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MICROWAVE RADIATIVE TRANSFER AT THE SUB-FIELD-OF-VIEW

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1. Introduction

Radiative transfer with channels that 'see' the surface is problematic because of emissivity and skin temperature uncertainties. This is especially true of inhomogeneous backgrounds, including coastlines, large rivers, mountainous regions, and even regions of high ocean temperature gradients (e.g. north wall of Gulf Stream). A possible solution might be the ability to integrate high resolution databases within a given field-of-view, and perform multiple radiative transfer within the field of view, weighed and integrated according to the antenna beam power.

2. Methodology

The AMSU antenna patterns were normalized by adding (negative) maximum value of each pattern to all values. All 10 channels were averaged for the 0 deg (crosstrack) and 90 deg (alongtrack) slices. The best fit to the eye was achieved with a 7th order polynomial. The 99% power level inside the field of view (fov) is at -20 dB. This is approximately 10 deg wide. Compared with 3.3 deg for the nominal 50% power of the AMSU fov, this is three times larger. Figure 1 gives the nominal AMSU fovs for a single scan, where the shading indicated the antenna power. Figure 2 shows the same AMSU fovs taken out to the 99% power level.

The GTOPO30 Digital Elevation Model (DEM) from the United States Geodetic Survey was

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used for this study. This model has a 0.008333º resolution, which translates to 0.93km at the equator. A single fov in the Philippines was selected. The nominal 50%, 95% and 99% power levels are shown in Figure 3. Figure 4 shows the same fov with the DEM warped according to the power fraction. This nominal land brightness temperature was 280K and the nominal ocean brightness temperature was 210K. Table 1 gives an example of integrated brightness temperature difference when the land/sea fraction was integrated according to the power fraction. For this example even going from 95% to 99% power levels yields almost a 1K difference.

3. Summary

A method has been presented to integrate land/sea fraction with antenna power fraction within the AMSU fov. If such a method is used to perform radiative transfer over inhomogeneous terrain, care must be takes to include as much of the actual fov as can be afforded computationally, lest unacceptable errors occur from truncation of the antenna power function.
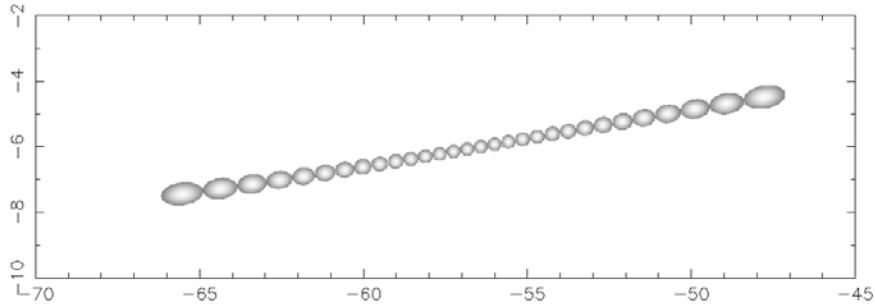
4. Acknowledgements

Figure 1. Nominal 50% power AMSU fovs. The gray scale indicates the relative power.
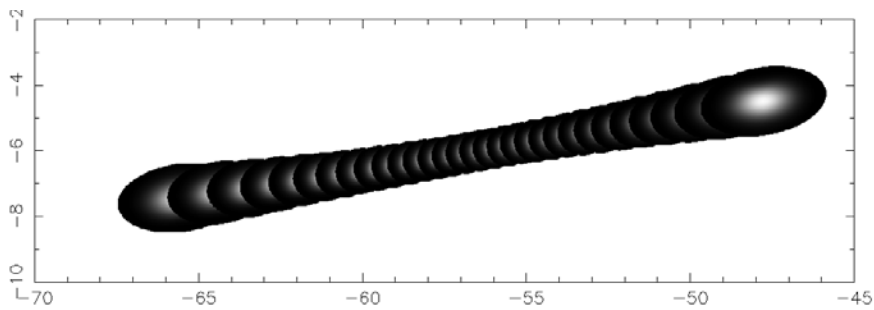

Figure 2. AMSU fovs at 99% power. The gray scale indicates the relative power.

Table 1. Simulated brightness temperature computed from nominal land brightness temperature of 280 K and nominal ocean brightness temperature of 210 K for the 50%, 95% and 99 % fov sizes, weighted according to antenna power.

	Land Fraction	Sea Fraction	Land Power Fraction	Sea Power Fraction	Tb
50%	0.480	0.522	0.488	0.512	244.16
95%	0.301	0.698	0.371	0.628	236.01
99%	0.238	0.761	0.358	0.641	235.13

Figure 3. Nominal 50% power AMSU fov (inner) with 95% and 99% power fov over the Philippines.
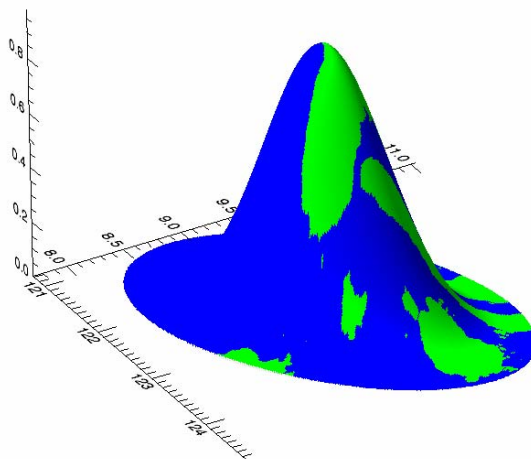

Figure 4. AMSU fov at the 99% power level, with DEM warped over the relative antenna power.