A HIGH RESOLUTION INFRARED SEA SURFACE EMISSIVITY DATABASE FOR SATELLITE APPLICATIONS

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1. INTRODUCTION

The infrared (IR) sea surface emissivity model of Masuda *et al* (1988) has been validated for small view angles with AERI measurements made during the 1995 OTIS field experiment (*Smith et al*, 1996). For larger view angles, however, the computed sea surface emissivity exhibits a relatively constant negative bias. This bias has implications for satellite remote sensing products that are sensitive to errors in sea surface emissivity.

Wu and Smith (1997) postulate that reflected emission from the sea surface, as illustrated in figure 1, effectively enhances the sea surface emissivity at larger view angles.

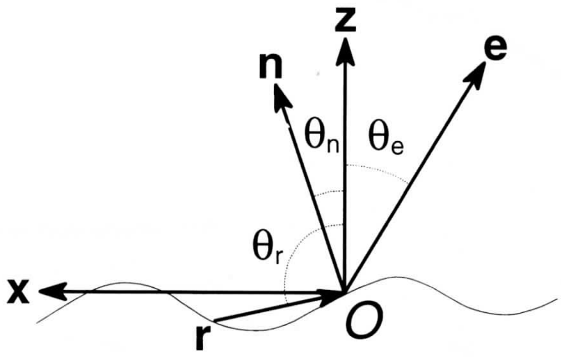

Figure 1. Illustration of geometry of emission and reflection at a wave facet tangent to the instantaneous sea surface at point *O*.

The direction of emission, **e**, is such that some emission from below the horizon, **r**, can be reflected at point ***O*** along **e**. Because of this contribution from **r**, radiance along **e** is effectively enhanced which is an equivalent to an enhancement of emissivity.

The emissivity calculations shown in this paper use the Wu-Smith methodology.

2. EMISSIVITY MODEL DATA

The main difference between the emissivity calculations shown here and those shown in Wu and Smith is that the emissivities were calculated at a resolution that adequately describes the emissivity variation in the IR window regions and also minimizes the computational burden. The frequency spacing of the calculated emissivities is ~16cm^{-1}. The pure water refractive index data used was that of Hale and Querry (1973) for the real part and Segelstein (1981) for the imaginary part from 600-3000cm^{-1}. These data are shown in figure 2. The salinity and chlorinity corrections applied to the pure water data was that of Friedman (1969), with constant values beyond ~1125cm^{-1}, shown in figure 3.

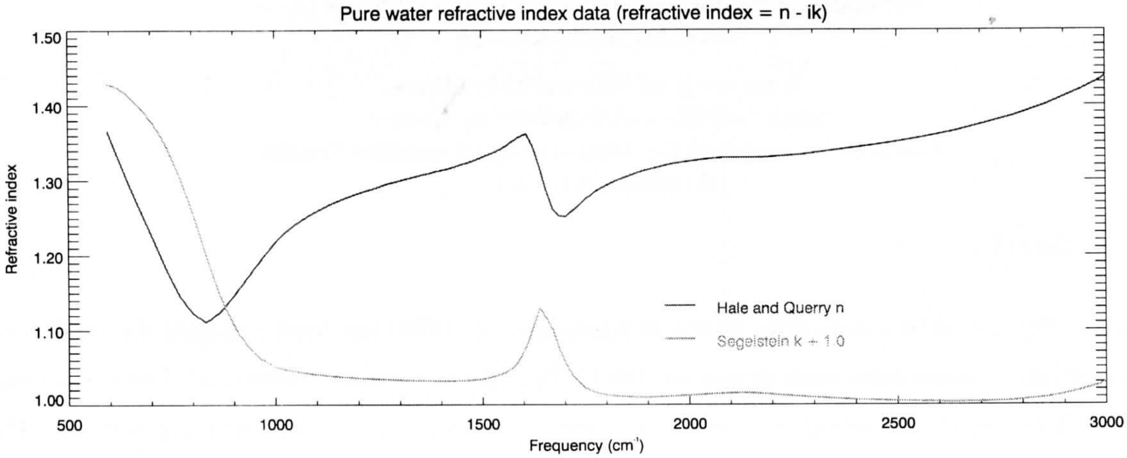

Figure 2. Spectral variation of the refractive index and extinction coefficient of pure water. From Hale and Querry (1973) and Segelstein (1981).

