFM-GEOMAR has been successful in obtaining an amount of funding from the DFG that is a multiple of its DFG charges.

Currently IFM-GEOMAR pays 1 Mio. € per annum for **computing time** at Kiel University. With respect to a balanced cost-performance ratio, this is considered a good deal, which the Institute should keep.

Vacant leadership positions as in the Biogeochemical Modelling group and in the Marine Geosystems group should be filled in the near future.

As some outstanding research is done by "*Mittelbau*" staff scientists, the Institute should secure this tradition on the long-term by assigning tenure to staff scientists but only after successful competition in a transparent, peer-reviewed tenure-track system. The establishment of such a system will allow for longer-term retention of young, qualified scientists who are presently leaving the Institute to take on leading positions elsewhere.

IFM-GEOMAR has as little as 21% fixed term scientists positions paid for by the institutional funding. Thus, the Institute should try to increase this number according to the recommendations of the German Science Council (*Wissenschaftsrat*).¹ It is also recommended that the currently high number of 13 permanent positions financed by third party funds ("Projekt-dauerstellen"), nine of which are taken by technicians and four by scientists, has to be reduced, since this issue puts the Institute under pressure with respect to permanent fundraising which might disturb its coherent research programme.

In order to overcome the current problem of the unbalanced distribution of permanently employed technicians between RD4 (Dynamics of the Ocean Floor), which has four, and other divisions, which have more than 15 technicians, plans are in the pipeline to consolidate technicians within a central pool of the future **Technology & Logistic Centre (TLC)**. These plans are strongly supported by the Evaluation Committee. A balanced distribution of the technical personnel between the research divisions should be striven for. In addition, the Institute should also try to reduce its currently high number of permanently employed administrative staff.

The peers point out the problem of the unbalanced ratio of a relatively high number of cruises and the inadequate number of scientists working on data analysis, which is especially true for RD4 (Dynamics of the Ocean Floor). This is an inherent problem of the system that funds cruises. Very frequently, there is funding of staff to prepare and implement sea missions, but attention to post-cruise scientific work is rather neglected. Therefore, in order to maintain their third-party funded staff, scientists of the Institute are forced to embark on ever new missions

¹ Systemevaluation der Blauen Liste – Stellungnahme des Wissenschaftsrates zum Abschluss der Bewertung der Einrichtungen der Blauen Liste, Band XII, Köln 2001, p. 39

before the possible scientific results of preceding expeditions have been processed. To allow those scientists who are involved to escape from this dilemma, an increase in financial support per each cruise should be sought that is specifically aimed at post-cruise data analysis and interpretation.

The **working atmosphere** in the Institute is very good and extremely open. In general, the scientists, graduate students, and support staff are excited and enthusiastic about present and future prospects and they share the vision for the Institute.

5. Promotion of Junior Academics and Cooperation

The promotion of junior academics is an highly-rated issue at IFM-GEOMAR. Between 2002 and 2004 seven habilitations (postdoctoral teaching qualifications), 73 doctoral theses and 125 diploma theses were successfully completed. At the end of 2004, 60 doctoral candidates who had been financed by third-party resources were working at IFM-GEOMAR. In contrast, the total number of post-doc positions, four in 2005 and six in 2006, is considered too low compared with the high total number of 167 scientists and should be increased. A most impressive fact is that 16 IFM-GEOMAR scientists have been called for external professorships in leading institutions around the world. Among others six Humboldt and two Marie-Curie fellows have been hosted at the Institute.

The high reputation enjoyed by IFM-GEOMAR, which is also manifested in its numerous international study programmes (e.g. GAME, POMOR, SOLAS, BioOcean), attracts many students from all over Germany. The graduate students and post-docs are satisfied with respect to facilities, research options and interaction across divisions. The PhD students are competent in defending their work and feel looked after and supported. This is regarded by the Evaluation Committee as an indicator for a good working atmosphere and good supervision at the Institute and can be considered all the more as a remarkable result in light of the fact that leadership positions have changed frequently. However, it would be desirable if the Institute were to consider establishing a more stringent structure for graduate work, including joint seminar series, more intensive guidance during the preparation of first manuscripts and presentations as well as the presence of a second supervisor as a mentor for all graduate work.

