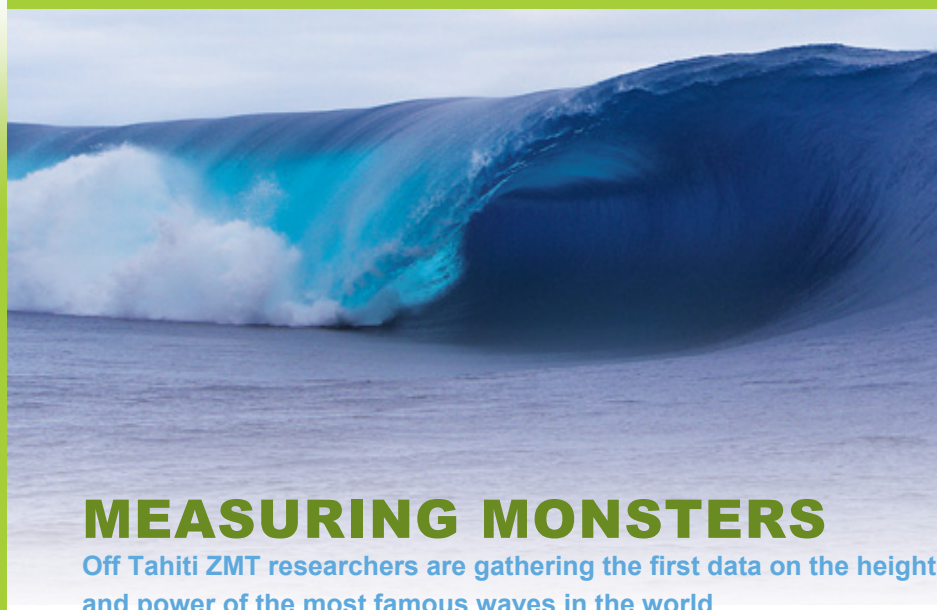

ON EXPEDITION

MEASURING MONSTERS

Off Tahiti ZMT researchers are gathering the first data on the height and power of the most famous waves in the world

They break precisely on the steep reef wall – the enormous waves off Tahiti. Every year they attract thousands of onlookers when the world's best surfers line up to ride the monsters. Now, ZMT researchers have been the first to discover exactly how high these giants really are – more than seven metres. “That doesn’t sound like much when you first hear it,” says Daniel Harris of ZMT. But when the ocean suddenly swells up to that height, it is monstrous and destructive. “I have confidence that this is like the most energetic thing ever recorded in such detail.” If the reef were unable to act like a wall, stopping and breaking the power of these surging masses of water, they would wreak unimaginable damage on land.

Dangerous mission

Taking measurements is not for the faint-hearted. On the reef, exactly three metres under the giants, Alessio Rovere and Daniel Harris installed pressure gauges to calculate the height of the waves. “Because the reefs are so rugged we were able to fix the little devices with cable retainers,” Rovere explains. He heads the junior research group on “Sea Level and Coastal Changes”, a collaboration between ZMT and MARUM, the Centre for Marine Environmental Sciences of Bremen University. This means diving where the waves are most dangerous. Rovere grew up on the Mediterranean coast of Italy, Harris on the coast of Australia. For these two scientists, diving and surfing are everyday activities – but not off Tahiti. From French colleagues at CRIOBE, a research centre on the nearby island of Moorea, they had to learn exactly when and how they could navigate the breakers to reach the reef. Professional surfers guided the boats safely through the lagoon. “We managed it well!” the two researchers recall, proud of the scientific findings they have achieved with the help of Elisa Casella (ZMT) and Valeriano Parravicini (CRIOBE).

