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Long-term forecasting of fire danger in the Russian Far East using climate change scenarios

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Wildland fire is one of the leading causes of land cover disturbance in temperate and boreal forests where it often represents an abrupt conversion of tree-dominated ecosystems to open landscapes. The extent and persistence of land cover disturbance lead to significant and long-lasting changes in ecosystem functioning. The Sikhote-Alin ecoregion of the Russian Far East (RFE) is an area of high biological importance designated by the UNESCO as a World Heritage Site. The projected trend towards higher temperatures in the boreal zone will affect vegetation flammability through its impact on fuel moisture, fire season length, and water levels. Fire danger modeling presents a unique opportunity to evaluate potential changes in fire occurrence in the RFE during the 21^{st} century under selected projected scenarios of climate change. A fuzzy logic driven model of fire danger, parameterized to the regional specifics of fire occurrence in the RFE, was applied to compare daily fire danger estimates from modeled and observed weather parameters during 1996 – 2000 and evaluate projected changes in fire danger in 2046 – 2050 and 2096-2100. Modeled weather parameters for the climate of the 20^{th} Century experiment (20C3M), and experiments for Special Report on Emissions Scenarios lines A2 (the worst case scenario) and B1 (the best case scenario) from the ECHAM5 model at the daily time-step were used in the analysis to assess a wide range of potential conditions. The study shows that both temperature and precipitation are projected to increase in the region during the 21^{st} century; however, the rate of temperature increase will surpass that of precipitation leading to the subsequent increase in fire danger, particularly within landscapes dominated by coniferous tree species.