The peers regret that according to the 12 years rule ensuing from the Framework Act for Higher Education ("*Hochschulrahmengesetz*"), that applies also to Leibniz Institutes, IFM-GEOMAR is forced to dismiss young researchers after their qualification phase has ended. In order to offer an incentive to young scientists, the Institute should examine its capacity for tenure-track positions as far as this does not collide with the recommended increase in the proportion of fixed-term, institution-financed positions for scientists.

IFM-GEOMAR is engaged in the promotion of the integrative research performed by young post-docs by supporting two **interdisciplinary junior research groups** at a time, each for a two-year period with € 50,000 per annum. This backing, which fosters promising young staff by enabling them to implement original research rapidly, is very much appreciated by the Evaluation Committee which further recommends a raise in the funding for junior-research groups as far as is feasible for the Institute.

The current positive relationship of IFM-GEOMAR with the University of Kiel is reflected in the partnerships in the fields of palaeo-climate, deep sea investigations and continental margins not only in ongoing cooperation in the two SFB but also in various upcoming proposals such as for

the establishment of an excellence cluster. A **bachelor/master** (BA/MA) programme in which the Institute intends to participate is also in the pipeline. Fishery biology, which is very popular among the students, and which is currently an independent subject in the Diploma studies, will become an important part of the biological oceanography course. The maintenance of aquaculture as a teaching topic is recommended since this field is important for the understanding of physical issues. The teaching cooperation with Kiel University, which is highly advantageous to the Institute in terms of recruiting PhD candidates, should be maintained. However, the Institute's professors should not exceed their **teaching loads** beyond the measure that is deemed appropriate for professors at institutes of the Leibniz Association. The Institute and the university could examine the possibility of post-docs doing some of the teaching as a means of reducing the teaching load of the senior scientists and preparing these junior scientists for an academic career.

Besides the cooperation with Kiel University, there are extensive collaborations with many leading institutions all over the world. Moreover, IFM-GEOMAR has important **coordination functions** at national, European and international level. IFM-GEOMAR scientists are the principal coordinators of a large number of large-scale ship expeditions, and the Institute is involved in numerous high-ranking cooperation projects. The Institute's high degree of networking can be seen in its leadership of two SFB (460, 574), its involvement in 44 projects of the 5th and 6th framework programmes of the EU, with coordinator functions in three of these, as well as in its activities in the planning and coordination of research in the context of large-scale international programmes such as the World Climate Research Programme. Moreover, IFM-GEOMAR is the largest single partner in the BMBF-Atlantic project ARGOTROPAT. The interdisciplinary research activities which are exploring new horizons such as the excellence cluster proposal together with Kiel University "The Future Ocean" and the issue of the 1000 ppm CO₂ world, the latter dealing with the future biogeochemical state of the ocean in a high carbon-dioxide environment, are growing. The Institute is further involved in two Priority Programmes ("*Schwerpunktprogramm*") funded by the DFG, the SPP 1144 "From Mantle to Ocean" and the SPP 1162 "*Aquashift*", the latter coordinated by the leader of RD3. In addition, the German Marine Research Consortium, KDM ("Konsortium Deutsche Meeresforschung"), with nine German members and two international associate members (IFREMER and NOC), is chaired by IFM-GEOMAR.

Owing to its high degree of networking and its high-quality science, IFM-GEOMAR has gained a **nationwide impact** on marine sciences. The Evaluation Committee states clearly that a university could neither perform the demanding projects nor support the necessary infrastructure and flexibility of the scientists for organising and participating in sea-going expeditions and longer research trips or achieve the level of science quality that IFM-GEOMAR does. The cooperation of the four research divisions in the planned SFB is also considered to be very impressive.

