The Study Area

The study area, consisting of a vast, pristine bog complex (mire), is located in Western Siberia (figure 1). The investigated mire is located 30 km SE from the town Khanty-Mansiysk, capital of Khanty-Mansiysk autonomous region-Yugra, Russia. Geographically the mire belong to the Middle Taiga sub-Zone (Krivolutskiy, 1998) This zone includes many large, correct oligotrophic (ophiobonum) mires [Jönsson, 1979]. Peatland accumulation started around 10000 years BP [Nearnash, 1977]. The mire is formed from two different (northern and southern parts) type of peatland truncation and has the actual area 74.5 km². The mire complex is drained at the eastern margin by the Mikhilnaya river and in the West by the Big river. No clear drainage system is present inside the mire complex. The peatland has a convex shape with vertical elevations difference from the center to the periphery of 2.2 m. Average area depth is 3.1 m, maximum: 5.5 m. The most abundant peat species are fenugrass (55.5 %), complex peat (14.5 %) and hollow-peat (6.6 %) [Zarov, 2013]. Oligotrophic microhabitats are ridge-hollow complexes in the central flat parts and "ryans" (pine-shrubs-ophiobonum biocenoses), occupy the moderate depression areas (figure 2).

Objectives

- To improve the knowledge of hydrology of peatland mires of the Middle Taiga Zone
- To estimate the main hydrological parameters of evaporation, evapotranspiration, precipitation;
- To develop a modeling tool which can be used to predict spatially distributed water flows of a pristine bog complex.

Lysimeter study and 1-D modeling

Both evaporation (E) and evapotranspiration (ET) were measured by bucket lysimeters (a 0.35 m, depth 0.08 m) in 6 sites with open water and selected one filled by bucket. Barometric (in situ) and absolute air pressure. Each bucket had hydrological microclimate measurement system (capacity 9.3 cm), calibrated 0.2 cm for measuring a water level and period timing (1 s). In the ET necessary two measuring site were added. The automated systems were developed by Zavgorodny et al. (2008) for lysimeter study.

3-D Modeling

For modeling waterlevels and waterflows use tool: MODFLOW included in GIS (v. 6.0) A. Ivanov model was developed. Cell size is 5.5 m in space steps = 1 day. Model area is = 960.12 cells.

Digital elevation model (DEM): Field measurements with differential GPS (Marine Geodes) at networked transect to 800 m, partly at 400 m. Horizontal accuracy: 2 cm. DEM created from field measured and orthophotos (2012). Input data method for modeling: waterlevel 2000 and 2013.

Digital Elevation Map (DEM) 2000

| Elevations m. a.s.l. 1950 T (km²) | Positive | Negative
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>950</td>
<td>272</td>
<td>57</td>
</tr>
<tr>
<td>920</td>
<td>197</td>
<td>56</td>
</tr>
<tr>
<td>890</td>
<td>197</td>
<td>56</td>
</tr>
<tr>
<td>860</td>
<td>197</td>
<td>56</td>
</tr>
</tbody>
</table>

Rain rate and precipitation for open water evaporation measurement in a selected point (m/day) was calculated from the yearly average of precipitation (m/day) at selected points.

Evapotranspiration interact (ET) - evaporation and transpiration (T) for measured and estimated (fig 5).

Remote sensing and water level change in terrain: 2008

Evapotranspiration (ET) - evaporation, precipitation (P) = evapotranspiration (PET).

Photolite in middle of the river valley. Topography of water level for display purposes.

Time series of modeled water level at selected points

Negative water levels: flow direction W > E

Positive water levels: flow direction E > W

Model flow at time step 2000: m³/day

Flow through cross section in m³/day

Left: flow by layer Right: accumulated flow

Water level in 2-pickers at 3 selected points

Changes in water level at selected points

Recorded water level in 2-pickers and predicted level by forward 1D modeling with daily precipitation and ET

Video shows level change in the mire from 2013 and 2014

Recharge (peatland) was calculated from the yearly average water level (meters) of the mire area. Average evapotranspiration over the period 1991-2011 available at

For Evapotranspiration (E and ET) use methods developed by the Lysimeter study.

HS10.5 High resolution modeling tool for prediction of waterflows through complex mires:

Example of the Mukhrino bog complex in West Siberian middle Taiga Zone

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A. Ivanov model was developed. Cell size is 5.5 m in space steps = 1 day. Model area is = 960.12 cells.