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Long-Term Crustal Deformation Monitoring in South America by DinSAR Techniques: a Study of Feasibility

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In this work we study the feasibility of characterizing crustal deformation in South America by using high doppler centroid (DC) ERS-2 Synthetic Aperture Radar scenes. Crustal deformation monitoring with SAR data implies the processing of long-term datasets by using advanced DinSAR (Differential Interferometric SAR) techniques. In particular, the well known Small Baseline Subsets (SBAS) [1] technique allows obtaining crustal deformation time series and mean velocity of deformation while maximizing the spatial coverage of the results. It has been broadly validated by using mainly ERS1/2 and ENVISAT ASAR datasets [2].

On the other hand, the exploitation of post 2000 ERS-2 acquisitions are known to be quite limited by the 3-gyroscope navigation mode failure occurred on February 2000. By searching to diminish undesirable effects and to ensure the mission continuity, the European Space Agency (ESA) also implemented a Yaw Control Monitoring mode (YCM) on the platform [2]. However, some instabilities have remained and are responsible of the significant fluctuations of the SAR Doppler Centroid (DC) frequency values. As a consequence, the products acquired by the ERS-2 satellite in the period from late 2000 to the present days show DC frequencies lying frequently outside nominal boundaries. This fact makes a large subset of them not useful for interferometric applications.

Unfortunately, historical archives of SAR data in Southern South America are mainly composed of ERS-2 scenes acquired after 2000. Here, we assess the feasibility of using archived ERS-2 acquisitions for crustal deformation characterization by taking advantage of a recently proposed extension of the SBAS technique [4]. It allows profiting high Doppler Centroid scenes, making possible post-2000 time series reconstruction in areas where no enough ENVISAT ASAR coverage is available.

To illustrate the approach, we present a test case relevant to the Copahue Volcano, located at the Argentinean-Chilean border in the southern Andes.

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