



An Integrated Concept on Earth and Environmental Sciences Postgraduate Education

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Today's graduate and postgraduate education in the field of Earth System and Environmental Science is a highly interdisciplinary and inter-institutional challenge. The integration of observations, palaeoclimate data, and climate modelling requires networks and collaborations of experts and specialists in order to better understand natural climate variations over a broad range of timescales and disciplines, and to cope with the challenges of recent climate change.

The existing research infrastructure at the Alfred-Wegener-Institut Bremerhaven (AWI), University of Bremen, and Jacobs University Bremen offers a unique research environment in north-western Germany to study past, present and future changes of the climate system, with special focus on high latitudinal processes. It covers all kind of disciplines, climate science, geosciences and biosciences, and provides a consistent framework for education and qualification of a new generation of expertly trained, internationally competitive master and PhD students.

On postgraduate level, the Postgraduate Programme Environmental Physics (PEP) at the University of Bremen (www.pep.uni-bremen.de) educates the participants on the complex relationship between atmosphere, hydrosphere (ocean), cryosphere (ice region) and solid earth (land). Here, the learning of experimental methods in environmental physics at the most advanced level, numerical data analysis using supercomputers, and data interpretation via sophisticated methods prepare students for a scientific career. Within cooperation with the Ocean University of China (OUC) students are participating one year in the PEP programme during their master studies since 2006, to get finally a double degree of both universities. Based on this successful cooperation a similar programme is in preparation with the Lulea University of Technology, Sweden.

The Earth System Science Research School (ESSReS) (www.earth-system-science.org) at the AWI enables PhD students from a variety of disciplines to cooperate and exchange views on the common theme of 'linking data and modelling', leading to a better understanding of local processes within a global context. Computational and conceptual models of the Earth system provide the ability to investigate different scenarios in biogeochemistry, such as the carbon cycle, the structure of marine sediments, and isotope distribution in climate components. Training and education, especially in time-series and data analysis, is a common key component for all participants.

The Helmholtz Graduate School for Polar and Marine Research (POLMAR) (polmar.awi.de), beyond the aforementioned programmes in further cooperation with the Max Planck Institute for Marine Microbiology, Bremen, the University of Potsdam, Bremerhaven University of Applied Science and the Institute for Marine Resources (IMARE), provides a consistent framework for education and qualification for PhD students in general. Developing all categories of skills needed for analysing complex climate and environmental systems and the development of integrated solutions in a supportive network of collaborating research institutions fosters outstanding career options. Structured scientific training and supervision supported by a broad range of transferable skills development courses is indicative for the entire concept.

This structured and integrated educational concept provides a strong basis for qualifying the next generation of excellent scientists for the challenging questions in Earth System Science and Polar and Marine Research.