P8.15 FOOTPRINT MATCHING FOR THE ADVANCED TECHNOLOGY MICROWAVE SOUNDER

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1. METHODOLOGY

The problem addressed here is to enable footprint matching of the higher frequency Advanced Technology Microwave Sounder (ATMS) fields of view with the two lowest frequency fields of view (fovs). A solution is to fit the measured antenna patterns, and convolute the higher frequency fovs with the lower frequency fovs, and integrate the convoluted values to find the weights. Figure 1 shows the layout of relative fields of view for ATMS. Red is 5.2º , green is 2.2º and blue is 1.1º fields of view. Left is for near edge of scan, and right is near nadir. Figure 2 gives the ATMS antenna patterns and a seventh order polynomial fit. A polynomial was used for fitting because a Gaussian did not fit the antenna patterns well, and indeed often did not converge. Only the main beam is considered here. Figure 3 presents the relative antenna patterns (expressed as a ratio from zero to one at the maximum power) of the 1.1º and the 2.2º fovs convoluted with the 5.2º fov, for near nadir and near edge of scan. Figure 4 shows an example of ATMS 1.1º fov matched to the 5.2º fov size using MHS 89 GHz data as a proxy. Shown are ATMS fovs 10-87. This is because MHS has 90 fovs vs the ATMS 96 fovs, and fovs 4-6 and 88-93 were insufficiently filled with the 1.1º fovs. Note the usual damping of high and low antenna temperatures, and blurring by reducing the resolution. The apparent mis-geolocation is an artifact of the plotting method. The plot is drawn in the southward direction, and the new fovs greatly overlap the older fovs. Figure 5 gives the original MHS 89 GHz data used as proxy for 1.1 º ATMS data.

A few comments are in order: Many footprint matching schemes use the nominal -3dB fov, which is the 50% power level. Half of the energy received by the instrument comes from outside this area. This method uses the -20dB level, which accounts for 99% of the received power. Many footprint matching schemes use a nominal Gaussian antenna pattern. This method uses a polynomial fit to the measured antenna patterns. It was found that a Gaussian does not fit the measured antenna patterns well. This technique ignores side-lobes. It is assumed that an antenna correction algorithm will pre-process the antenna temperatures. Footprint matching from the large fov to smaller fovs is an entirely different problem, and is not addressed here.

2. ACKNOWLEGMENTS

The views expressed in this publication are those of the author and do not necessarily represent an official position or policy of NOAA, the Department of Commerce, or the United States Government.

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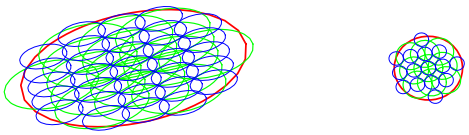


Figure 1. Layout of relative fields of view for ATMS. Red is 5.2º , green is 2.2º and blue is 1.1º fields of view. Left is for near edge of scan, and right is near nadir.

