IMPROVEMENTS OF THE *PIRAM* BULK MODEL TO CALCULATE REFRACTIVITY PROFILES WITHIN THE MARINE SURFACE BOUNDARY LAYER.

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INTRODUCTION

Within the Marine Surface Boundary Layer (MSBL), the vertical refractivity profile is rarely standard. At radiofrequencies (RF), the evaporation duct strongly modifies the low altitude radar coverage diagrams. At optical wavelengths, the most frequent propagation mechanism is subrefraction which limits the detection range of electro-optical (EO) sensors and leads to mirage effects.

REFRACTIVITY PROFILES MODELING

The French *PIRAM* model uses a *bulk* method based upon Monin-Obukhov similarity theory (J. Claverie et al., *AGARD-CP-567*, pp 29-1/29-11, 1995). From in situ simple meteorological measurements, it computes the vertical refractivity profiles for RF bands, as well as for optical bands. Without any major difficulty, the method can be extended to determine the refractive index structure constant (C_n^2) vertical profiles within the MSBL.
PIRAM generally leads to very satisfactory agreements between propagation modeling and measurements concerning radar data (H.J.M. Heemskerk, *5th Int. Radar Conf. Proceedings*, Brest (FR), 1999) and EO data (J. Claverie et al., *RTO-MP-1*, pp 5-1/5-13, 1998).

IMPROVEMENTS OF THE PIRAM MODEL

For some particular experimental data sets, the results provided by the actual PIRAM version did not match very well with the observed values (J. Claverie and Y. Hurtaud, *AP200 Conf.*, Davos (CH), 2000). Significant improvements of the model have been achieved by :

- Changing the stability functions needed in the vertical profiles expressions and changing also the roughness lengths calculation.
- Modifying the *bulk* profiles near the sea surface, in order to take into account the interactions between the lower atmosphere and the wave field.

As the PIRAM model concerns the first tens of meter above the sea surface, it is of major interest to be able to link our computed profiles with upper air data. These upper air data may come from radiosondes measurements or from meteorological mesoscale models. So, our actual modifications of the PIRAM model, also concerns the feasibility of generating what we could call *hybrid vertical refractivity profiles*.