SAR Terrain-Geocoding

Relative Geometric Comparison between Range-Doppler and Rational-Function methods

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ABSTRACT

SAR geocoding is necessary as an essential preprocessing step in many applications where joint analysis of SAR imagery and other geospatial data, including optical images and raster/vector GIS datasets, are to be carried out.

Synthetic Aperture Radar (SAR) geocoding is generally defined as the process of performing geometric transformation of SAR imagery with the aid of a digital elevation model (DEM) from the original radar azimuth/range coordinate system to the specified geographic latitude/longitude or map projection coordinate systems.

The Range-Doppler (RD) model is the most widely used physical model for satellite SAR remote systems and is the most accurate. The main drawback of the method is that is not very computational efficient.

The Rational-Function (RF) model is not widely used but has gained considerable interest in the last decade as an ideal replacement of RD method because of its high computational efficiency and fitting accuracy.

At CCRS two SAR terrain-geocoding methods, based on the RD and the RF model, have been designed and implemented. In this presentation we will briefly describe the RD mathematical model and in more detail the RF mathematical model. Then the relative geometric accuracy tests for the two methods will be analysed.

The conclusions are that the RF model has major four advantages over the RD model:

1. High computational efficiency: it can even be implemented on modern graphic hardware – reducing energy and cost per product dramatically.
2. High fitting accuracy comparing to RD method, no geometric and radiometric accuracy loss.
3. The RF method also can be successfully applied to any SAR sensor and any processing level (SLC, SGX, SGF)
4. The generation of RF coefficients is terrain independent, so they can be provided in the metadata associated with each product.