Abstract Details

AOGS 1st Annual Meeting > Ocean and Atmospheres > Air-Sea Coupling Observed from Space >

Corresponding Author : Dr. W. Timohty Liu (liu@pacific.jpl.nasa.gov)

Organization: Jet Propulsion Laboratory

Category: Ocean and Atmospheres

Paper ID: 57-OOA-A484

Title: Air-Sea Coupling Observed from Space

Abstract: The advance of spacebased microwave sensors that measure ocean surface wind vector, dynamic topography, and sea surface temperature (SST) and atmospheric water content, under both clear and cloudy conditions, night and day, open new opportunity of studying ocean-atmosphere coupling. The recent improvement in the spatial resolution of scatterometer winds (10 km) pushes the applications to coastal oceans and marginal seas. The ocean will respond to surface wind and thermal forcing by changing SST and dynamic topography, which are observed by spacebased radiometer and altimeter. Dynamic coupling should be manifested through lag correlations between the curl of wind stress (CWS) and dynamic topography and between CWS and SST. Waves and current advection often obscure direct observations of such simple correlations in open oceans. South China Sea (SCS) is semi-enclosed, where such negative lag correlations were observed in annual time scales using only spacebased data. In the center of the SCS basin, the winter monsoon causes positive CWS (cyclonic circulation), divergence of surface water, upwelling of cold water, depression of sea level and SST. The summer monsoon, with negative CWS, causes opposite responses. The anticyclone circulation in the center of the basin during summer is punctuated by a topography-induced wind jet branching off from the South Vietnamese coast. Large wind-driven ocean thermal and biological responses were also observed with the passing of typhoons in the South China Sea. Two mechanisms of ocean-driven coupling are also evident. When the ocean is warm and SST is above deep convection threshold, surface winds from different directions converge to the local SST maximum, driven by pressure gradient force. Decreases in vertical mixing and increases in vertical wind shear in the atmospheric boundary layer may also cause the deceleration of surface winds as they move from warmer to colder water. The two mechanisms were found to be responsible for the formation and maintenance of year-round double intertropical convergence zones in the eastern Pacific. The boundary-layer instability mechanism causes negative contemporary correlation between wind speed and SST, and is evident during winter and spring in the vicinity of East China Sea, where bathymetry-induced warm and cold tongues are co-located with high and low winds. The negative correlations wsree also found over tropical instability waves and the cool water of typhoon-wakes. A strong wind jet blowing along the Kuroshio front, most probably driven by cross-front pressure gradient was also found, and location of convergence with respect to the SST fronts reveals the role played by both mechanisms.

Presentation Mode: Oral

Keywords: air-sea-interaction, remote-sensing, typhoon, ocean-current, monsoon, convection, wind, sea-surface temperature, ecology

Status: Pending.

Co-Authors

No.	Title	First Name	Family Name	Organization
1	Dr.	Xiaosu	Xie	Jet Propulsion Lab.
2	Dr.	Shang Ping	Xie	Univ. of Hawaii
3	Dr.	W. Timothy	Liu	Jet Propulsion Laboratory
4	Dr.	I-I	Lin	National Taiwan Univ