EGU21-10921
https://doi.org/10.5194/egusphere-egu21-10921
EGU General Assembly 2021

Detection and Mapping of Forest Disturbance in Eurasian Continent

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The global distribution and disturbance information of forest have strong impact on the change of Earth's ecosystems. In the 1990s, the Eurasian continent forest cover an area of 182 million ha, accounting about 33.2% of the Eurasian continent land area. However, we lack a complete mapping of high-resolution forest disturbances in Eurasia. Remote sensing can regularly obtain forest cover data across expansive range. Therefore, a complete set of Landsat time-series-based forest disturbance detection method is constructed in this paper to map a 30-meter forest disturbance detection distribution map of Eurasian continent.

In the construction of Landsat time series(LTS) data, the Landsat TM, ETM +, and OLI images of forest growth season were selected and synthesized into inter-annual time series over 35 years from 1986 to 2020. And the appropriate indices, NBR and NDVI, were selected as the input data for time series analysis. In time series analysis, the adaptive threshold of model learning is effectively applied in the process of extracting potential disturbance points, and the rich temporal information of LTS is fully mined to optimize and filter the disturbances.

The LTS images and forest disturbance based on adaptive threshold model are used to map three decades of forest disturbances, including the characteristics of the disturbance, spatiotemporal distribution and disturbance frequency across Eurasian continent. The derived disturbance year maps revealed that the disturbed forest area is 237 million ha and 12.8% of Eurasia's forest area. In order to validate the accuracy of the map, 10066 interpreted Landsat pixels, including 3932 disturbed samples and 6134 undisturbed samples, are selected as reference data. The overall accuracy of the disturbance map is 86.6%, with a commission error of 13.4% and an omission error of 9.4%. The results indicated that the LTS and adaptive threshold model can effectively support the mapping of forest disturbance in Eurasian continent.