Geophysical Research Abstracts
Vol. 12, EGU2010-902-2, 2010
EGU General Assembly 2010


# A despeckle filter for the Cassini SAR images of Titan's surface

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Cassini carries a multimode Ku-band (13.78 GHz) radar instrument designed to probe the surface of Titan and that of other targets in the Saturn system in four operating modes: imaging, altimetry, scatterometry, and radiometry. The Synthetic Aperture Radar (SAR) mode is used at altitudes under ∼4000 km, resulting in spatial resolution ranging from ∼350 m to >1 km. Images are acquired either left or right of nadir using 2–7 looks. A swath 120–450 km wide is created from 5 antenna beams. SAR coverage is dependent on spacecraft range and orbital geometry. Radar backscatter variations in SAR images can be interpreted in terms of variations of surface slope, near-surface roughness, or near-surface dielectric properties. The images obtained using SAR revealed that Titan has very complex surface (Elachi et al. 2005).
A filtering technique is applied to obtain the restored image. One of the major problems hampering the derivation of meaningful texture information from SAR imagery is the speckle noise. It overlays "real" structures and causes gray value variations even in homogeneous parts of the image. Our method is based on probabilistic methods and regards an image as a random element drawn from a prespecified set of possible images. The TSPR (Total Sum Preserving Regularization) filter used here is based on a membrane model Markov random field approximation with a Gaussian conditional probability density function optimized by a synchronous local iterative method. The final form of despeckling gives a sum-preserving regularization for the pixel values of the image. The TSPR method preserves the mean values of local homogeneous regions and decreases the standard deviation up to six times (Bratsolis and Sigelle, 2003).
The despeckle filter can be used as intermediate stage for the extraction of meaningful
regions that correspond to structural units in the scene or distinguish objects of interest (Bratsolis, 2009).

References

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