**Evaluation of Permafrost Remote Sensing Products and Background Parameterization for Models**

**Introduction**

**Terrestrial Permafrost**

Permafrost (defined as ground below or at 0°C for at least 2 years) has been identified as one of six indicators of global climate change (World Meteorological Observation, WMO). Permafrost is a key component of the cryosphere through its influence on regional energy and water exchanges, greenhouse gas fluxes and carbon budgets – and hence plays an important role in the global climate system.

**Regional-Scale Instruments**

**Operational Remote Sensing Observations**

**COSMO-CLM** (model of the Consortium for Small-scale Modelling in CLimate Mode)

**Evaluation of Permafrost Remote Sensing Products and Background Parameterization for Models**

**Evaluation of Background-Data for Modelling**

**First Results:**

- **Land cover:** Accurate 100% vegetation cover & wetlands & ponds, model LUT definition for tundra: sparse vegetation, 50% barren.
- **Water:** Accurate 100% water bodies, wetlands, peatland.
- **Soils/rock:** Accurate 100% soils/rock, model LUT definition for tundra: sparse vegetation, 50% barren.

**Ongoing**

- New regional to circum-arctic thematic background data: soils/rock, water bodies, wetlands, peatland
- Adaptation of pre-processing for models for permafrost regions

**Evaluation**

German-Russian long-term measurement field Samoylov (RU): AWI / HGF-SPARC

**GTN-P Global terrestrial Network of Permafrost initiated by the IPA, authorized under GCOS**

**GTN-P site Nadym (RU) vs AWI / HGF-SPARC: Samoylov (RU), Svalbard (NO), Polar Bear Pass (CA)**

**Monthly Bias (Tair – LST)**

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Nb of Values</th>
<th>Nb of Night</th>
<th>Nb of Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>-6,00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-5,00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-4,00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-3,00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-2,00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-1,00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0,00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3,00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4,00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5,00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6,00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Comparison Tair versus LST**

\[ R^2 = 0.9686 \]

**GTN-P field Samoylov (RU)**

**Global Lake Data Set (Kourzeneva, 2010)**

**First Results:**

- Water (23 %)
- Wet (47 %)
- Dry (30 %)

**GTN-P site Nadym (RU)**

**V. Romanovsky in Los Angeles Times**

**Operational EO Earth Observation**

- Surface Temperature
- Surface moisture & freeze/thaw
- Snow from GLOBCover, GLOBCarbon
- Ice

**Evaluation of**

- Global and regional input-datasets (land cover, soils) [outside model]
- External background parameters (albedo, fraction vegetation, LAI, Z0, thermal emissivity) [outside model/ modelled]
- Output parameters (soil moisture, frozen/ thawed state, temperature) [modelled]

**Regional Climate Modelling**

- **COSMO-CLM** (model of the Consortium for Small-scale Modelling in CLimate Mode)
- to provide a consistent meteorological data set at high spatial- and temporal resolution

**AWI / HGF-SPARC: Samoylov (RU), Svalbard (NO), Polar Bear Pass (CA)**

**Langer et al. (2010)**

**Westermann et al. (2011)**

**Future**

- New regional to circum-arctic thematic background data: soils/rock, water bodies, wetlands, peatland
- Adaptation of pre-processing for models for permafrost regions

**Present**

- New regional to circum-arctic thematic background data: soils/rock, water bodies, wetlands, peatland
- Adaptation of pre-processing for models for permafrost regions

Global warming is most pronounced in high-latitudes.