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795: Observations of the Marine Atmospheric Surface Layer Gradients during the CASPER-West Field Experiment

Tuesday, January 8, 2019
04:00 PM - 06:00 PM
Hall 4

The bulk of our knowledge of air-sea exchange coefficients for momentum and heat derives from single-point measurements made at some height within the marine atmospheric surface layer (MASL). These point measurements rely on assumptions regarding the vertical structure of the MASL. Foremost among these assumptions, is the validity of Monin-Obukhov Similarity Theory (MOST), which postulates that the gradient-flux relationship is a universal function of surface layer stability. Under neutral conditions, this simplifies to the familiar logarithmic profile. While MOST has been validated over land, observations of the actual gradients within the MASL remain scarce, in part due to the challenges of making near-surface profile measurements over the ocean.

The Research Platform *FLIP* was recently deployed on the west coast for the Coupled Air-Sea Processes and Electromagnetic ducting Research field campaign (CASPER-West), a large-scale air-sea interaction study that took place offshore of Pt. Mugu, CA. *FLIP* remains an ideal platform for making measurements in proximity to the air-sea interface, with minimal contamination from the platform. During CASPER, a meteorological mast was installed on *FLIP* that resolved both the bulk and flux profiles of momentum and heat, from 3 to 16 m above the surface. This mast included 7 flux levels, 10 mean wind measurements, and over 20 temperature and humidity probes. This presentation will focus on the vertical gradients measured from *FLIP's* mast, with the specific aim of using these high-resolution measurements to test the variability predicted by MOST.

As a preliminary step, linear regression was used to determine the natural prevalence of the logarithmic profile. For the mean wind profiles, only 10.2% of the profiles were strongly logarithmic ($r^2 > 0.9$). For specific humidity, this increased to 40.9% of profiles, with no temperature profiles exhibiting a strong logarithmic relationship. Mean r^2 was 0.624, 0.265, and 0.853 for wind, temperature, and specific humidity respectively, which increased to 0.761, 0.362, and 0.950 for wind speeds > 6 ms^{-1} (12.3% of the total data set). Wind speed exhibited positive, and temperature demonstrated negative, relationships with bulk air-sea temperature difference; for example, in stable conditions the mean r^2 increased to 0.783 for wind speed, and decreased to 0.145 for temperature. Further analysis will focus on comparing strongly-logarithmic profiles to the empirical gradient-flux relationships available in the literature as well as, determining environmental factors driving the majority of profiles away from the expected logarithmic behavior. This unique dataset provides an opportunity to directly evaluate the prevalence and validity of the MASL vertical structure predicted by MOST, which is assumed to be generally valid over the ocean.

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