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AN ALGORITHM FOR DEM CONVERSION TO WRAPPED INTERFEROMETRIC PHASE

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EXTENDED SUMMARY

Multi-pass interferometry is a technique, the main target of which is the computation of heights over a test area. Its quality is affected by errors resulting from steep relief, tropospheric disturbances and the phase unwrapping procedure errors. The radar signal sensitivity to water vapor of atmosphere has recently lead researchers to use this technique in order to estimate tropospheric signal delay. Heights and signal delay caused by the effect of the troposphere are parameters with significant importance in several research fields such as geophysical applications, topographic mapping, meteorology etc.

The influence of the troposphere on interferometic SAR images is strongly determined by high temporal and spatial variability. This characteristic renders the atmospheric models too generalized to demonstrate the artifacts caused by the tropospheric effect and differential interferometry a useful tool for atmospheric studies.

One of the most important steps of this procedure is the use of a high quality DEM and its height-to-phase conversion. By this step, height effects can be removed from the interferogram, leading to the enhancement of the tropospheric disturbances.

In this paper, a height-to-phase conversion algorithm is presented. Through the height-to-phase conversion, a phase image is derived by a DEM. This image can be either unwrapped or wrapped. The wrapped phase image reflects the phase cycles caused by topography and can be used in order to evaluate the quality of any wrapped interferogram on the same area. This enables the extracting of the phase pattern that is caused by other sources such as tropospheric effects. This information, in addition to inteferograms and coherence images, will produce maps of the spatial tropospheric water vapor contents.

The algorithm developed was evaluated against the initial DEM and the corresponding interferogram. Its results were proved reliable both in SAR image and DEM geometry. The phase image derived by the DEM will significantly contribute to the spatial estimation of tropospheric water vapor, which is the subject of ongoing research.

Key words: Interferometry, DEM to phase conversion, Reverse Geocoding, Troposphere, Wrapped phase