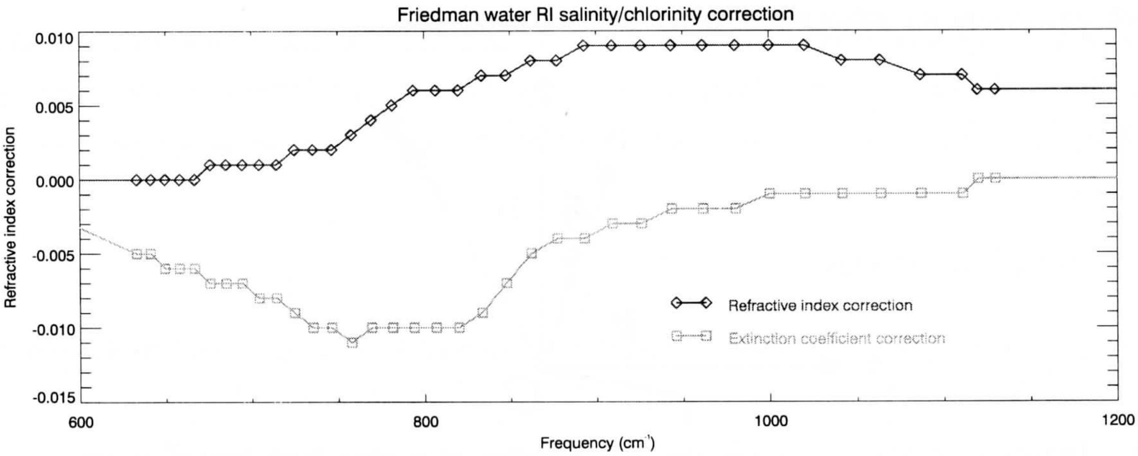

Figure 3. Spectral variation of the refractive index salinity and chlorinity correction of Friedman (1969). Constant values beyond 1125cm^{-1} are used.

3. EMISSIVITY CALCULATIONS

Sea surface IR emissivities were calculated from 600-3000cm^{-1} for 13 wind speeds (0-15ms^{-1}) and 37 view angles (0-65°). Three separate sets of calculations were performed using an average, vertical (parallel), and horizontal (perpendicular) reflectivity. The latter two are provided for those cases where there is not insignificant polarization sensitivity in the IR. The result of the average reflectivity calculation for a wind speed of 0ms^{-1} is shown in figure 4. The features at approximately 600-800cm^{-1} and 1600-1700cm^{-1} are due to the spectral variations in the water refractive index data (see figure 2.)

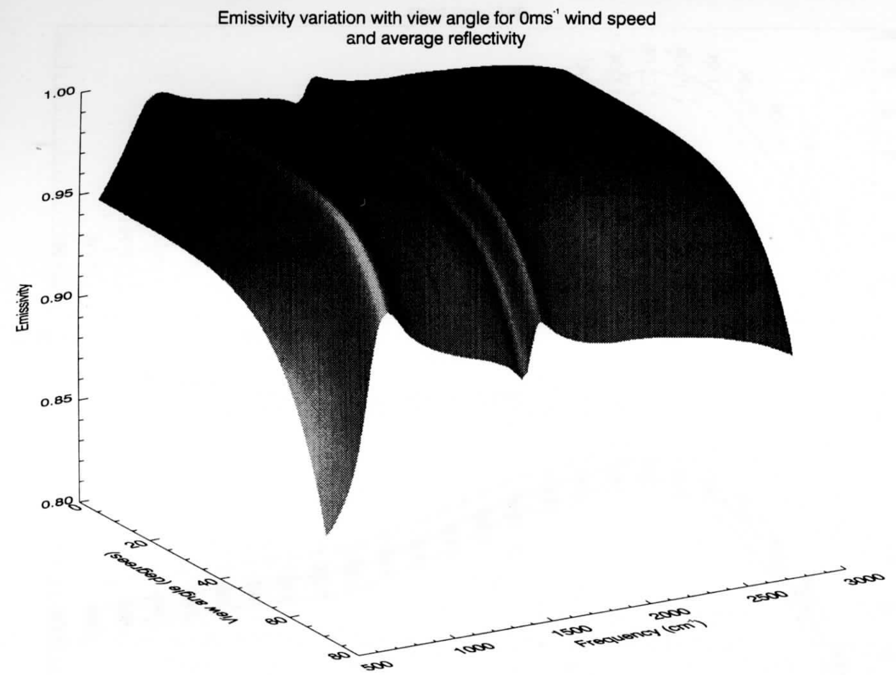

Figure 4. **Spectral and view angle variation of the calculated emissivity using average reflectivity for a wind speed of 0ms^{-1}.**

4. VERIFICATION

The calculated emissivities were compared with the original AERI measurements of sea surface emissivity during the 1995 OTIS field experiment. These comparisons are shown in figure 5. The main improvement of the Wu-Smith model is the much better agreement of the larger view angle cases (middle and bottom panel) over the Masuda model.

