Geophysical Research Abstracts
Vol. 20, EGU2018-10271, 2018
EGU General Assembly 2018

Evolution of surface flux and ocean heat content with ENSO

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The Earth's energy imbalance is caused by increasing greenhouse gases in the atmosphere and its partitioning between atmospheric, ocean, cryosphere and land heat reservoirs govern the rate at which the global climate evolves. Most of the imbalance, over 90%, goes into the ocean and accordingly ocean heat content (OHC) provides a primary indicator of climate change. Natural variability, especially El Niño plays an important role both globally and locally. El Niño Southern Oscillation (ENSO) is the dominate mode of the air-sea interaction in the climate system on inter-annual time scale, which has global impact through atmospheric teleconnections and ocean circulation changes. How the surface flux and ocean heat content (OHC) changes related to ENSO: does the ocean gains or loses heat during an ENSO event? What mechanisms (change of ocean heat transport or air-sea heat flux) are responsible for the ENSO's impact on ocean energy budget on basin and global scale? We use an advanced ocean temperature analysis data to identify the global and regional ocean heat content changes: we find ocean loses heat during El Niño (negative OHC tendency) and there is strong heat redistribution in the tropical Indo-Pacific Ocean and a clear OHC footprint in the Indian and Atlantic Ocean related to ENSO. Moreover, by adopting a holistic approach that includes top-of-atmosphere (TOA) radiation and vertically-integrated atmospheric transports, surface fluxes can be obtained. The surface flux data based on this method is used to explore the evolution of surface flux and meridional ocean heat transports related to ENSO.