UNDERSTANDING THE ANNUAL CYCLE OF LATENT HEAT FLUXES OVER THE EQUATORIAL PACIFIC

Lee, H.-K. and **Chu, P.-S.**
Department of Meteorology
School of Ocean and Earth Science and Technology
University of Hawaii
Honolulu, Hawaii 96822, USA

Sui, C.-H. and Lau, K.-M.
Climate and Radiation Branch
Laboratory for Atmospheres
NASA/Goddard Space Flight Center
Greenbelt, MD 20771, USA

The annual cycle in the latent heat flux (LHF) and its associated bulk parameters (sea surface temperature, wind speed, humidity difference) over the equatorial Pacific are described. The in-situ daily-averaged TAO buoy observations between 8°N and 8°S during the period 1992-96 form the database. LHF is computed using a modified bulk parameterization scheme to account for active convection and low wind speed frequently observed in the monsoonal western Pacific. Harmonic analysis is used to help quantify the phase and amplitude of the annual and semiannual cycles of LHF.

The annual cycle of LHF is conspicuous in two regions, namely, the western/central and the northeastern Pacific. For the former region, maximum LHF occurs in boreal winter when the winter monsoon is strong. For the northeastern Pacific, maximum LHF occurs in boreal summer and early fall when southeast trade winds are strong, the temperature difference between sea surface and air near the bottom of the atmospheric boundary layer is large, and the meridional sea surface temperature gradient is strong. This maximum value reflects the importance of the equatorial cold tongue in modulating the stability of the atmospheric boundary layer in a large region immediately to the north of the equatorial cold tongue. As the eastern Pacific warms from boreal winter to spring, the slack horizontal temperature gradient may result in a decrease of surface pressure gradients and thus a reduction of wind speeds. Consequently, low LHF dominates.

In contrast to the aforementioned two regions, the annual cycle in LHF in the equatorial cold tongue is weak and low LHF prevails throughout the year. Despite the fact that sea surface temperatures exhibit a strong annual cycle, the semiannual cycle (i.e., the second harmonic) of LHF overshadows the annual cycle in the core of the cold tongue region.

Relative role of dynamic and thermodynamic processes in modulating the flux is assessed quantitatively by partitioning the flux into various components. Two meridional transects, one along 110°W and another along 165°E where data are more abundant, are chosen. Variations in wind speed (i.e., dynamic process) are more important to the LHF in the western/central Pacific. On the other hand, variations in humidity difference (thermodynamic process) seem to be of primary importance to the annual variations in LHF in a large region of the eastern Pacific.