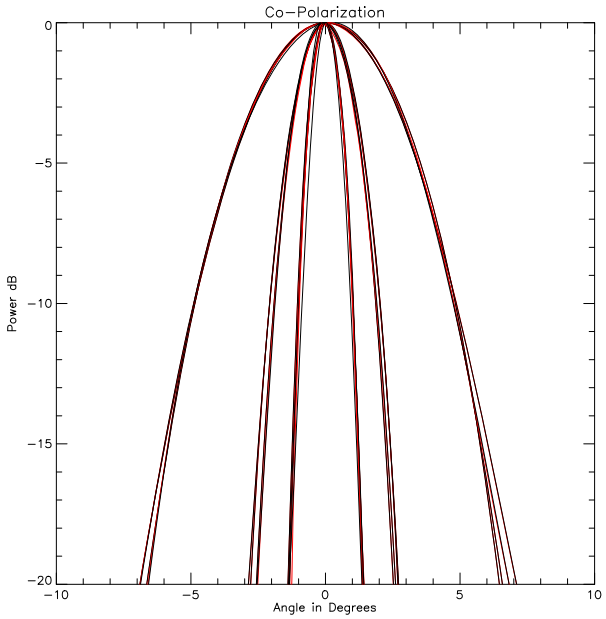
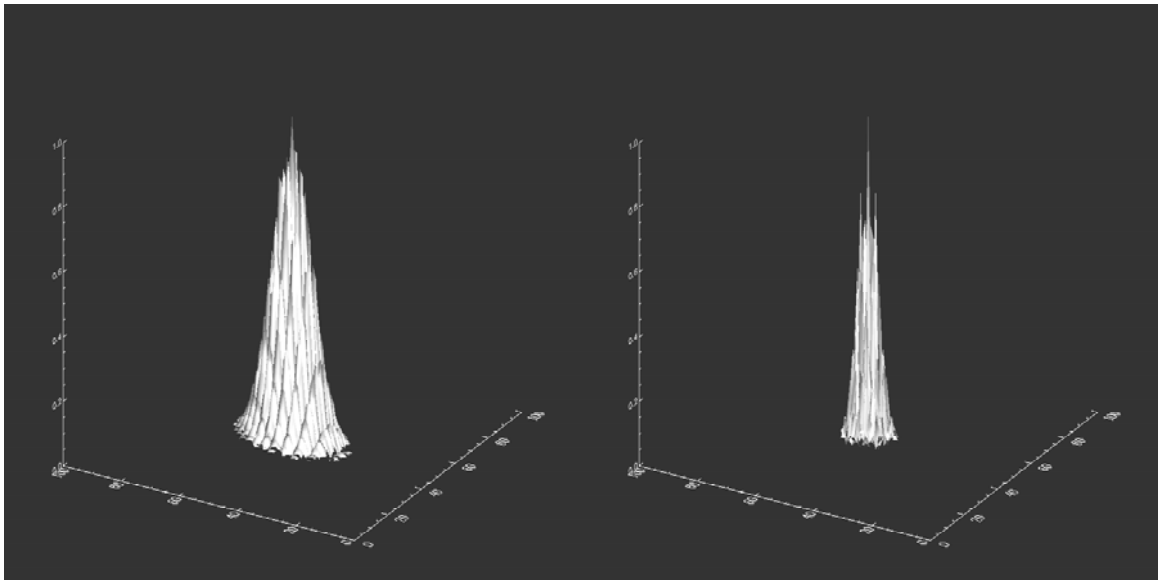


