Performance of Forecast Models during CASPER West Campaign

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The CASPER (Coupled Air-Sea Processes and Electromagnetic ducting Research) West field campaign took place in the Southern CA Bight, south of Pt. Mugu in fall of 2018. Over a 30 day period a plethora of measurements were collected on atmospheric, oceanic, wave, and EM propagation data for both radio frequency and electro-optics. In coordination with CASPER's measurement objectives, high resolution numerical weather prediction models were run in near-real time to provide forecasting support, guidance on daily operations, and an evaluation of spatio-temporal variability in the local ducting phenomena. The performance of two models are investigated in this study using CASPER West radio-sonde soundings, bulk surface data, and surface flux time series collected aboard the stationary research vessel FLIP. Historically, this region is known for being a challenging environment to simulate due to the presence of a variety of mesoscale forcings from spatial variability of the topography and coastline, the Channel Islands, sea surface temperature structures from small scale oceanic filaments and eddies, to diurnal sea/land breeze variations causing changes in the marine atmospheric boundary layer. We compare two models the Coupled Ocean Atmosphere Mesoscale Prediction System (COAMPS®) and the North American Mesoscale Model (NAM) for their ability to capture the evolution of mesoscale features in state variables that contribute to atmospheric refractivity, a key parameter conveying the effects of the environmental on EM signals in propagation models.

We perform an overall statistical validation using CASPER observations and study individual cases to investigate forecasts of refractivity and ducting, the differences between the two model's forecasts, identify sources of performance error and model biases. This inter-comparison study is more apt to elucidate ways to improve environmental modeling systems which are heavily relied upon to predict the performance of EM sensors in Naval operations.