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SPECTRAL SURFACE CHARACTERISTICS
AS AN INDICATOR OF ECOSYSTEM EVOLUTION

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The response of spectral surface characteristics (vegetation index, albedo, and surface temperature) in areas of maximum global warming during the summer months can serve as an indicator of ecosystem changes in Russia under current climate warming. Data from the MOD13C2 NDVI product, albedo from MCD43C1, and surface temperature from MOD11C3 with a resolution of $0.05^{\circ} \times 0.05^{\circ}$ for 2000–2024 were used. The type of surface temperature regulation is determined by the relationship between albedo and surface temperature, based on MODIS data. In regions with the strongest increase in summer air temperature, areas characterized by a radiative type of surface temperature regulation (negative relationship between albedo and surface temperature), typically associated with sparse or absent vegetation cover, were identified. Trends in the areal extent of these territories were calculated for each summer month. In the subboreal zone of Southern European Russia, enhanced summer warming leads to an expansion of areas with radiative surface temperature regulation, creating new seasonal hotspots of desertification and leading to vegetation degradation. In the boreal zone of Southern Central Siberia, the evapotranspiration type of surface temperature regulation (positive relationship between albedo and surface temperature) predominates. However, under increasing air temperatures or following wildfire disturbances, areas with radiative regulation emerge in a mosaic pattern. In the subarctic zone, rising temperatures result in a reduction in the extent of areas with radiative surface temperature regulation due to increasing NDVI and phytomass, particularly in Northern Central Siberia. Further increases in air temperature may lead to the expansion of radiative surface temperature regulation in the subboreal zone and the persistence of such areas in boreal and subarctic regions. The spatial extent of these territories is strongly controlled by topography and local environmental and climatic conditions.

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