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Measuring wintertime surface fluxes at the Tiksi observatory in northern Sakha (Yakutia)

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Tiksi hydrometeorological observatory has been equipped by new instrumentation for meteorology, turbulence, trace gas and aerosols studies as a joint effort by National Oceanic and Atmospheric Administration (NOAA), Roshydromet (Yakutian Hydrometeorological Service, Arctic and Antarctic Research Institute and Voeikov Main Geophysical Observatory units) and the Finnish Meteorological Institute (FMI). The site is close to the coast of the Laptev Sea on deep permafrost soil with low tundra vegetation and patches of arctic semidesert. Near-by terrain is gently sloping to the south. Further away they are hills in the NE- and W-directions. Turbulence (3-d wind components and sonic temperature) was measured at 10 Hz by USA-1Scientific sonic by Metek, Gmbh. Concentrations of CO_2 and H_2O were measured by LiCor LI7000 analyzer and CH4 concentrations by Los Gatos RMT200 analyzer. Measurement height was 2.5m.

Active layer freeze up took place in extended October period. Methane and carbon dioxide emissions were observed up to early December. Emissions to the atmosphere were enhanced by turbulence created by high wind speeds. Midwinter conditions existed from the end of October to the beginning of April based on rather constant negative net radiation between 20-30 Wm-2 that cools the surface and forms highly stable stratification. Weather conditions are characterized by either low or high wind speed modes. Roughly half of the time wind speed was low, below 2 ms-1. Then, katabatic winds were common and air temperature was between -40..-30°C. High wind speeds, up to 24 ms-1, were observed during synoptic disturbances which lasted typically a few days.

In this presentation we will show climatology of surface layer characteristics in late autumn and winter. We will show frequency of well-developed turbulence vs. katabatic low wind speed conditions and related atmospheric stability. The effect of wind speed on methane and carbon dioxide emissions during the freezing period will be shown.