ABSTRACT FINAL ID: G22A-02;

TITLE: A new algorithm for reduction of the tropospheric signal in InSAR data, applied to the 2006 slow slip event in Guerrero, Mexico.

SESSION TYPE: Oral

SESSION TITLE: G22A. InSAR Applications for the Detection of Crustal Deformation II

AUTHORS (FIRST NAME, LAST NAME): David P Bekaert[1], Andrew J Hooper[1]

INSTITUTIONS (ALL): 1. Delft Institute of Earth Observation and Space Systems (DEOS), Delft University of Technology, Delft, Netherlands.

Title of Team:

ABSTRACT BODY: Radar signals travelling though the atmosphere suffer from propagation delays. For the troposphere, variation of temperature, pressure and relative humidity with height and space leads to a spatially varying signal, partially correlated with topography, which obscures the deformation signal in interferograms.

Using time series InSAR techniques, we can reduce the tropospheric signal by filtering in space and time. However, in the case where strain rates are low, the residual tropospheric signal can still dominate. Tropospheric signal can be reduced prior to filtering by estimating a linear relation (slope) between the phase and topography in a non-deforming area. However, assuming a single relationship between phase and topography throughout the interferogram does not account for the spatial variation of the tropospheric properties, which can be significant over large areas (100s of km), especially when the area includes different climatic zones.

We have developed a new algorithm to correct for the tropospheric signal, which estimates a spatially varying functional relationship between phase and topography. Deformation correlated with topography biases our estimation. However, as the tropospheric signal manifests at all spatial scales we are able to obtain a reliable estimate after spatial filtering. As the study area is split into multiple regions, it is important to have the same reference for each region. This is not possible when assuming a linear relationship (slope and offset), as the offset cannot be estimated from the filtered data. We therefore define a common reference by using our functional relationship initially constrained by sounding data, and under the assumption that the tropospheric delay is reduced to a constant at a specific height.

We apply our algorithm to the study of the 2006 Slow Slip Event in Guerrero, Mexico, where the topography varies up to 3.5 km and the large extent of our data area (100 by 350 km) results in atmospheric noise significantly larger than the slow slip deformation of 4 cm over an area of 100 km. After correction of the long wavelength tropospheric signal and application of our model, the estimates for the slow slip deformation signal show a good correlation with continuous GPS measurements.

KEYWORDS: [3362] ATMOSPHERIC PROCESSES / Stratosphere/troposphere interactions, [1240] GEODESY AND GRAVITY / Satellite geodesy: results, [1207] GEODESY AND GRAVITY / Transient deformation, [9350] GEOGRAPHIC LOCATION / North America.

(No Image Selected)

(No Table Selected)