5. DATA AVAILABLILITY

The sea surface emissivity datasets for average, vertical, and horizontal reflectivities are available from either the authors or through the website,

http://airs2.ssec.wisc.edu/~paulv/#IRsse

All the datafiles are in netCDF format. Information about the netCDF data format and software is available at the UCAR website,

http://www.unidata.ucar.edu/packages/netcdf

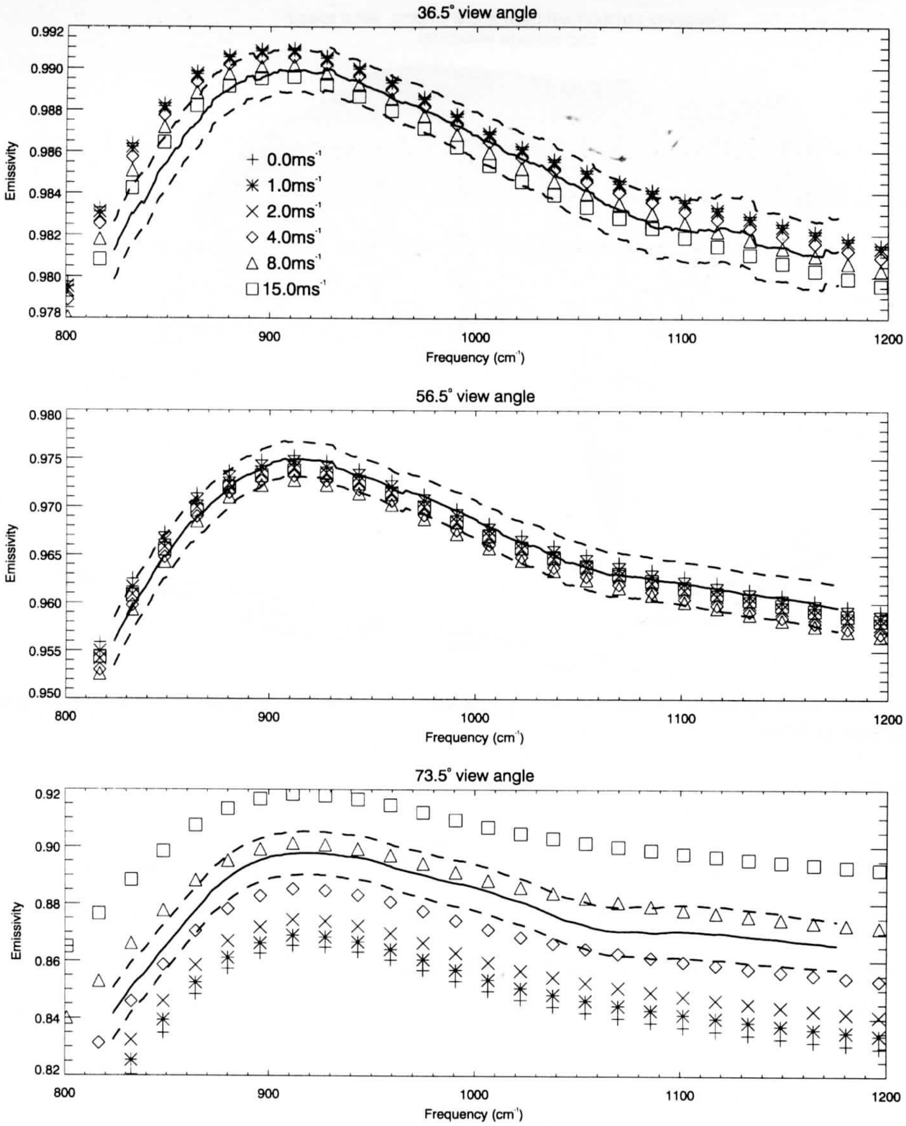

Figure 5. **Comparison of calculated and AERI measurement derived sea surface emissivity. Solid and dashed curves are the mean and standard deviation of the AERI derived emissivity. The mean wind speed at the time of observation was about 10ms^{-1}.**

6. ACKNOWLEDGMENTS

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