Figure 2. ATMS Antenna Patterns and Polynomial Fit

1.1 deg fovs convoluted with 5.2 deg

FOV FOV



2.2 deg fovs convoluted with 5.2 deg

FOV FOV

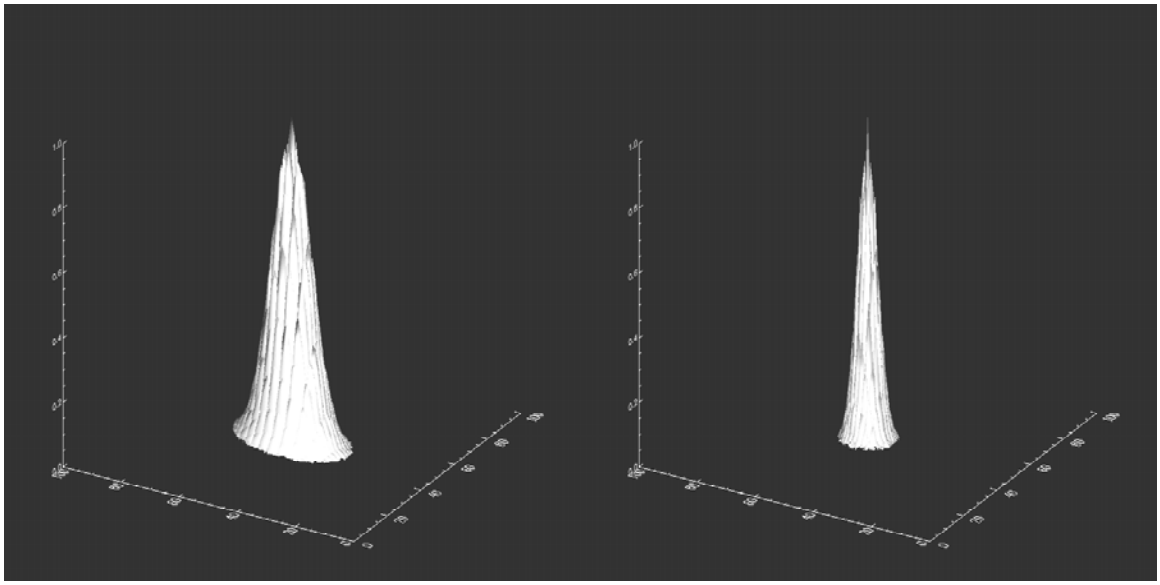


Figure 3. Convolution of smaller fovs with largest fovs using relative antenna power (a value between zero and one, where one is the maximum power), for near edge of scan (left) and near nadir (right).

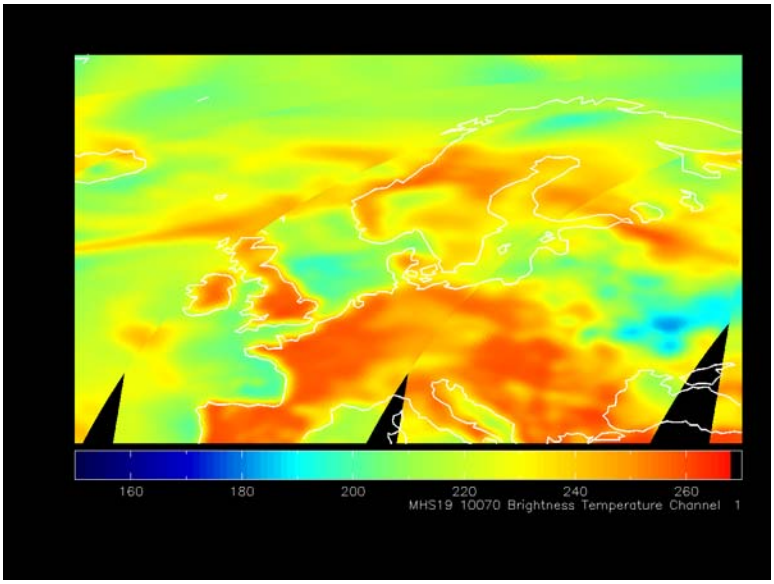


Figure 4. ATMS 1.1º fov matched to the 5.2º fov size using MHS 89 GHz data as a proxy. Shown are ATMS fovs 10-87. This is because MHS has 90 fovs vs the ATMS 96 fovs, and fovs 4-6 and 88-93 were insufficiently filled with the 1.1º fovs. Note the usual damping of high and low antenna temperatures, and blurring by reducing the resolution.

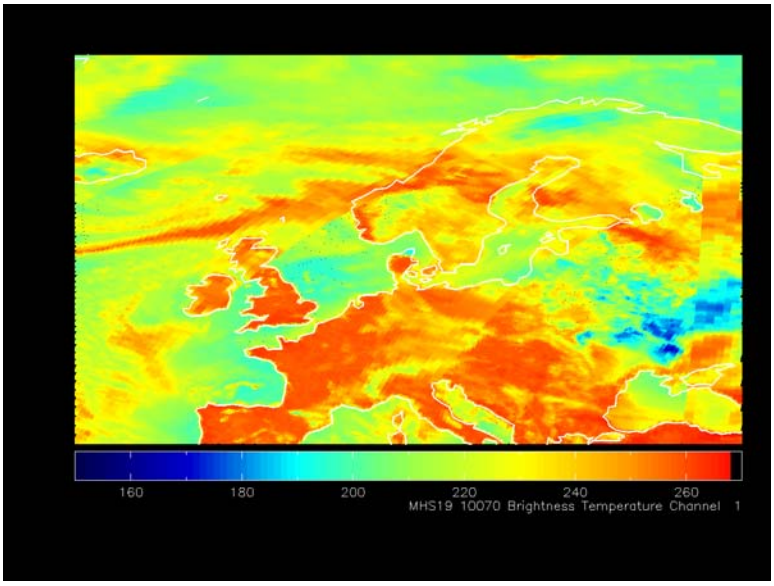


Figure 5. Original MHS 89 GHz data used as proxy for 1.1 º ATMS data.