Practical Considerations for Deriving Refractivity for Parabolic Wave Propagation Models

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Many small and seemingly inconsequential decisions must be made when using data from numerical weather models with parabolic equation models. Some examples of such decisions include which value to use for common constants, which formula to use when computing refractive index, which earth radius for modified refractivity, how to determine surface roughness, how finely in altitude should the evaporation duct be sampled, and how to reconcile weather model terrain with higher resolution digital terrain data. Each of these questions may have multiple valid answers. The particular solution chosen probably does not significantly change results. Yet there will be some variation from option to option. This talk discusses these decisions, looking at common approaches, exploring reasoning, and quantifying differences. Variation will be considered for a few standard cases such as over water, over land, and hybrid propagation paths. Differences will be quantified by comparing propagation results with all other variables held constant. Results from three predominant propagation models will be discussed. Refractivity from three predominant weather models will be compared, focusing on the minor, debatable decisions and assumptions made along the way. The talk will look at the National Oceanic and Atmospheric Administration's (NOAA) Climate Forecast System Reanalysis (CFSR), the Wave Watch 3 wave model, the US Navy's Coupled Ocean / Atmosphere Mesoscale Prediction System (COAMPS) model, and European Center for Medium-Range Weather Forecasts (ECMWF)s ERA Interim reanalysis. The talk will discuss the process of converting these sources to refractivity fields suitable for use with parabolic wave models and will run three notional cases with TEMPER, APM, and VTRPE propagation models. When assumptions or questions of judgment for which multiple reasonable approaches exist are encountered, the impacts will be quantified and discussed using the approach described above.