SP 10: Development and implementation of a hierarchical model chain for modelling regional climate variability and climate change over southern Amazonia

Researchers

- **Jürgen Böhner**, Helge Dietrich, Institute of Geography, University of Hamburg, Bundesstr. 55, D-20146 Hamburg, Germany

- Klaus Fraedrich, Frank Lunkeit, Andre Ringeler, Meteorological Institute, University of Hamburg, Grindelberg 5, D-20146 Hamburg, Germany

Objective

Fundamental research issues, to be addressed in our subproject are:

- to analyse and model present and future climate (and particularly hydroclimatic) variability in the target area at appropriate (high resolution) spatiotemporal scales.

- to investigate, assess and quantify the sensitivity of regional weather and climate responses to global climate change and land use change.

- to provide climatological information for various impact studies in the CarBioCial framework for present and future time slices.

Left: Research area with SRTM-based topography (500m-resolution), *Right:* example of dynamical downscaling of 2m air temperature for June 29th 2011

Methods

The modelling work comprises the development, implementation and validation of a comprehensive climate model chain:

a) Large-scale atmospheric processes of the global climate system will be represented by reanalyses data (e.g. ERA40), Global Forecast System data, and GCM based climate projections.

b) In order to achieve a sufficient model representation of mesoscale atmospheric processes, consecutive dynamical downscaling steps will be performed using the non-hydr. regional climate model WRF.

c) To bridge the spatial scale gap between the grid-point presentation of the WRF and the needs for local scale climate information at the test site level, we will finally apply and implement a comprehensive statistical downscaling scheme

Working Plan

1) **Data acquisition, screening and assimilation:** acquire, screen and process necessary data and implement data assimilation schemes for the operational integration of various sources.

2) **Model implementation, calibration and validation:** calibrate and validate modelling components and to elaborate robust statistical regionalization functions, based on available climate records and independent climate observations.

3) **Hindcast simulation:** retroactively model climate variations at spatio-temporal high-resolution in order to analyse present climate dynamics and its interrelation with environmental processes.

4) **Climate change scenarios:** model the range and magnitude of possible future climate changes for alternative scenarios, and to assess the potential climate impact .

5) **Forecast applications:** provide short to medium range weather forecast, required to support the field campaigns and experimental set-ups of different Subprojects.
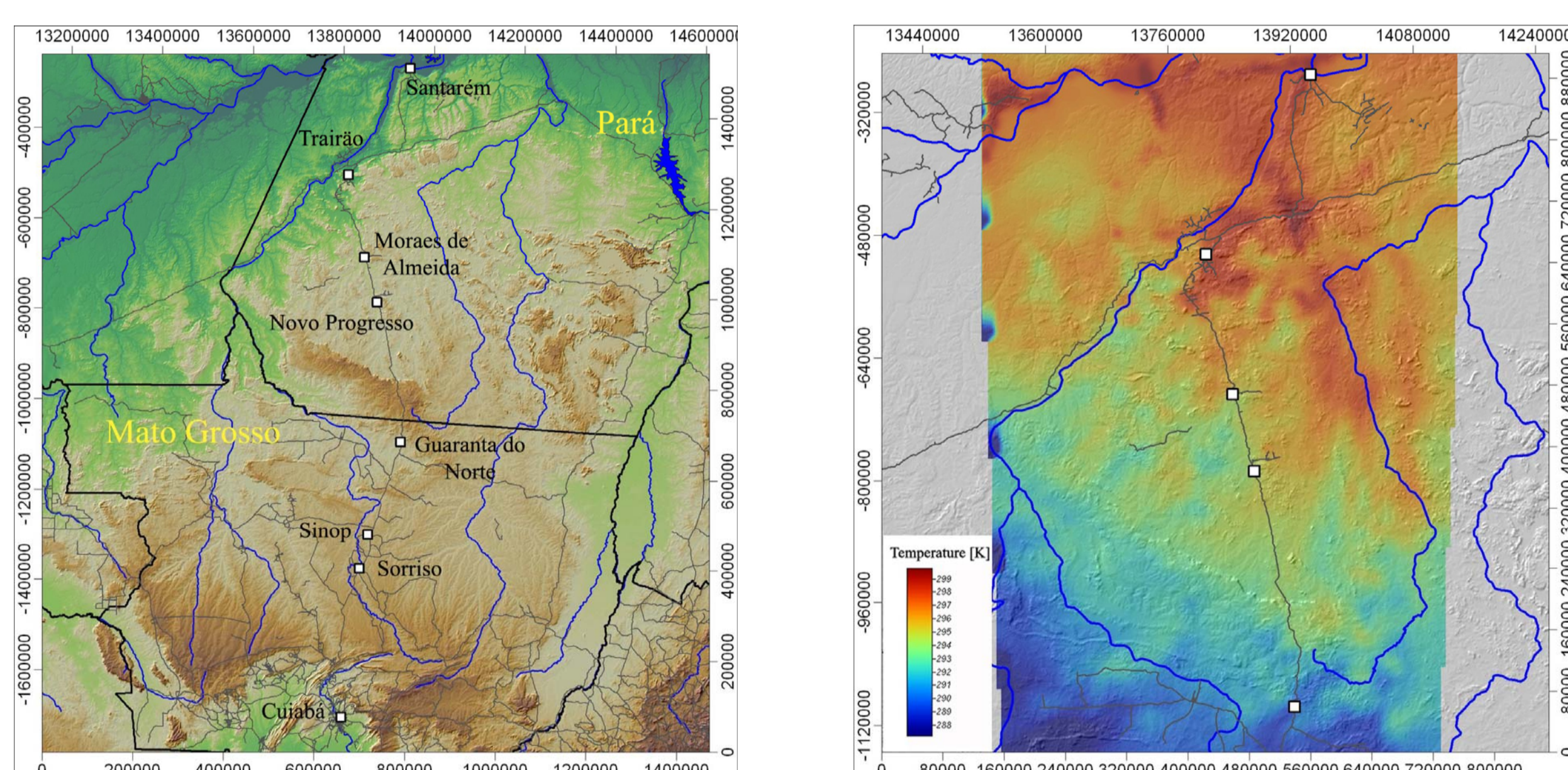
Expected Results

We expect to deliver a comprehensive operational ensemble of closely interlinked climate modelling tools for scale crossing analysis and modelling applications. The expected results comprise:

- baseline climate datasets and analyses (incl. uncertainty information), consisting of daily and monthly resolution time-series and long-term climatic means (temperature, precipitation, humidity, solar radiation, wind speed and direction, latent and sensible heat fluxes) for the time period 1958-2009, covering the investigation area in a horizontal grid discretization down to 1 x 1 km² (or even less for test sites).

- climate scenarios (forced by IPCC SRES A2, A1B, B1 runs and embedded land use scenarios), representing the range and mag-nitude of possible future changes of local to regional-scale climatic settings for the investigation area at spatiotemporal high resolution.

- an operational forecast system for short to medium range weather forecast, providing 6h resolution climate data (solar radiation, temperature, humidity, wind speed and direction, precipitation) for test sites (local, plot, farm level) and the entire investigation area.