기후 분과 [P-009]

Intraseasonal Atmospheric Processes Linked to the Interdecadal Increasing Trend in Fire Events over Central Siberia

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The Siberian-Arctic region is a vast area of boreal forest where a significant amount of carbon is stored within the ecosystem. Managing the risk of Siberian fire events has become critically important in the era of global warming. Notably, when normalized by their long-term means at each grid point, the Central Siberian region has experienced the most severe increasing trends in fire events over the past two decades.

Due to limitations in the temporal resolution of reanalysis datasets related to fire activities, previous studies have mainly focused on the role of monthly or seasonal mean atmospheric anomalies at the interannual time scale. However, in the extratropics, atmospheric systems typically evolve with shorter timescales, often less than several weeks.

In this study, using a gridded dataset of the Fire Weather Index (FWI), which spatially and temporally resembles the interdecadal trends observed in satellite-based burned area data, we suggest that extratropical Rossby waves—excited by barotropic instability near the Atlantic jet exit—play a key role in preconditioning fire-prone land surfaces. This preconditioning results in anomalously high transpirational demands on plants under reduced soil moisture levels. These significant changes in land surface conditions are largely driven by a quasi-stationary anomalous anticyclonic circulation, which increases incoming solar radiation under clear skies and is associated with reduced precipitation.

The findings of this study are expected to enhance the understanding of the atmospheric role in high-latitude fire activities and contribute to the development of scientific strategies for managing and mitigating fire events in the region.

Key words:Forest Fire, Rossby Wave, Land-Atmosphere Interaction