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Detection of Marine Boundary Layer Heights and their Inter-annual Variability in the Southeast Pacific using COSMIC, CALIOP, and Radiosonde Data

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In this study, the spatial and temporal variability of the marine boundary layer (MBL) over the Southeast Pacific is studied using high resolution radiosonde data from the VAMOS Ocean-Cloud-Atmosphere-Land Study Regional Experiment (VOCALS-REx), lidar cloud measurements from the CALIOP instrument on the CALIPSO satellite, radio occultation (RO) data from the COSMIC satellites, and the ERA-Interim reanalysis. The MBLH is usually well defined by the height of these clouds. With high vertical resolution RO data (about 60 meters in the lower troposphere), RO data are very useful to detect the PBLH. Although RO measurements are not sensitive to clouds, they are very sensitive to the vertical gradients of bending angle and refractivity, which depend on temperature, pressure, and water vapor profiles. The PBLH derived by using different RO variables (i.e. bending angles, refractivity, and partial water vapor pressure) are also compared. PBL heights determined by RO measurements are shown to be quite accurate compared to the CALIOP and radiosonde observations. The results show that although there exists a negative bias in the refractivity due to super-refraction, the spatial and temporal variations of the MBLH determined from the RO observations are consistent with those from CALIOP and the radiosondes, in agreement with the results of Xie et al. (2012). We find that the minimum gradient in the RO bending angle gives the most accurate estimation of the MBL height.