

Air-Sea Fluxes at NOAA Ocean Climate Station Reference Sites

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Abstract

The ocean and atmosphere interact through air-sea fluxes. These fluxes are the most direct ocean climate indicators of how the ocean influences climate and weather, and their extremes, and how the atmosphere forces ocean variability. Through intense air-sea heat fluxes, the ocean supports and modifies tropical cyclones, winter storms and cold-air outbreaks, affecting weather and climate, locally, remotely and globally. These air-sea fluxes of heat and momentum (wind stress) in turn modify the ocean's currents and distribution of heat, with delayed feedbacks potentially providing predictability over timescales of up to several years. Air-sea fluxes from Numerical Weather Prediction (NWP) models, however, have large biases and uncertainties (Kubota et al. 2008, Tomita et al. 2010). It is well accepted that these errors must be identified and reduced in order to make progress with weather forecasts and climate projection. Only by understanding the nature of the error can the model be improved. Two NOAA Ocean Climate Station (OCS) buoys, the Kuroshio Extension Observatory (KEO) at 32.3°N, 144.5°E and Station Papa at 50°N, 145°W, have been measuring air-sea fluxes and upper ocean properties since 2004 and 2007 respectively. Both lie under the North Pacific storm track. Both observe frequent and severe winter storms and KEO also observes numerous Tropical Cyclones (TC) and typhoons, providing excellent reference time series for evaluating extreme air-sea interaction in NWP models. For more information on the OCS stations see: <http://www.pmel.noaa.gov/OCS/>.

In this project, high-resolution air-sea flux reference time series will be computed from NOAA Ocean Climate Station (OCS) data and made publicly available through an easy-to-use webpage. During year 1, air-sea heat, moisture, and momentum fluxes and all their components will be computed at these stations using the COARE v3.0 algorithm and made publicly available through a data delivery and display page similar to that offered by the PMEL TAO group: <http://www.pmel.noaa.gov/tao/oceansites/flux/main.html>. These ocean climate indicators will then be used to diagnose biases in fluxes produced by new NWP reanalyses (i.e. NCEP's Climate Forecast System Reanalysis and ECMWF Reanalysis-Interim). In years 2-3 of this project, we will upgrade to the COARE v3.5 algorithm, once it is fully developed. We will also increase the variables provided through the OCS flux website to include skin temperature, meteorological state variables adjusted to 10-m height, and transfer coefficients. Likewise, analyses will be expanded to include comparisons and analysis of the ocean heat balances in the numerical ocean, with a focus on identifying processes affecting the distribution of heat in the ocean that may feedback onto the air-sea fluxes.