Geophysical Research Abstracts
Vol. 20, EGU2018-3692, 2018
EGU General Assembly 2018

Top-of-Atmosphere Earth Radiation Budget Variability During and After the 2014-2016 El Niño Event

Norman Loeb (1), Hailan Wang (2), Fred Rose (2), Tyler Thorsen (1), Seiji Kato (1), and Karina von Schuckmann (3)

(1) NASA Langley Research Center, Hampton, United States (norman.g.loeb@nasa.gov), (2) Science Systems and Applications, Inc., Hampton, Virginia, (3) Mercator-Ocean, Ramonville-Saint-Agne, France

Prior to 2014, the CERES record (March 2000 onwards) is dominated by a cool phase of the Pacific Decadal Oscillation (PDO) with three significant La Niña events (1998–2001, 2007–09 and 2010–12) and four relatively weak El Niño events (2002–03, 2004–05, 2006–07 and 2009–10) occurring. During 2013, near-neutral conditions persist over the Pacific Ocean throughout the year, followed by a gradual build-up of El Niño conditions in 2014, which reach maximum strength during late 2015—early 2016. By mid-2016, the ENSO index returns to neutral conditions. The 2014-2016 El Niño event is considered to be one of the three strongest El Niño events since 1950, and also coincides with a return to the warm phase of the PDO.

Anomalies in CERES outgoing longwave radiation (OLR) and outgoing shortwave radiation (OSR) exhibit remarkable behavior during and after the 2014-2016 El Niño event. OLR anomalies steadily increase after 2013, reaching 1.8 Wm-2 in early 2016. In contrast, OSR anomalies show a steady decrease, and reach a minimum of -2 Wm-2 only in January 2017, one year after the peak of the El Niño. Interestingly, the magnitudes of OLR and OSR anomalies remain appreciable through July 2017, the latest CERES month processed at the time of this writing. However, because OLR and OSR anomalies are of opposite sign, the magnitude of anomalies in net TOA flux are smaller, but are generally positive during and following the 2014-2016 El Niño event.

To confirm that these remarkable variations in TOA radiation are robust, this presentation compares TOA flux anomalies during and after the 2014-2016 El Niño event from CERES EBAF Ed4.0 and other satellite and reanalysis datasets. We examine how anomalies amongst individual CERES instruments processed independently (Terra, Aqua and SNPP) compare with one another and with EBAF Ed4.0 during this period. Global mean net TOA flux anomalies are also compared with Argo-based ocean heating rates for the top 700 m and 2000 m ocean layers. Finally, we decompose the global and regional TOA flux anomalies into individual components that contribute to TOA flux variability during the 2014-2016 El Niño event in order to better understand what are the main drivers of the SW and LW TOA flux variability.