Estimating soil carbon content of desertified land in China drylands based on Sentinel 2 data

Desertification is one of the most important environmental problems in drylands of China, and the damage is very serious. It is of great significance to carry out monitoring of desertification in large areas to grasp the status and dynamics of desertification and formulate scientific and effective prevention and control strategies. Soil organic matter is one of the important indicators of desertification conditions. However, due to data lack and disturbances of vegetation signals, etc., large areas of soil organic matter acquisition have always faced greater difficulties. Compared with traditional ground-based observations, remote sensing technology has the potential to provide more reliable, time- and labor-saving estimates of soil organic matter content in large areas, which in turn provides data support for desertification monitoring and assessment.

This study, uses Google Earth Engine (GEE) with mass remote sensing data provision and cloud computing capabilities, exploring different machine learning methods such as CART, Random Forest (RF), and Support Vector Machine (SVM) to estimate the soil organic matter content of desertified land in China drylands, based on Sentinel-2 high-resolution image reflectance (non-growth season), topographic data, climate data, characteristic spectral index data, and ground measured soil organic matter content data (0-20cm). Overall, CART showed better accuracy than RF and SVM. The CART model obtained moderate results with R^2 of 0.48 and RMSE 0.35 without considering ancillary factors. By including the terrain, climate and characteristic spectral factors, the model accuracy improved greatly (R^2 can reach 0.86, the RMSE to 0.16, and the precision increased by 53%), which fully highlighting the importance of including the characteristic index and climate and topography factor when estimating the soil organic matter content. In particular, compared with other existing soil products in the region, this study obtained a full-coverage, higher-resolution and more reliable spatial distribution map of soil organic matter content, which could provide better support for desertification monitoring in China drylands in the future.