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VOCALS/Southeast Pacific science: Cloudy atmospheric boundary layer observations over subtropical eastern oceans from COSMIC GPS occultation

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The shallow atmospheric boundary layer (ABL) clouds prevailing over subtropical eastern oceans (SEOs) are generally trapped below a strong inversion layer. These highly reflective low clouds produce profound radiative cooling effects and their climate feedback remains a primary cause of uncertainty in global climate model projections. The lack of high vertical resolution global observations of ABL thermodynamic structures from conventional nadir-viewing satellites impedes our understanding of the complicated ABL processes and makes ABL parameterizations in climate and weather prediction models challenging to develop and verify. The Global Positioning System (GPS) radio occultation (RO) soundings from Constellation Observing System for Meteorology Ionosphere and Climate (COSMIC) offer a unique capability for global observations of cloudy ABL with high vertical resolution (~200 m). In this study, the ABL heights are derived from COSMIC RO soundings (2007-2010), which are compared with the ship-borne radiosondes collected during VAMOS Ocean-Cloud-Atmosphere-Land Study (VOCALS) field campaign over southeast Pacific Ocean in 2008. The high-resolution ECMWF and NCEP analyses are also analyzed. COSMIC RO soundings show good agreement with radiosondes in ABL heights but underestimate the refractivity gradient across the ABL top. On the other hand, both the ECMWF and NCEP analyses underestimate the gradient across the ABL top and produce systematically shallower ABL. We will present ABL height climatology (annual, seasonal and diurnal variations) from COSMIC RO, ECMWF and NCEP analyses over five selected SEOs regions, which include the northeast and southeast Pacific and Atlantic Oceans as well as the southeast Indian Ocean (off coast of west Australia). COSMIC RO and analyses reveal similar large-scale features of ABL heights, such as, the deepening of the ABL heights westward from shallow stratocumulus topped ABL near-coast to a much higher ABL over trade-cumulus region. However, significant differences in spatial patterns are found. The difference between the three dataset will be explored, and the implication to the ABL parameterization in weather and climate models will also be discussed.