DUE PERMAFROST: A Circumpolar Remote Sensing Service for Permafrost – Evaluation Case Studies and Intercomparison with Regional Climate Model Simulations

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The ESA Data User Element (DUE) Permafrost project provides a Circumpolar remote sensing service for permafrost-related applications. The data products are freely downloadable (http://www.ipf.tuwien.ac.at/permafrost) and published at the PANGAEA World Data Centre (DUE Permafrost Project Consortium, 2012). Remote sensing products are land surface temperature, surface soil moisture, ground frozen/non frozen state, terrain parameters, land cover parameters, and surface waters. Snow parameters (snow extent and snow water equivalent) can be derived from the DUE project GlobSnow (http://www.globsnow.info). The time series of Circumpolar land surface temperature and surface soil moisture offer weekly and monthly averaged data products from 2007 to 2010, Circumpolar ground frozen/non frozen state is provided as daily dataset. The ongoing service will also include the time series of 2011 and 2012. The Circumpolar terrain and land cover products are static, e.g. the first Circumpolar Digital Elevation Model (DEM) north of 55° N with a spatial resolution of 100 m (S. Maurizio & T. Strozzi, 2012).

Evaluation is crucial to test the scientific validity of the DUE Permafrost data products for high-latitude permafrost landscapes. The primary programme providing ground data is the Global Terrestrial Network for Permafrost (GTN-P) initiated by the International Permafrost Association (IPA) in the 1990s. The involvement of scientific stakeholders and the IPA, and the ongoing evaluation of the remote sensing derived products make the DUE Permafrost products widely accepted by the scientific community. Evaluation case studies of DUE Permafrost remote-sensing derived products (e.g., land surface temperature and ground frozen/non frozen state) show good agreement with ground data from GTN-P monitoring sites in Alaska and Siberia.

The Helmholtz Climate Initiative REKLIM (Regionale Klimaänderungen/Regional climate change) is a climate research program where regional observations and process studies are innovatively coupled with regional model simulations (http://www.reklim.de/en/home). Within the REKLIM framework we spatio-temporally compared the geophysical surface parameters derived from the Regional Climate Model (RCM) HIRHAM and the RCM COSMO-CLM (CCLM) with the geophysical remote sensing products provided by DUE Permafrost and DUE GlobSnow. The HIRHAM4 / HIRHAM4 + LSM and HIRHAM5 modelled data span the circumpolar spatial domain for the period 2008 to 2010 according to the temporal availability of the DUE Permafrost data products. The CCLM modelled data span the Central Siberian spatial domain and the time frame from 1987-2010.

One case study involved spatial comparisons of HIRHAM and CCLM-simulated time series of the monthly averaged parameters surface temperature and ground frozen/non frozen state (calculated from modelled soil temperature) with the monthly averaged DUE Permafrost data products.

The second case study spatio-temporally compared the parameter snow water equivalent simulated by COSMO-CLM with the daily data record of DUE GlobSnow.

The result is that data products derived from remote sensing are climate-scale observations and can successfully be used for large-scale assessment studies.

DUE Permafrost Project Consortium (2012): ESA Data User Element (DUE) Permafrost: Circumpolar Remote Sensing Service for Permafrost (Full Product Set). doi:10.1594/PANGAEA.780111.

S. Maurizio & T. Strozzi (2012): Circumpolar digital elevation models > 55° N with links to geotiff images. doi:10.1594/PANGAEA.779748 in DUE Permafrost Project Consortium (2012).