

Spatial Variations of Soil Temperature and its Environmental Controls across Eurasian Continent

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Subsurface soil thermal status is a comprehensive indicator of energy, mass, and biogeochemical exchanges in the atmosphere-ground interaction. It plays an important role in the terrestrial carbon cycle, hydrological processes, and infrastructure, and varies in a complex environment. This study represents a continental-scale analysis of the soil temperature and its climatic and environmental controls across the Eurasian continent. It provides a comprehensive picture of soil temperature over the 20-year baseline period of 1981-2000 and investigates the potential correlations between soil temperature and environmental factors, including air temperature, snow cover, vegetation, and soils. Mean annual soil temperature (MAST) ranges from -13.3 to 26.5 °C with an average of 7.5 °C across the Eurasian continent. Spatial variations of latitude and elevation could explain 82% of the variations of the MAST. MAST declines 0.5 °C with an increase of 1 degree in latitude and 0.3 °C with an increase of 100 m in elevation. The difference between air and soil temperature (ΔAT) is positive at almost sites and 3.5 ± 2.1 °C over the Eurasian continent as a whole. High ΔAT is mainly found at central and eastern Siberia, which could be > 8 °C. ΔAT has a strong nonlinear correlation to mean annual air temperature (MAAT) and the correlation becomes weak when MAAT is higher than ~ 5 °C. MAAT and snow cover index explain 71% of the variation in ΔAT .

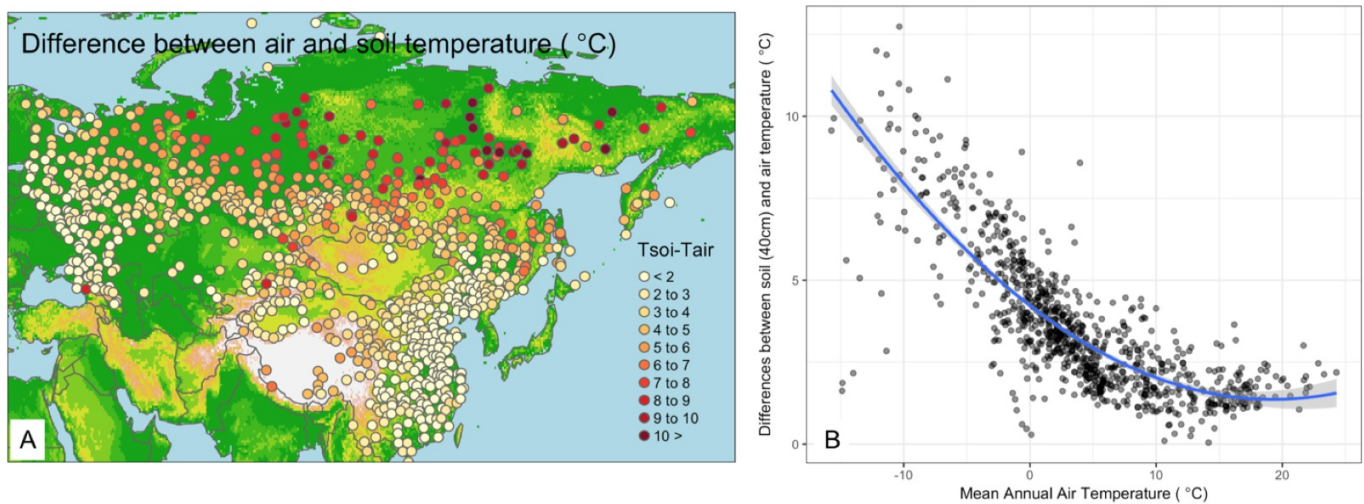


Figure 1. **A)** Differences between long-term mean air temperature and soil temperature at 40 cm (1981-2000) (i.e., ΔAT) across the Eurasian continent; **B)** relationship between ΔAT (the difference between air and soil temperatures) and long-term mean annual air temperature.