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Linking the variability of atmospheric carbon monoxide to climate modes in the Southern Hemisphere

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Biomass burning is a major driver of atmospheric carbon monoxide (CO) variability 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 investigate the link between CO and climate using satellite measured CO and climate indices.

Observations of total column CO from the satellite instrument MOPITT are used to build a record of interannual variability in CO since 2001. Four biomass burning regions in the Southern Hemisphere are explored. Data driven relationships are determined between CO and climate indices for the climate modes: El Niño Southern Oscillation (ENSO); the Indian Ocean Dipole (IOD); the Tropical Southern Atlantic (TSA); and the Southern Annular Mode (SAM). Stepwise forward and backward regression is used to select the best statistical model from combinations of lagged indices. We find evidence for the importance of first-order interaction terms of the climate modes when explaining CO variability. Implications of the model results are discussed for the Maritime Southeast Asia and Australasia regions. We also draw on the chemistry-climate model CAM-chem to explain the source contribution as well as the relative contributions of emissions and meteorology to CO variability.