CORRECTING THE IONOSPHERIC PHASE ADVANCE SIGNAL OF INSAR USING GLOBAL IONOSPHERE MAPPING (GIM) MODEL AND PALSAR DATA

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The Global Ionosphere Mapping (GIM) is processed daily based on GPS observation. A comparison with dual frequency altimetry data conducted by Mannucci et al (1998) shows that the GIM model can retrieve large-scale (~500 km) features in the ionosphere in a wide range of latitude.

Gray and Mattar (2000) showed evidence for azimuth shifts in L-band interferograms obtained from the JERS-1 satellite and attributed them to disrupted electron density in the ionosphere. They found the streaks were prominent in the polar auroral zone. Recently, the similar azimuth streaks and phase shifts were observed in ALOS interferograms of the 2008 Sichuan, China earthquake although it is not clear whether the anomalous phase signal is caused by ionospheric anomaly or orbital error.

Theoretically, one of the effects of ionosphere on SAR signals is that of a frequency-dependent phase shift. We have constructed simulations of this phase advance effect on interferograms and find that TEC variations within the scene can strongly contribute to the fringe pattern including ramps and waves. Even a uniform difference in TEC between the reference and repeat images causes a phase ramp in range.

In order to explore the ionospheric phase advance effect on L-band radar interferometry, we make use of 21 repeat PALSAR images over the Pinon Flat Observatory (PFO), California, where we maintain corner reflectors for calibration. The GIM model provides the estimated TEC value during the imaging period. We have designed processing code to reduce the ionospheric phase shift using an azimuth-dependent linear TEC model. Our test dataset consists of 20 independent interferograms over a time span from 2006 to 2009. Although the temporal TEC variation is not significant (i.e. 8~12 TECU), the improvement in the RMS of the residual phase may indicate whether the ionospheric effect is considerable in first order. The dense GPS network deployed in southern California may support a higher resolution ionospheric TEC model.