6. Results and Scientific Resonance

The scientific work carried out by IFM-GEOMAR is very good, in part even excellent. The peers rate the research activities of numerous groups of all four research divisions to be at the top of their fields. Numerous scientists are well-known and accepted internationally, thus contributing to the high scientific reputation of IFM-GEOMAR.

The overall **publication record** in the period 2002 to 2004 in peer-reviewed journals totals to 717 papers. Of these, 23 were published in high-ranking journals such as “*Nature*” and “*Science*”, with 13 of them under the Institute’s first-author leadership resulting in a publication factor per scientist per year that is within the international range. Room for further increase, however, is seen by the peers. One criticism that is raised is the fact that some permanently employed scientists are not maintaining an acceptable level of publication in top quality, international, peer-reviewed journals. The peers regret that, due to the German labour legislation, it is currently impossible to react to this fact in an appropriate way.

IFM-GEOMAR has filed six **patents** during the period 2002 to 2004. Of these patents no licences were realized up to now. With respect to the patenting activities in the marine active substances, the peers recommend that IFM-GEOMAR not delay the publication of scientific research results in favour of commercial interests. During the same period of time, one company was spun-off.

One of IFM-GEOMAR strengths lies in its expertise in the **development of new equipment**, for example the complex Lander systems for benthic *in-situ* biogeochemical observations which measure sample fluid and gas emission from the seabed. Furthermore, the peers appreciate the Institute’s targeted response to the Indian Ocean tsunami, which is seen in its rapid development of new equipment for tsunami monitoring, a fact which constitutes IFM-GEOMAR as an institute in Germany which, as a flexible institute with fast reactions, is able to respond to pressing socially relevant issues from other countries.

IFM-GEOMAR is very actively involved in the **outreach** to the general public. This can be clearly seen in the open house and ship days, exhibitions, press releases and the public aquarium, as well as in its projects with schools. The group leader of RD1 (Ocean Circulation and Climate Dynamics) is highly appreciated as a talented speaker in events involving the general public. Likewise, the group leader of RD4 has been actively engaged with the media and public through meetings of the American Association for the Advancement of Science and the Euro-Science Open Forum. It would be desirable to improve the outreach of other groups to the general public, for example in ecosystems.

Furthermore, IFM-GEOMAR provides **services** to the national and international community including the management for two medium-sized and two smaller research vessels and a core repository as well as the sea **aquarium**, which is open to the public.

7. Implementation of German Science Council’s Recommendations

IFM-GEOMAR has implemented most of the recommendations of the German Science Council (“*Wissenschaftsrat*”) made in the last evaluation in 1998. This is highly appreciated by the current Evaluation Committee.

Among the successes in implementation are the reorganisation of the leadership structure, the creation of a job pool for scientists that allows greater flexibility in allocating scientists to successful research groups on a performance-related basis, the promotion of the biological departments and the increase in patent numbers from one to six. In connection with the restructuring process, the disciplines of marine microbiology and marine molecular biology have been replenished and promoted by the newly appointed chairs of the Planktology and Molecular Ecology subgroups, enabling the biological divisions to participate in international competition and implement excellent projects. In addition to the quality of science, a note-worthy positive

feature of the biological groups is their level of cooperation, which includes also the groups that work on physical oceanography and geo-sciences. The cooperation of the biological groups is further manifested in the establishment of a molecular facility, which is very well equipped and is used for a multitude of different research topics and projects spanning the entire range of marine organisms from bacteria to fish. However, a higher level of integration of the Molecular Ecology subgroup as well as of the Marine Microbiology group within the Institute should be achieved.

The merger of the two institutes must be regarded as the most successful implementation of a recommendation by the German Science Council. Here, the ten small-unit subdivisions of IfM have been abolished and incorporated into the newly established coherent research divisions, which have fostered significantly the collaboration among the research groups. Furthermore, approximately half of the chairs have been newly appointed. The great efforts that have been undertaken to modify and update research topics in RD3 (Marine Ecology), including the reallocation of personnel, are also duly acknowledged.

