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Predicting atmospheric carbon monoxide over fire regions using climate indices

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Fire is a major driver of atmospheric carbon monoxide (CO) variability, particularly in the Southern Hemisphere. The magnitude of emissions, such as CO, from biomass burning is connected to climate through both the availability and dryness of fuel. We assess the data driven relationships between CO and climate using satellite measured CO and climate indices, with the aim of predicting atmospheric loading in the fire season. Successful prediction of CO is important for air quality forecasting, especially in the Southern Hemisphere and tropical fire seasons.

Interannual variability in CO between 2001 and 2016 is determined from total column CO observations from the satellite instrument MOPITT, with a focus on biomass burning regions of the Southern Hemisphere and tropics. CO anomalies are linked to climate in each of the studied regions using a combination of climate indices for the climate modes: El Niño Southern Oscillation (ENSO); the Indian Ocean Dipole (IOD); the Tropical Southern Atlantic (TSA); and the Antarctic Oscillation (AAO). Step-wise forward and backward regression combined with the Bayesian Information Criterion is used to select the statistical models with the best predictive power. Combinations of lagged indices between 1 and 8 months are tested. We find that first-order interaction terms are necessary for explaining CO variability in the examined regions. Implications for Maritime Southeast Asia and Australasia are discussed.