Mongolian Spectral Analyzer



Overview

For this research area, four areas representative of forest steppe, steppe, and Gobi eco-regions of Mongolia were selected, field research was conducted, data were collected, and Sentinel-2...

Key Takeaways

Spectral analyzer technology in Mongolia combines field spectroradiometers and satellite-based remote sensing to monitor soil, vegetation, and environmental parameters with high precision.

Applications in Mongolia

Soil Moisture Monitoring: Spectroradiometers are widely used in Mongolia to measure surface soil moisture across diverse ecological zones, including forest-steppe, steppe, and Gobi regions. Field measurements of spectral reflectance, particularly in the red (665 nm) and near-infrared (842 nm) bands, are correlated with laboratory-determined moisture content. These measurements are integrated with Sentinel-2 satellite data to calculate the Normalized Difference Water Index (NDWI), enabling continuous monitoring of soil moisture over large areas.

The method achieves a strong correlation (R^2 = 0. 74) between field and satellite-derived moisture estimates, providing a cost-effective and scalable approach for pasture and agricultural management in Mongolia. Vegetation and Grassland Analysis: Spectral analyzers are also applied to assess vegetation, particularly Poaceae grasses, which are important for livestock grazing.

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Ground-based spectral reflectance data are collected and converted into multispectral bands to simulate satellite imagery. This allows researchers to map grass abundance and distribution in semi-arid Mongolian steppes, supporting sustainable pasture management and ecological studies. Spectral Enhancement for Remote Sensing: Advanced spectral enhancement techniques, such as decorrelation, Brovey transform, and Gram-Schmidt transformation, are applied to optical and radar satellite data.

These methods improve the identification of land cover types, including forests, settlements, and water bodies, enhancing the accuracy of thematic mapping and environmental monitoring in regions like Khuvsgul Lake.

Technology Overview

Optical Spectrum Analyzers: High-resolution optical spectrum analyzers, such as those covering 843–1630 nm, are used for precise spectral measurements. These devices employ tunable laser sources and interferometric principles to achieve ultra-high resolution, allowing detailed analysis of spectral peaks and accurate wavelength calibration. Such analyzers are essential for laboratory and field studies requiring fine spectral discrimination.

R

F Spectrum Analyzers: For radio frequency applications, handheld real-time spectrum analyzers (RTSAs) like the PXN Series operate from 9 kHz to 9 GHz. They provide high dynamic range, low phase noise, and advanced measurement capabilities, including AM/FM demodulation, harmonic analysis, and vector modulation. These analyzers are useful for telecommunications, signal monitoring, and research requiring precise RF characterization.

Summary

Mongolian spectral analyzer technology integrates field spectroradiometers, satellite remote sensing, and advanced optical/RF analyzers to support environmental monitoring, soil and vegetation analysis, and land management. By combining high-resolution spectral measurements with satellite data, researchers can achieve accurate, scalable, and cost-effective monitoring across Mongolia's diverse ecological zones. This technology is critical for sustainable agriculture, ecological research, and resource management in the region.

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Development of the spectral forest index in the Khangai region, Mongolia using Sentinel-2 imagery Bayanmunkh Norovsuren a Department of Environment and Forest Engineering, School of

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Abstract Analyzing forest health in Mongolia through spectral indices derived from Sentinel-2 satellite data provides an innovative and effective approach for environmental monitoring and management.

Geographically Weighted Regression Enhances Spectral Diversity

The spectral variation hypothesis (SVH) posits that the complexity of spectral information in remote sensing imagery can serve as a proxy for regional biodiversity. However, the relationship

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