

POEM-PBSim - A Simulator for Earth's Planetary Boundaries

Initiative: Außergewöhnliches

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Projekt-Website: <https://www.pik-potsdam.de/en/output/projects/all/830>

The planetary boundaries framework has been introduced to define a safe operating space for humanity given the multitude of anthropogenic pressures on vital components of the Earth system. Despite their substantial importance for national and international policy processes on sustainable development, Earth's planetary boundaries remain only poorly defined and quantified, mainly due to non-linear feedbacks in the Earth system and non-trivial interactions between different Earthsystem components. Fundamental scientific progress along these lines is urgently needed and requires a novel and integrative Earth-system modelling approach based on fast, modular coupled models including an advanced representation of the terrestrial biosphere. The focus of this project is to make the prototype of the Potsdam Earth Model (POEM) operational as a planetary boundary simulator (POEM-PBSim) and perform a first quantification of key planetary boundaries. Using this model configuration, the expertise of the PIK will be integrated to explore three science questions selected because they represent key aspects of the planetary boundary agenda, illustrate the importance of interactions between different components of the Earth system and make use of key strengths of POEM-PBSim in terms of its advanced terrestrial biosphere model and the representation of Earth-system feedbacks. The Earth system components studied (forests, ocean circulation and marine biosphere) are not treated as mere components of the climate system, but as defining dimensions of a "safe operating space for humanity" that may inform the agendas on sustainable development. This pilot project will thus not only provide an operational model system for Earth's interacting planetary boundaries, but also yield next-phase scientific insights on selected planetary boundaries and their interactions.

Projektbeteiligte

Dr. Georg Feulner

Potsdam-Institut für
Klimafolgenforschung e. V.
Forschungsbereich 1 - Erdsystemanalyse
Potsdam

Priv.-Doz. Dr. Dieter Gerten

Potsdam-Institut für
Klimafolgenforschung e. V.
Forschungsbereich I: Erdsystemanalyse
Potsdam

Dr. Matthias Hofmann

Potsdam-Institut für
Klimafolgenforschung e. V.
Fachbereich Erdsystemanalyse
Potsdam

Prof. Dr. Wolfgang Lucht

Potsdam-Institut für
Klimafolgenforschung e. V.
Fachbereich Erdsystemanalyse
Potsdam

Prof. Stefan Rahmstorf

Potsdam-Institut für
Klimafolgenforschung e. V.
Fachbereich Erdsystemanalyse
Potsdam

Dr. Kirsten Thonicke

Potsdam-Institut für
Klimafolgenforschung e. V.
Fachbereich Erdsystemanalyse
Potsdam

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