Modeling the Impact of Sea Surface Salinity on the Evaporation Duct

Paul A. Frederickson*[(1)], Thomas R. Hanley[(2)], and Michael H. Newkirk[(2)]
(1) Dept. of Meteorology, Naval Postgraduate School, Monterey, CA
(2) The Johns Hopkins University, Applied Physics Laboratory, Laurel, MD

For the past several decades models based on Monin-Obukhov similarity theory have been used to characterize the evaporation duct by producing estimates of the near-surface vertical refractivity profile. The Navy Atmospheric Vertical Surface Layer Model (NAVSLaM), developed by the Naval Postgraduate School, is one such model. Since evaporation ducts are primarily caused by the rapid decrease in humidity just above the sea surface, it is important for these models to use a reasonable estimate of the humidity at the sea surface, which is assumed to be saturated. This depends not only on the sea surface temperature, but also on the salinity, since ocean salinity causes a reduction in the saturation specific humidity from that of pure water. NAVSLaM employs the TOGA-COARE (Fairall et al, *J. Geophys. Res.*, 101, 3747-3764, 1996) assumption that the sea surface specific humidity is 98% of the value for pure water, based on a typical ocean salinity value of 34 practical salinity units (PSU). Salinity values in the open ocean, however, generally range between 31 and 38 PSU, and in the Mediterranean and Red Seas and the Persian Gulf can reach values as high as 42 PSU. Near fresh water sources values can be much lower than 31 PSU.

In this study we include salinity as an input to a modified version of NAVSLaM and allow the sea surface specific humidity to vary according to a simple salinity-dependent equation. We then examine the impact of typical global sea surface salinity variations on the evaporation duct height (EDH), and also demonstrate how the resulting variations in EDH impact actual radio frequency propagation predictions. Recommendations on how to best incorporate sea surface salinity as a new input to evaporation duct models such as NAVSLaM will also be presented.