POTSDAM INSTITUTE FOR CLIMATE IMPACT RESEARCH **PIK**

MEMBER OF THE LEIBNIZ ASSOCIATION

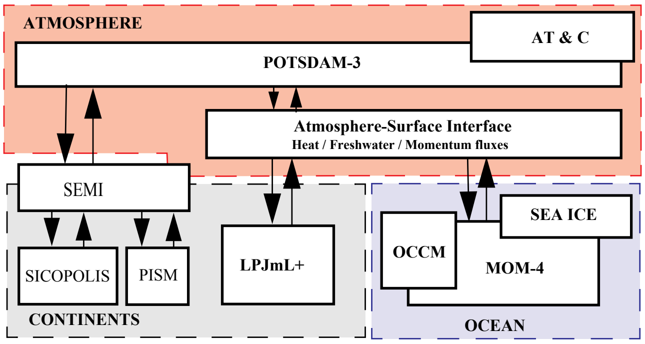
DEVELOPMENT OF CLIMBER-3

EARTH SYSTEM MODEL OF INTERMEDIATE COMPLEXITY

The basis of CLIMBER-3 will consist of GFDL´s MOM-4 3D ocean circulation model and an in-house developed statistical dynamical (SD) atmospheric model. To these core modules, land vegetation (LPJmL) and sea and land ice (SICOPOLIS) modules will be coupled. Due to the SD approach, the model will be computationally efficient while capturing the key atmospheric climate characteristics. This, in combination with the use of parallel computing techniques, should make it fast enough to efficiently study paleoclimates over multimillennia timescales as well as potentially dangerous tipping elements under anthropogenic forcing.

CLIMBER-3

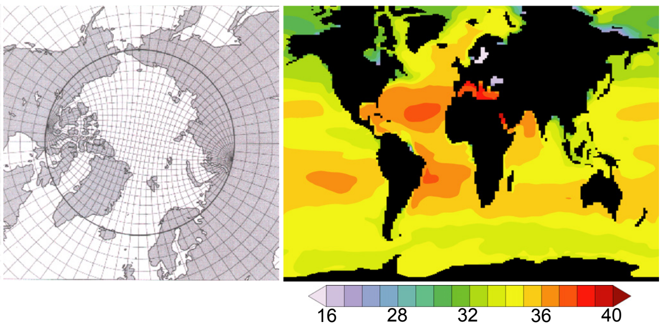
Goal is to develop the next generation EMIC CLIMBER-3, beyond the highly successful CLIMBER-2 model, in an attempt to overcome the gap between simple and comprehensive models.



AT&C = Atmospheric Transport and Chemistry model
OCCM = Oceanic Carbon Cycle model, PISM = Parallel Ice Sheet Model
SEMI = Surface Energy and Mass balance Integrator
SICOPOLIS = SImulation COde for POLythermal Ice Sheets
Figure 1: Principal scheme and main components of the CLIMBER-3 model.

OCEAN: MOM4

Developed at GFDL, MOM-4 (Modular Ocean Model) solves the ocean's hydrostatic primitive equations and is fully parallelised.



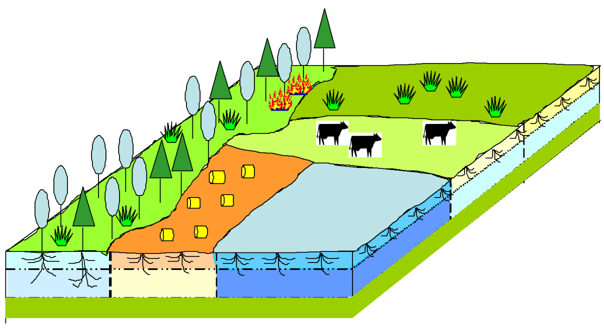
(Left) Tripolar model grid of MOM-4.
(Right) Sea surface salinity in PSU generated by MOM-4

ATMOSPHERE: POTSDAM-3

The major in-house development required is a new statistical-dynamical atmosphere model, POTSDAM-3 (Potsdam Statistical Dynamical Atmospheric Model 3):

- Synoptic scale eddies are not resolved individually, rather their statistical characteristics are predicted.
- Large scale circulation (monsoons, jet streams, Hadley circulation) and the main high- and low-pressure areas are explicitly resolved.
- Set of equations will be solved using Finite Difference and Finite Volume numerical methods
- MPI parallel computing techniques to speed up calculations

LAND VEGETATION: LPJML+



Scheme of the LPJmL model illustrating the dynamic vegetation, soil and water processes.

LPJmL is a leading Dynamic Global Vegetation Model that simulates the dynamics of natural and agricultural ecosystems and the linked carbon and water flows in response to climatic changes and human interventions.

SCIENTIFIC GOALS

- Tipping elements in the Earth climate system
- Paleo-climate
- Statistical Characteristics of Stormtracks

Leibniz Gemeinschaft

RESEARCH DOMAIN I - EARTH SYSTEM ANALYSIS

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