Influence of the refractivity profiles vertical resolution on the assessment of propagation effects within the Marine Surface Boundary Layer (MSBL)

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Optical (infrared or visible bands) and radar propagation within the MSBL are strongly influenced by temperature and humidity gradients, and thus by the refractivity gradients. Close to the air-sea boundary, the environmental conditions can cause abnormal propagation effects such as mirages and ducting.

Initialized by in-situ measurements (or NWP models outputs) and applying the Monin-Obukhov similarity theory, "bulk" models are now widely used to compute the vertical refractivity profiles. Many available experimental data have demonstrated the reliability of these models especially for neutral or unstable atmospheric conditions.

For optical propagation assessment, the refractivity profiles can be linked with ray tracing algorithms to estimate the maximum detection range of a given sensor or the spatial extent of the mirage zone (within the mirage zone, a target will be seen under two distinct elevation angles). For radar propagation prediction, the refractivity profile is commonly associated with a PE (Parabolic Equation) model in order to estimate the radio coverage diagram.

Recently, blending techniques have been developed in order to merge the surface layer profiles with those coming from mesoscale NWP models and concerning the higher altitudes. As the bulk models have no limitations in terms of vertical resolution, the resulting output grib files, related to a defined geographical area, could become oversized. So it is necessary to investigate what could be a "reasonable" vertical resolution for describing the surface layer effects. For this, we have to consider both optical and radar applications and to keep in mind that the objective is to define a fixed grid of altitude levels.

Our presentation will show various simulation results concerning the propagation effects by using "full resolution" vertical profiles and then by using several "lower resolution" ones.