Although the project of the Benthos Ecology subgroup that deals with an alternative substance to tributyl tin has captured the interest of the industry, the issue of technology transfer has met the requests of the German Science Council to a lesser extent only. The increase in the proportion of fixed-term, institution-financed positions for scientists above the threshold of 21% has not been implemented, nor has the number of post-doc positions been increased.

8. Summary of the Evaluation Committee's Recommendations

Within a short time, the newly established IFM-GEOMAR has emerged as one of the leading marine institutes in Germany and one of the top in the world. Based on the high international standing of numerous leaders from all four research divisions as well as on the research concept of the Institute it is reasonable to expect that IFM-GEOMAR will maintain its efficiency and its scientific excellence in the future and might be even able to increase its capabilities in some areas. In order to achieve these goals, the following recommendations have been drawn up:

Mission, Tasks, Main Work Areas

- A higher level of cooperation of groups working on microbes would be desirable and also cooperation in the field of molecular biology could be intensified.

Structural Features and Organisation

- Plans to unite the Institute in state-of-the-art facilities on the East Campus latest 2010 as well as the expansion of the former GEOMAR site are strongly supported. The funding agencies of the IFM-GEOMAR are encouraged to enable the Institute to move one year earlier from the west to the east shore. Teaching on the former IfM site on the west shore, which is in close proximity to the university campus, will still be necessary.
- An incentive fund that promotes the integration of groups and disciplines to initiate original collaboration between the merged institutes should be set up.
- With respect to administrative support, there is room for improvement that should be addressed quickly.

- Due to the spatial separation of the two sites of the Institute, the communication between the director and the staff is suboptimal and should be improved now, in advance of the physical unification of the two research sites.

Resources, Expenditures and Personnel

- The consolidation of technicians within a central pool of the future Technology & Logistic Centre (TLC) is strongly supported.
- The currently high number of permanent positions financed by third party funds ("*Projektdauerstellen*") has to be reduced, since this issue puts the Institute under pressure with respect to permanent fundraising which might disturb its coherent research programme.
- The proportion of fixed-term, institution-financed positions for scientists of presently 21% has to be increased to approach the percentage recommended by the German Science Council.
- The support of RD4 (Dynamics of the Ocean Floor) with respect to technical positions should be increased within the Institute.
- Vacant leadership positions should be filled in the near future.
- As some outstanding research is done by "*Mittelbau*" staff scientists, the Institute should secure this tradition on the long-term by assigning tenure to staff scientists but only after successful competition in a transparent, peer-reviewed tenure-track system.
- Resources for new, advanced instrumentation are needed by all groups and efforts should be made to secure necessary funding and infrastructure for these tools.

Promotion of Junior Academics and Cooperation

- An increase in the number of post-doc positions is recommended.
- The scope of the existing scheme for interdisciplinary junior research groups should be expanded to spawn integrative research, provided the Institute can deal with such expansion.
- It is recommended that teaching by the Institute professors should not exceed their teaching loads beyond the measure that is deemed appropriate to professors at institutes of the Leibniz Association.
- In order to offer an incentive to young scientists, the Institute should examine its capacity for tenure-track positions as far as this does not collide with the recommended increase in the proportion of fixed-term, institution-financed positions for scientists.

Results and Scientific Resonance

- IFM-GEOMAR should ensure that scientific collaboration and publication activity is not compromised by cooperation with industry.
- All scientists, including the permanently employed staff, should maintain an acceptable level of publication in top quality, international, peer-reviewed journals.
- Outreach to the general public is very good in some areas. An expansion would be desirable to cover all other public issues to which the work of the Institute is relevant.

