Microwave radiometry product generation

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Microwave radiometers, such as the special sensor microwave imaged SSM/I, play a fundamental role in several remote sensing applications. A dense spatial and temporal coverage represents radiometers peculiarity to perform operational earth observation monitoring. Ocean surface wind speed, rain rate, integrated water vapor maps are routinely generated exploiting various radiometer channels. In order to apply such models we need to have measurements of the same resolution scale.

Unfortunately, due to the different electrical size of the antenna at different wavelengths, it is unavoidable that the channels are characterized by different spatial resolution. The preferred approach is to enhance the low resolution measurements up to that of the high resolution. The optimal methods to increase spatial resolution rely on an overlap of the adjacent antenna measurements gain functions. This information redundancy enables the resolution enhancement retrieval.

Mathematically, it is a linear inversion problem. The matrix which describes the model and depends on antenna gain, is undetermined and ill-conditioned. The system inversion causes noise amplification. Proper regularization techniques take into control noise amplification when the inversion is done.

Here, an inversion technique based on TSVD method for the 2-D case is described. The antenna gain is assumed separable (D.G. Long private communication). This inversion method is very attractive in terms of computational efficiency since the expansion coefficients depend only on the system configuration and not on measurements.

The study is conducted using synthetic microwave radiometer measurements. Radiometric measurements are simulated considering an hypothetical ideal sensor with a linear scanning configuration as the SSM/I.