A Late-Summer Strong Surface-Based Ducting Event and Its Potential Causes

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Atmospheric radio frequency (RF) refractivity profiles were measured approximately 80 km off the southern California coast with the JHU/APL-built Helicopter Atmospheric Profiler System (HAPS) and rocketsondes launched from a ship at sea. These profiles show strong instances of surface-based ducting observed on 18 September 2008 with heights ranging from about 350 to 450 meters. Additionally, the Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS) model was applied to the 18 September data set, to investigate causes of the extraordinarily deep marine atmospheric boundary layer that created the large surface-based ducts.

These ducts can have a dominating effect on the long-range propagation of radar and communications signals oriented toward the horizon. Understanding the meteorological forcing behind the formation of surface-based ducts can lead to better predictions of conditions likely to cause ducting and predictions of RF propagation effects, even in the absence of measured refractivity data. By tracking not only local weather conditions in the area of interest, but larger mesoscale trends, a better understanding of the meteorological processes that caused this ducting can be obtained. Preliminary results indicate that the deep surface-based duct resulted from low-level moisture advecting from the south beneath a thick layer of upper-level dry air associated with a high pressure cell to the southwest of the study area. These events, typically called 'southerly surges', result from a pressure reversal that causes rapid changes in coastal environmental conditions: abrupt wind shifts, sudden drop in temperature and low-level fog moving up the coast. Comparisons of the COAMPS results to the observations will be presented, along with a synoptic overview of the meteorology that preceded the formation of the deep boundary layer.