EMS Annual Meeting Abstracts
Vol. 14, EMS2017-358, 2017

Ship observations and numerical simulation of the marine atmospheric boundary layer over the spring oceanic front in the northwestern South China Sea

Rui Shi (1), Ju Chen (1), Xinyu Guo (2), and Dongxiao Wang (1)

(1) South China Sea Institute of Oceanology, Chinese Academy of Sciences, Guangzhou, China (shirui@scsio.ac.cn), (2) Center for Marine Environmental Studies, Ehime University, Matsuyama, Japan(guo.xinyu.mz@ehime-u.ac.jp)

The response of the marine atmospheric boundary layer (MABL) structure to an oceanic front is analyzed using Global Positioning System (GPS) sounding data obtained during a survey in the northwestern South China Sea (NSCS) over a period of about one week in April 2013. The Weather Research and Forecasting (WRF) model is used to further examine the thermodynamical mechanisms of the MABL's response to the front. The WRF model successfully simulates the change in the MABL structure across the front, which agrees well with the observations. The spatially high-pass-filtered fields of sea surface temperature (SST) and 10-m neutral equivalent wind from the WRF model simulation show a tight, positive coupling between the SST and surface winds near the front. Meanwhile, the SST front works as a damping zone to reduce the enhancement of wind blowing from the warm to the cold side of the front in the lower boundary layer. Analysis of the momentum budget shows that the most active and significant term affecting horizontal momentum over the frontal zone is the adjustment of the pressure gradient. It is found that the front in the NSCS is wide enough for slowly moving air parcels to be affected by the change in underlying SST. The different thermal structure upwind and downwind of the front causes a baroclinic adjustment of the perturbation pressure from the surface to the mid-layer of the MABL, which dominates the change in the wind profile across the front.