Assessment of Atmospheric Column Water Vapor Effect on Displacement Interferometric Estimations in DInSAR Method (ASAR Sensor)

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Abstract:

Atmosphere is known to be one of the factors having major influence on remotely sensed data, in particular on Synthetic-Aperture Radar (SAR) Images. Although the effect of atmosphere on the amplitude of the SAR images is negligible which is commonly neglected in practice, but its effect on the phase of SAR data is evident. Among influential factors of atmosphere, water vapor is the main source of creating error in the interferometric measurements. Different modeling approaches are suggested by scientists in order to reduce the effect of water vapor on the interferometric measurements, but the performance of these models is not high enough to accurately capture the relation between atmospheric column water vapor and its associated error induced on the interferometric measurements. In this study, we applied and tested many various models for three different areas and sixteen stations of Iran, which are based on MERIS water vapor product, values of earth surface displacement obtained by Iran Permanent GPS Network (IPGN), and DInSAR method. These models are examined against the data and the optimal model is concluded at the end of this research. Such a study of various models showed that in the repeat pass DInSAR method, increasing sum of atmospheric column water vapor value to 4 gr/cm² in master and slave images may result in up to 6 cm error in vertical displacement of the interferometric measurements. Moreover, we found that increasing the value of atmospheric column water vapor results in the increase of the error in the displacement measurement of DInSAR method measured by ASAR sensor, where the increase is Power or Exponential function. At the end, for correcting achieved vertical displacement values of ASAR sensor we introduce a relation to form $3 \times (WV)^2/10^3$.

Keywords

Radar Remote Sensing, Atmospheric Water Vapor, MERIS, ASAR, Modelling