Motivation of the coupling

- Understand and represent land surface processes in Arctic region.
- Improve land and atmosphere interactions in the modeling.
- Land model CLM4.0 (Community land model) has more sophisticated bio-geophysical and hydrological processes with improved vegetation dynamics.

Model setup

- Run time interval: 1979-2011.
- Horizontal resolution: 25 km.
- Vertical resolution: 40 pressure levels from land surface up to 10hPa (~30km height).
- Boundary forcing (Era-Interim): Surface pressure, Wind, Temperature, Specific humidity, Cloud water, Cloud ice, Sea surface temperature, Sea ice fraction.
- Surface data (for HIRHAM-CLM): Plant functional types (Pfts), Soil color, Organic matter, Percentage of lake and wetland, Percentage of sand and clay, Percentage of glacier.

Surface input data improvement

- New surface input data are created from the following different sources:
  - Pfts, leaf area index, stem area index and Soil color from MODIS (Moderate Resolution Imaging Spectroradiometer, Lawrence and Chase, 2007).
  - Soil organic matter from WISE (Wide-field Infrared Survey Explorer, Wright et al. 2010) and HWSD (Harmonized World Soil Database, Freddy Nachtergaele et al. 2012).
  - Lake and wetland fraction from GLWD (Global Lake and Wetland Database, Cogley J.G. 1991).
  - Soil sand and clay fraction are derived from IGBP (The International Geosphere-Biosphere programme) soil data.
- Canopy top and bottom heights are from Bonan (1996) as described in Bonan et al. (2002b).

Validation of HIRHAM5

Figures

- Figure 1: Integration area and orography [m]
- Figure 2: Spatial distribution of selected land surface input data of CLM4.0
- Figure 3: HIRHAM CLM4.0 coupling scheme
- Figure 4: Annual cycle of atmospheric fields: mean 2m temperature (a, unit: °C), short wave radiation (b, unit: W/m²) and long wave radiation (c, unit: W/m²) from HIRHAM5 (red line) in comparison with Era-interim (green line) for the whole domain (dashed line) and only land domain (straight line) for year 1979-2011.
- Figure 5: Vegetation distribution
- Figure 6: Annual cycle of differences in mean LST (land surface temperature, units: °C) from HIRHAM5 in comparison with MODIS satellite observation for different Pfts land cover (HIRHAM5 minus MODIS: a, Forest; b, Forest-tundra; c, Non-wood-tundra) during different years from 2008 to 2010.
- Figure 7: Seasonal mean of 2m temperature (unit: °C) for 1979 (a, b, c, d) and differences of HIRHAM5 minus CLM4.0 (e, f).

Summary

- Creation of new land surface data and new coupled version is technically running.
- Latent and sensible heat flux feedback, albedo (short wave radiation) feedback.
- Current focus & next steps
- Validation of HIRHAM5 simulation.
- Carrying on and validation of simulation from CLM4.0 driven by HIRHAM5.
- Processing available dataset for simulation validation.
- Incorporation of long wave coupling in the model setup.

Reference: