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Large variability in El Niño-Southern Oscillation (ENSO) induces anomalous CO_2 fluxes both in biosphere and hydrosphere. In the negative phase of ENSO (i.e., El Niño), dryer climate over lower latitudes decreases productivity of land vegetation and increases vulnerability to biomass burning. At the same time, suppressed upwelling of carbon-rich water near the Pacific South America reduces outgassing of oceanic CO_2 to atmosphere. In years of a strong El Niño, anomalous land and ocean CO_2 fluxes account for a large part of interannual variability of the total net CO_2 flux of the Earth surface. Thus, anomalously large atmospheric CO_2 growth rates co-occur with periods of El Niño events.

Biomass burning is believed to be the dominant component of variability in atmospheric CO_2 growth rate during El Niño. The 1997/98 El Niño induced the most significant anomalous CO_2 release on record, largely due to forest and peat fires in Southeast Asia. Likewise, a massive fire haze over Southeast Asia was found during the recent 2015/16 El Niño. Despite the seemingly large impact of biomass burning in the two events, the 2015/16 El Niño accompanied substantially less atmospheric CO_2 growth compared with that in the 1997/98 El Niño. It turns out that CO_2 emission from biomass burning in 2015 was substantially less than that in 1997 because precipitation before the peak of fire emission (Sept-Oct) shortened the drought length of 2015.

However, it is still arguable that the insignificant biomass burning is the dominate cause behind no obvious signs of large CO_2 release in the 2015/16 El Niño. In the recent decades, both biospheric and hydrospheric CO_2 fluxes has shown trends towards a net sink of CO_2, which suggest a possibility of that increasing CO_2 uptake has suppressed the atmospheric CO_2 growth in the 2015/16 El Niño. To evaluate this possibility, a synthesis of land-ocean CO_2 flux over the period of the two El Niño events is necessary. Here, we explore mechanisms behind differences in the atmospheric CO_2 growth in the 1997/98 and 2015/16 El Niño. The aim of this study is to fully characterize the causes for insignificant atmospheric CO_2 growth in 2015/16 through analyzing types (anomaly/trend) of relative contributions of land-ocean fluxes to atmospheric CO_2 growth between the two El Niño events. Through the analysis, we discuss about components that would likely continue to mitigate atmospheric CO_2 growth in future El Niño.

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