Valuable data

ZMT’s new measurements on the height and power of the waves near the coast are the first to complement existing data from satellite images and observations of ice sheets, which are usually the basis for predicting the rise in sea levels. Moreover, the measurements also flow into hydrodynamic models of the physical changes on coasts, making them significantly more meaningful. Provided that healthy coral reefs grow more quickly than the rise in sea level, the coasts are protected. However, if ocean warming, climate change or human impact cause the reefs to deteriorate, then the future could see far more super-energy waves like the ones off Tahiti regularly battering the coasts unchecked. > READ MORE

Member of Leibniz Association

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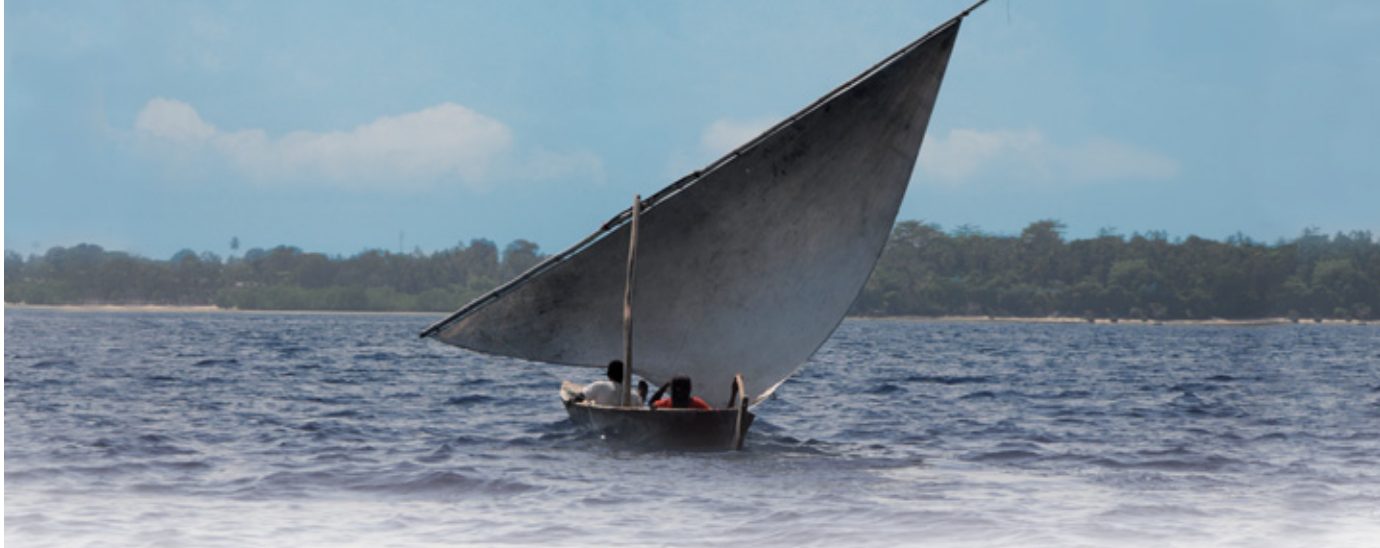

HUMANS' NOTION OF COAST AND OCEAN

Anna-Katharina Hornidge is establishing ZMT's marine development and knowledge sociology

"A sporting challenge" is how Anna-Katharina Hornidge looks back on her application to ZMT. In the previous eight years she had been working at the University of Bonn's Center for Development Research, investigating the ways humans manage natural and knowledge-based resources, especially in the terrestrial field – agriculture and urban spaces. "But if you take the demand for more sustainability seriously, then we can't afford just to think in terrestrial terms anymore."

> *"We have not yet given enough thought to our knowledge about the oceans and how we produce it."*

Only 30 per cent of the planet's surface is land mass, the rest is covered by the oceans. Seven billion people have to use the resources in the oceans and will continue to do so. How they do it, what understanding, stocks of knowledge and strategies they have and keep acquiring about the oceans and coastal areas – these are all things we know far too little about, says the development and knowledge sociologist. "We have not yet given enough thought to our knowledge about the oceans." With marine developmental and knowledge sociology – or marine science and future studies – she is now breaking completely new ground at ZMT.

