

# Modelling thermal and hydrologic regime of the permafrost

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The model for thermal and hydrological regime of the soils, which is suitable for the climate model of intermediate complexity, is developed. The soil model numerics is based on the method of "phase boundary catching" [1]. The soil hydrology is computed, based on [2], but with the runoff, parameterized in accordance to [3].

Here, this model is applied to the computation of the active layer thickness (ALT) in the Northern Hemisphere. The model has been forced by the monthly NCEP/NCAR reanalysis climatology for 1979-1995. For simplicity, the soil heterogeneity is neglected and everywhere the soil thermo/hydrophysical parameters, corresponding to loam, are prescribed. The computed ALT is shown in Fig. 1.

The total area, covered by permafrost in the model, is about 21 mln.sq.km. This is quite close to the observationally based estimate ~23 mln.sq.km [4]. This value is also agree with the continuous potential permafrost area 20 mln sq.km, estimated, using the severity index [5] (with the surface air temperature, again taken from the NCEP/NCAR reanalysis dataset). Moreover, the geographical boundaries of the regions, where the permafrost is simulated by the model, are in the good agreement with the severity index isoline, bounding the continuous potential permafrost.

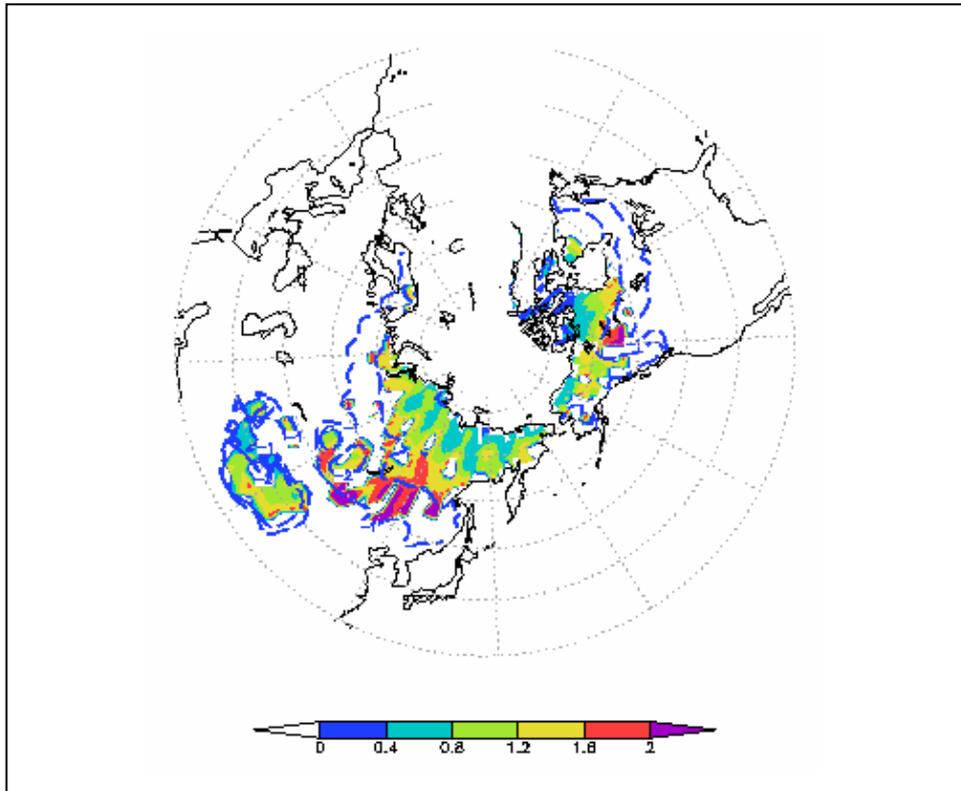


Fig.1: Simulated active layer thickness (color shades) together with the severity index isolines -1 and -2 (bounding sporadic and continuous potential permafrost, respectively).

The computed ALT can be compared with the results of the direct measurements, performed in the limited number of experimental sites. Here, this comparison is performed for the site near Yakutsk (62N 129E). The modeled value is 1.3 m, while the measurements embed the range 1.4-1.7 m with the mean value 1.5 m [6]. This underestimation can be due to cold bias in the NCEP/NCAR reanalysis (note that the area, covered by the continuous potential permafrost in this reanalysis, is close to the observationally estimated area, covered by the all types of permafrost).

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