

Announcement

# International master course on “Climate of the Earth system”



**18 October 2023 - 24 January 2024, every Wednesday  
13:00-17:00 CET, hybrid lectures, exercises and  
project work**



co-organized by the University of Rostock and  
the Leibniz Institute for Baltic Sea Research Warnemünde (IOW)  
under the umbrella of Baltic Earth (baltic.earth)



*(Photos: Institute of Physics, University of Rostock)*

**We invite master students to the new international hybrid master course on  
“Climate of the Earth system” at the University of Rostock**

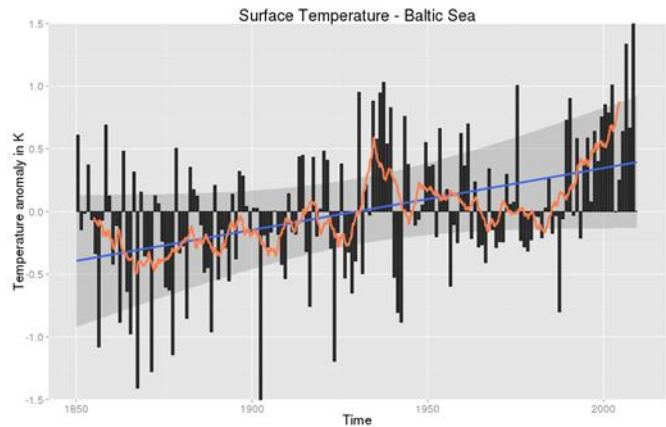
Students will be introduced into fundamental processes in the Earth's climate system of the atmosphere, ocean, and sea ice and into basic methods of the statistical analysis and modelling of climate variability on Earth including the impact of anthropogenic greenhouse gas emissions and other drivers such as variations in solar insolation and volcanic eruptions.

Global radiation budgets, feedback mechanisms and tipping points in the Earth's climate system will be explained. Deterministic climate models based upon first principles such as high-resolution coupled atmosphere, ocean and sea ice models will be presented. The large-scale circulation in the atmosphere and in the ocean will be discussed.

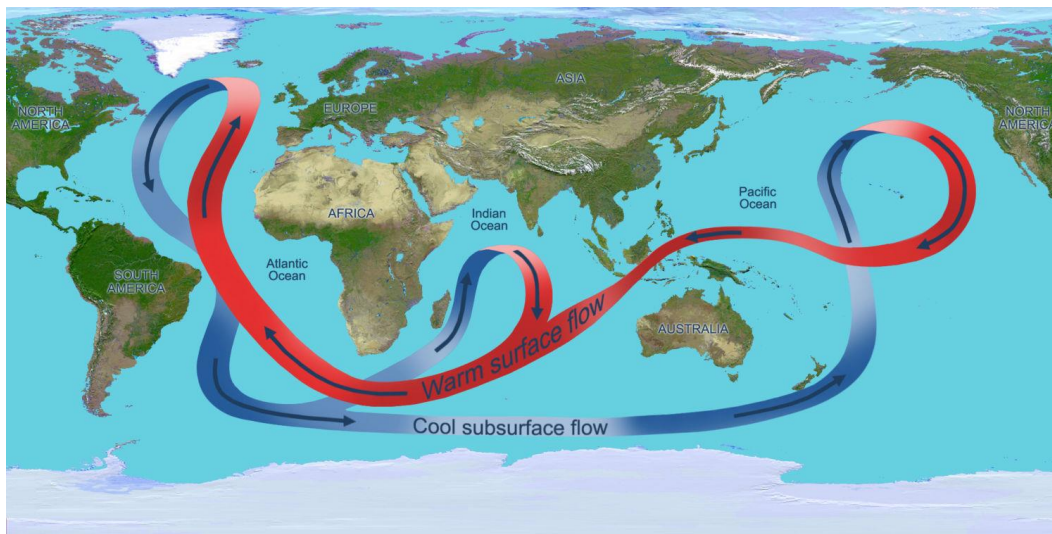
Students will be introduced into the analysis of internal climate variability of the Earth system from years to millennia as recorded from instrumental data, historical documents and proxy data such as tree ring data or sediment cores.

For the analysis of climate variability both statistical methods and numerical modeling are used. Methods for the detection of systematical changes in climate and for the attribution of drivers to these changes will be presented and discussed.

The course will introduce fundamentals of statistics such as probability density distribution, covariance matrix, estimation of statistical parameters, auto- and cross-covariance functions, spectra, time series analysis, multivariate data analysis, uncertainty analysis in statistical methods and strategies of statistical analysis of instrumental observational, proxy and model data. Deterministic climate models will be compared with stochastic climate models.



(Source: M. Kniebusch/IOW)



(Illustration depicting the circulation of the global ocean. Throughout the Atlantic Ocean, the circulation carries warm waters (red arrows) northward near the surface and cold deep waters (blue arrows) southward. Image courtesy of NASA/JPL)

In the exercises, necessary basic knowledge in scientific programming for the modelling and analysis of Earth system data is taught and applied.

In addition to lectures and exercises, the course will give the students the opportunity to further deepen the learned knowledge during a 4-week project work.

**Course site:** Institute of Physics, University of Rostock, Albert-Einstein-Straße 23 – 24, 18059 Rostock, lecture hall HS3, **hybrid lectures and exercises**

**Course period:** 18 October 2023 - 24 January 2024, every Wednesday 13:00-17:00 CET

**Requirements for the participants:** undergraduate students at the master level registered at Rostock University or registered guest students, basic knowledge in hydrodynamics is required



**Responsible teacher:** Prof. Dr. Markus Meier (University of Rostock and IOW)

**Exercises and project work:** scientific programming with python using jupyter notebooks, greenhouse effect and radiation budget models, analytical models of the wind- and buoyancy-driven circulation of the ocean, deterministic numerical climate models based upon first principles, statistical analysis of homogeneous and inhomogeneous time series, wavelet analysis, empirical orthogonal functions, and 4-week project work supervised by Dr. Florian Börgel and Dr. Sven Karsten (IOW).



(Photo: M. Sommer/IOW)

**Examination:** 4-week project work and presentation

**Credits:** 6 ECTS (corresponding to 180 hours of lecture attendance time, preparation and follow-up of the attendance time, solving exercises, structured self- and literature study, project work and preparation for the presentation of the project work)



(Photo: Leibniz Institute for Baltic Sea Research Warnemünde, Rostock, Germany/M. Sommer)

**Applications for external guest auditorship (Gasthörer):** For application details see <https://www.uni-rostock.de/en/study/german-prospective-students/guest-auditorship/> where you also can find the application form "application for the guest auditorship" [https://www.uni-rostock.de/storages/uni-rostock/UniHome/Studium/9\\_Referenzenpool/9.2\\_Formulare/Antrag\\_Gasthoerer\\_engl.pdf](https://www.uni-rostock.de/storages/uni-rostock/UniHome/Studium/9_Referenzenpool/9.2_Formulare/Antrag_Gasthoerer_engl.pdf).

The course participation as a guest auditor costs €46.00 but will be reimbursed after the successful completion of the course.

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