A totally new approach

Anna-Katharina Hornidge grew up with an interest in development, knowledge and the sustainable management of resources. It is precisely this process that she herself likes to consider most: the formation of concrete notions of environment in the social arena. "Shared concepts of reality and morality steer our everyday thinking and influence the development of technological, institutional and social solutions," says Hornidge. Fundamental studies on scientific and non-scientific cultures of marine knowledge production and the politics guiding them are still pending, but are becoming ever more urgent as the complexity of the problems generated by the use of marine resources increases.

It is important, she thinks, to keep considering how societies produce their research on the oceans. What are the structures governing it? Where does the money for marine sciences come from? What are the institutional incentive systems for marine research, and who are the winners and losers in these systems? In short: "We scientists play a big role in shaping the planet, science is a world-making activity – what actually guides us in our work?"

Hornidge is thrilled about her mission to establish marine science and future studies at ZMT in cooperation with colleagues from the economics and natural sciences. "ZMT's structure and its many research groups are an excellent basis for effective interdisciplinary work." She will now introduce a new disciplinary focus into the conversation.

New Research Group at ZMT

Anna-Katharina Hornidge took up a new professorship in social sciences at ZMT and the University of Bremen in May 2015. She is the leader of the research group on "Development and Knowledge Sociology" which she is currently building. Her work focuses on three thematic areas: "Natural marine resources and sense-making", "Knowledge, innovations and science policy" and "Variants of differentiation and governance of change".

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LEAKY CONTINENTS

On tropical coasts, groundwater constantly drips, seeps and flows into the sea. Nils Moosdorf and Mirta Teichberg on the relevance of freshwater inflow

What role does groundwater play in tropical coastal regions?

Moosdorf: As well as rivers, submarine sources also introduce freshwater into the sea. Furthermore, the border between the land and the ocean is not impermeable. Groundwater level on land is usually higher than marine sea level and water constantly runs off the continents. Freshwater trickles into the sea on the beach – you hardly notice it but, all in all, it amounts to quite a lot. Little work has been done on submarine groundwater discharge so far. The effects of these inflows on coastal ecosystems could be quite large. At a regional to global scale we don't know the magnitude of impacts yet – we have only just embarked on our investigations.

What might be the impact on marine ecosystems?

Teichberg: I am studying the growth of seagrass and algae in their natural surroundings, and their response to changing environmental influence and disturbance. In this context, I also consider inflowing groundwater. It transports nutrients into coastal ecosystems and they, in turn, influence the growth of organisms. It could be very important for my research to know whether there are sources of groundwater in a coastal habitat.

Moosdorf: If a coral reef is unable to survive because it is being suffocated by algae, it is likely that the nutrient levels are too high. And they could be transported by the groundwater. The explanation for the increase in nutrients in groundwater could be the use of agricultural fertilizers a long way away on land. Or another example: if people on the coasts pump off ever more groundwater, the nutrient-rich, submarine sources may dry up. This may also have a negative impact on coastal ecosystems which have adapted to such inflow. When we know more about groundwater flows we will be able to identify these connections.

Why has so little research been done on the impact of groundwater?

Teichberg: It is difficult to identify these inflows and the impact they have precisely. When you have a river flowing into the sea, you can measure the nutrient inflow. To find groundwater sources that may flow out of the seabed at random is quite a different matter.

Moosdorf: It is interesting that local fishermen know their submarine sources. In the Gulf of Mexico, they call them Blue Holes – and they fish there because the catch is better. Written documents from the 19th century report on fishermen in Tahiti out at sea diving to the seabed to drink freshwater. Today, we can identify coastal regions with freshwater sources using remote sensing and satellite imaging. Another method is to measure the water temperature with the help of infrared cameras. Where the water temperature is constant may point to groundwater discharge. This is of particular relevance to ocean acidification. In some places it is conceivable that the constant groundwater discharge also maintains the pH value of the water whilst everywhere else it otherwise changes. This all needs investigation.

