Multi-application InSAR Integration with TerraSAR-X and RADARSAT-2

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ABSTRACT:

Operational integration of InSAR into best practices pushes service providers like 3vGeomatics to make InSAR products more reliable and available in near-real-time. In this context we have proposed a unified InSAR processing chain with equal performance for important key applications: Urban, Permafrost, Geohazard/Mining, and Oil&Gas. This chain includes multi-sensor integration, specifically combining C-band (RS2) and X-band (TSX) for improved monitoring reliability through data redundancy, fewer acquisition conflicts, faster response, and better characterization of displacement signal and contaminating errors. The unified chain enhances existing individual chains in three areas: atmospheric correction, non-linear motion, and temporary targets. Advanced a-priori atmospheric screen (APS) generation couples spatial filtering and unwrapping to achieve a smooth low-order phase surface (cutoff scale 3 to 5 km) for every interferogram of an InSAR stack. These "per-interferogram" initial APS are network-inverted to calculate "per-scene" APS. X-band interferograms typically have significant phase dynamics >1 fringe below the cutoff scale, making filtering without aliasing difficult. To overcome this problem we leverage a simultaneously acquired C-band stack (same look direction and similar incidence angle to allow accurate fine registration with the X-band). The C-band interferograms have factor 2 less movement signal and height error and >2 less atmospheric error, which means that the described APS correction is considerably less challenging for C-band. This allows calculating an approximate displacement and height error solution that is removed from the X-band interferograms, increasing their coherence and reducing small-scale phase variations. This then allows recovering error-free X-band APS and successful network processing of the X-band InSAR stack with its superior temporal resolution and motion sensitivity. Examples of displacement products are generated using the enhanced APS correction scheme and C/X-band synergy of the unified chain. The performance and quality advantage of the unified chain is verified against traditional InSAR products for individual applications and sensors.

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