The Carbon Cycle Response to the 2015 El Niño

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The net sink of atmospheric carbon dioxide (CO_2), defined as the difference of anthropogenic emissions and the observed atmospheric growth rate, displays interannual variability linked to El Niño Southern Oscillation (ENSO) and to volcanic eruptions (see figure). During a typical El Niño, outgassing of carbon dioxide from the tropical Pacific Ocean is suppressed, increasing the net atmospheric sink of CO_2. This effect is generally overwhelmed by emissions of carbon dioxide from the tropical land biosphere, due particularly to wildfires in Southeast Asia. The overall result is generally a reduced net surface sink of carbon dioxide. The exceptionally strong El Niño in 2015 coupled with rising fossil fuel emissions resulted in an annual-mean atmospheric CO_2 growth rate at Mauna Loa of approximately 3 ppm/yr, corresponding to an atmospheric accumulation rate of about 6 PgC/yr. Since the last major El Niño in 1997-8, significant new observational programs and modeling tools have become available, and we now have a unique opportunity to observe and assess this event. In this presentation, we will discuss the physical nature of the 2015 El Niño and its impact on the global carbon cycle, as revealed by analysis of *in situ* atmospheric CO_2 observations, remote atmospheric soundings from surface- and space-based instruments, ocean pCO_2 observations and analyses, global wildfire emissions estimates, and atmospheric models.

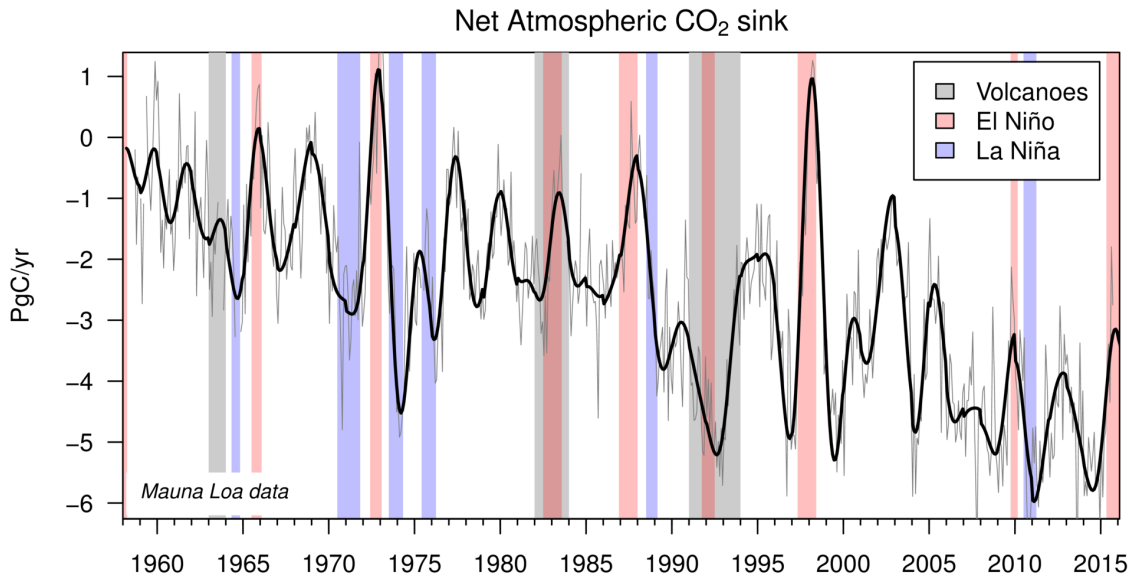

Figure 1. The net atmospheric CO_2 sink as inferred from the difference of the atmospheric growth rate and fossil fuel emissions estimates. The atmospheric CO_2 growth rate is computed in two different ways (thin and thick lines) from monthly-mean Mauna Loa observations. El Niños (shaded in red) and La Niñas (shaded in blue) are defined as deviations of ±1.0 in the Multivariate ENSO Index lasting at least 5 months. Impacts of major volcanic eruptions (shaded in gray) are computed as periods for which the weighted volcanic dust veil index exceeds 100.