Appendix

Participants:

1. Evaluation Team

Chairman (Member of the Senate Committee Evaluation, SAE)

Prof. Dr. Dietrich **Wegener** Experimental Physics V, University of Dortmund

Vice Chairwomen (Members of the Senate Committee Evaluation, SAE)

Prof. Dr. Brigitte **Nixdorf** BTU Cottbus, Freshwater Conservation, Bad Saarow

Prof. Dr. Sylvia **Schnell** Institute for Applied Microbiology, Justus Liebig University Gießen, IFZ

External Experts

Prof. Dr. Ulrike-G. **Berninger** Department of Organismic Biology, University of Salzburg

Prof. Dr. Peter **Burkill** National Oceanography Centre, Southampton, UK

Prof. Dr. Reiner **Eckmann** Limnological Institute, University of Konstanz

Prof. Dr. Manfred K. **Grieshaber** Institute for Zoological Physiology, University of Düsseldorf

Prof. Dr. Robert **Huber** Institute for Microbiology, University of Regensburg

Prof. Dr. Terrence M. **Joyce** Woods Hole Oceanographic Institution, Physical Oceanography

Prof. Dr. Terry A. **Plank** Department of Earth Sciences, Boston University

Prof. Dr. Christoph **Schär** Institute for Atmospheric and Climate Science, ETH, Zürich

Prof. Dr. Steve **Scott** Department of Geology, University of Toronto

Prof. Dr. Hans R. **Thierstein** Geological Institute, ETH / University of Zürich

Prof. Dr. Friedhelm **von Blanckenburg** Institute for Mineralogy, University of Hanover

Prof. Dr. Graham **Westbrook** School of Geography, Earth & Environmental Sciences, University of Birmingham

Federal Representative

RegDir Sabine **ten Hagen-Knauer** Federal Ministry of Education and Research, Bonn
excused

Representative of the States

excused

2. Guests

Representative of the relevant Federal Department

Dr. Hans-Ortwin **Nalbach** Federal Ministry of Education and Research,
Bonn

Representative of the relevant State Department

Permanent Secretary Jost **de Jager** Ministry of Science, Trade & Commerce, and
Michael **Wagner** Transportation of the State of Schleswig-
Holstein

Representative of the Bund-Länder Commission for Educational Planning and Research Promotion, Bonn

MinDirig Jürgen **Schlegel**
excused

Representative of the Leibniz Association

Prof. Dr. Hans-Joachim **Kümpel** Leibniz Institute for Applied Geosciences,
Hanover

Representative of the Scientific Advisory Board

Prof. Dr. em. Hartmut **Graßl** Max-Planck-Institute for Meteorology, Ham-
burg

Representatives of Cooperating Institutions

The following representatives of cooperating institutions took part in a one hour interview:

Prof. Dr. Jörn Eckert	Rector, Christian Albrechts University of Kiel
Prof. Dr. Jürgen Grotemeyer	Dean, Faculty of Mathematics and Natural Sciences, Christian Albrechts University of Kiel
Prof. Dr. Ralph Schneider	Group Leader, Institute for Geo Sciences, Christian Albrechts University of Kiel
Prof. Dr. Jochem Marotzke	Director, Max-Planck-Institute for Meteorol- ogy, Hamburg

Anlage C: Stellungnahme der Einrichtung zum Bewertungsbericht

**Leibniz-Institut für Meereswissenschaften (IFM-GEOMAR)
an der Universität Kiel**

Die Kolleginnen und Kollegen vom IFM-GEOMAR bedanken sich bei der internationalen Gutachtergruppe sehr herzlich für den äußerst positiven und ausgewogenen Bewertungsbericht, den wir am 29. September 2006 erhalten haben. Der Bericht ist eine Bestätigung unserer bisherigen Arbeiten und enthält wertvolle und wichtige Hinweise für die Zukunft – sowohl für das Institut als auch für unsere Zuwendungsgeber.

Bitte erlauben Sie mir im Folgenden auf kleinere Unrichtigkeiten hinzuweisen, die uns bei der Lektüre des Berichtes aufgefallen sind:

1. Die Mikrobiologie ist nicht in 3 Forschungsbereiche fragmentiert, sondern gehört zum Forschungsbereich 3 (Marine Ökosysteme) und kooperiert z. T. mit den Forschungsbereichen 2 und 4 (p. B-5).
2. Forschungsbereich 1 ist nicht klein, sondern (mit 10 Professoren bzw. 30 Wissenschaftlern) der größte der 4 Forschungsbereiche (p. B-5).