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The variability of southern hemisphere CO pollution as observed by MOPITT and the response to climate

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Biomass burning is an annual occurrence in the tropical southern hemisphere (SH) and a major source of regional pollution. Vegetation fires emit carbon monoxide (CO), which due to its medium lifetime is an excellent tracer of tropospheric transport. CO is also one of the few tropospheric trace gases currently observed from satellite and this provides long-term global measurements. In this paper, we use the 5 year CO data record from the Measurement Of Pollution In The Troposphere (MOPITT) instrument to examine the inter-annual variability of the SH CO loading and show how this relates to climate conditions which determine the intensity of fire sources. The MOPITT observations show an annual springtime peak in the SH zonal CO loading each year with dry-season biomass burning in S. America, southern Africa, the Maritime Continent, and northwestern Australia. Although fires in southern Africa and S. America typically produce the greatest amount of CO, the most significant inter-annual variation is due to varying fire activity and emissions from the Maritime Continent and northern Australia. We find that this variation in turn correlates well with the El Nino Southern Oscillation precipitation index. Between 2000 and 2005, emissions were greatest in late 2002 and an inverse modeling of the MOPITT data using the MOZART chemical transport model estimates the southeast Asia regional fire source for the year August 2002 to September 2003 to be 52 Tg CO. Comparison of the MOPITT retrievals and NOAA surface network measurements indicate that the latter do not fully capture the inter-annual variability or the seasonal range of the CO zonal average concentration due to biases associated with atmospheric and geographic sampling.