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Subsidence through space and time in the lake Mead area : Insights from cross-platform ERS/Envisat interferometry and viscoelastic models.

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Interferograms from the archived SAR data set of ERS-1 and ERS-2 satellites have been calculated in order to retrieve the temporal and spatial subsidence around lake Mead between 1992 and 2001 (see Cavalie et al., this session). It was shown that the subsidence evolution can be closely associated with the load of lake Mead water level fluctuations on a elastic or viscoelastic surface.

However, from 2000 to 2004, the lake level fell drastically and therefore it led to a regional uplift of a few centimers. In order to record this uplift, we perform 7 cross-platform ERS/Envisat interferograms using the Roipac software made available by JPL (Paul Rosen et al.).

We discuss here the additional steps included in the data treatment that allow to retrieve a good spatial repartition of the exploitable phase in the scene.

(1) Normal baselines chosen for ERS/Envisat interferograms stand between 1300 m and 2200 m, according to the spectral shift principle (Gatelli et al., 1994). To increase the interferogram phase coherency, the SAR synthesis is performed with varying range frequency filtering and an optimal azimuth frequency filtering (Colesanti et al., 2004). The best common band filter in range that improves the local interferogram coherency varies in sign and amplitude across the scene, depending on the local look angle. We therefore combine the results of the various filters to obtain an interferogram with a coherency as good as possible.

(2)The rate of fringes in the obtained ERS/Envisat interferograms is extremely high due to the small elevation ambiguities and because orbital fringes do not everywhere

compensate frequency difference fringes. We thus remove a first model of orbital fringes, frequency difference fringes, and topographic fringes, using an improved SRTM DEM (an accuracy of about a meter is obtained by combining all ERS (45) and ENVISAT (12) data).This process strongly reduces the fringe pattern. Finally, the useful differential interferogram phase covers about two thirds of the SAR frame.

The resulting ERS/Envisat interferograms, and Envisat/Envisat interferograms are then corrected from tropostatic effect (phase/elevation correlation). They are combined with ERS/ERS interferograms to obtain the spatial and temporal ground subsidence from 1992 to 2005. We constrain the viscoelastic parameters that allow the best adjustment between the model and the spatial and temporal behavior of the inverted displacement.