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The OCO-2 tracks large increase in carbon release to the atmosphere during the 2014-2016 El Niño

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The powerful El Niño event of 2015-2016 – the third most intense since the 1950s – has exerted a large impact on the Earth's natural climate system. The column-averaged CO_2 dry-air mole fraction (XCO_2) observations from the recently launched Orbiting Carbon Observatory-2 (OCO-2) satellite, from the Greenhouse gases observing satellite (GOSAT) and from the ground-based Total Carbon Column Observing Network (TCCON) are analyzed together with in situ observations for the period of September 2014 to October 2016 (25 months). From the differences between satellite (OCO-2) observations and simulations using an atmospheric chemistry-transport model, we estimate that, relative to the mean annual fluxes for 2013, over the period July 2015 to June 2016, the most recent El Niño has contributed to an excess CO_2 emission from the Earth's surface (land+ocean) to the atmosphere in the range of 2.4 $\pm$ 0.2 PgC (1 Pg = 10^{15} g). The excess CO_2 flux resulted primarily from reduction in vegetation uptake due to drought, and to a lesser degree from increased biomass burning. It is about the half of the CO_2 flux anomaly (range: 4.4-6.7 PgC) estimated for the 1997/1998 El Niño. The annual total sink is estimated to be 3.9 $\pm$ 0.2 PgC for the assumed fossil fuel emission of 10.1 PgC in contrast to an average sink of more than 6 PgC yr^{-1} during 'reference' period of 2013-2014. The major uncertainty in attribution arise from error in anthropogenic emission trends, satellite data and atmospheric transport. We believe improvements in modeling atmospheric-CO_2 are needed to enable attribution at smaller, regional scales.