ZMT research on groundwater discharge

The geologist **Nils Moosdorf** heads ZMT's research group on Submarine Groundwater Discharge. He is coordinating the collaborative project entitled "Submarine groundwater discharge from tropical islands as nutrient supply for marine ecosystems (SDG-NUT)" with Indonesia, which is scheduled to run until 2018. **> READ MORE**

Amongst other things, the ecologist **Mirta Teichberg** studies the responses of macroalgae and seagrass to nutrient inflow from the land and the concomitant ecological consequences. She heads the research group on Algae and Seagrass Ecology. **> READ MORE**

ECOLOC

German-Chinese research project headed by ZMT

On China's only tropical island of Hainan tourism is booming, as is fishing. But the island's sensitive ecosystems are suffering as a result of the increasing, not particularly sustainable use of resources. At the same time, cold, nutrient-rich water from the depths – a so-called upwelling area – influences habitats. During the next three years, the impact of regional environmental change as well as climate change will be studied locally in the context of the German-Chinese project "Environmental change affecting COastal ecosystems of tropical China during the Anthropocene: Landward vs. OCeanic influence" (ECOLOC), which is receiving funding of 1.3 million Euro from the Federal Ministry of Education and Research (BMBF). Tim Jennerjahn, a biogeochemist at ZMT, is heading the German side of the project which involves cooperation with a further eight research institutes in Germany and China. **> READ MORE**

ECSA

ZMT organises a major international symposium

From 4 to 7 September 2016, the international symposium "ECSA 56" will take place in Bremen, organised by ZMT in collaboration with the Estuarine Coastal Sciences Association (ECSA). Founded in 1971, ECSA is an international organisation for the promotion of multi-disciplinary research into estuaries and coastal seas with the aim of creating the foundations for sustainable environmental management. For this purpose, ECSA has been bringing together excellent researchers and experts from all over the world for more than 50 years. The theme of the 2016 symposium is "Coastal Systems in Transition: From a natural to an anthropogenically modified state".
Register now at www.estuarinecoastalconference.com

Confirmed

ZMT Director to remain as Vice President of the Leibniz Association

ZMT Director, Hildegard Westphal, was re-elected as an Academic Vice President of the Leibniz Association for a further two years at the Annual Meeting in November 2015. Amongst other things, the geologist focuses on the research organisation's international networking. **> READ MORE**

Exhibited

Research with Indonesia

At the international Frankfurt Book Fair in October 2015, scientists from ZMT used the example of Indonesia to show school students how changing environmental conditions impact on tropical oceans and their species-rich habitats. In the same month, ZMT also presented aspects of its research – including a digital 3D coral reef model – in Indonesia at the exhibition entitled "Fostering Ideas – German Indonesian Science and Technology Exhibition" at the National Museum of Indonesia in Jakarta (pictured right). Both exhibitions demonstrate the success of long-term research collaborations.

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ZMT FACES

Any questions? Meet our ZMT Welcome Team: **Petra Käpnick, Wiebke Harms-Krusemeyer** and **Elke Kasper**. They will always do their best to make new international and national researchers and guests feel at home, not just at ZMT but in Bremen, as well. They help them become familiar with the surroundings and advise them on matters relating to the organisation of their stay. **> READ MORE**

Welcome, too, to **Andrea Daschner** who joined the ZMT in July 2015 as head of the Public Relations Department. A journalist by training, she spent ten years working as an editor and correspondent for English publications and German national media in London before relocating to Bremen. Before taking up her new position at ZMT she worked at Jacobs University. **> READ MORE**

PUBLICATIONS

In 2015, ZMT's scientists published a total of 124 peer-reviewed articles including 10 papers in top journals with an impact factor higher than 5 like Nature Communications, Global Change Biology, Earth-Science Reviews and many more. Thirty-nine (31%) of these papers were published as open access articles. In accordance with its open access policy, ZMT has set itself the goal of 50% of open access papers by 2017.
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