



## **The sinking coastal lands of the Upper Adriatic: InSAR detects subsidence due to anthropic activity**

Valeria Secreti (1), Elisa Trasatti (2), and Maurizio Battaglia (1)

(1) Scienze della Terra, Sapienza Università di Roma, Roma, Italy (secreti.1548197@studenti.uniroma1.it), (2) Istituto Nazionale di Geofisica e Vulcanologia, Roma, Italy (elisa.trasatti@ingv.it)

In this work, we employ InSAR (Interferometric Synthetic Aperture Radar) data to document the increase in the subsidence rate in Lido Di Dante (Ravenna, NE Adriatic coast, Italy). The area of Ravenna (a UNESCO World Heritage Site) has been affected by significant subsidence for decades. This subsidence is the result of both natural factors and human activity. Natural factors include processes like the compaction of recent sedimentary deposits, oxidation and shrinkage of organic soils. Human activity consists of pumping of groundwater for agriculture and human use and the exploitation of hydrocarbon reservoirs both inland and off-shore. In particular, the coast of the Ravenna area is subject to gas pumping of the Angela-Angelina gas field. The gas reservoir is exploited since 1973 and the platform is located 2km from the shoreline. The SAR images processed are from the whole dataset acquired by the ERS-1/2 and ENVISAT satellites (European Space Agency – ESA). ERS1-2 data covers the period from 1992 to 2000, while ENVISAT data cover the period from 2003 to 2010. The database consists of time in ascending and descending orbits calculated using the PSInSAR (Permanent Scatterers) technique. GPS data from the CGPS sites FAEZ e RAVE from INGV were used to validate the InSAR data. Data from the GPS stations were compared only with the ENVISAT dataset, since the GPS measurements started only in 2008. From 1992 to 2000, the coast subsided with rates of up to 5- 7 mm/yr, while in the inland areas were relatively stable. A total subsidence of approximately 70 mm occurred from 1992 to 2001. From 2003 to 2010, the subsidence rate increased to 7- 10 mm/yr, again the inland areas were relatively stable. The total displacement from 2003 to 2010 was approximately 80 mm. The InSAR time series record a linear correlation between subsidence and gas extraction since the subsidence increases when the volume of gas extracted increases. There is a change in the slope of the ERS time series between 1997 and 1998, the period when the Angela-Angelina platform, in the “A.C27.EA” concession area, came into operation. To better understand the correlation between gas extraction and observed deformation, the deformation source is modelled as a closing crack (dislocation tensile fault). We invert the deformation adopting two different inversion tools. The results indicate that the area affected by the subsidence can be identified with the gas reservoir exploited by Angela-Angelina platform. Our results show that the subsidence in the littoral zone of Lido di Dante is a consequence of hydrocarbon extraction. In particular, the increase in subsidence at the end of the 90s is clearly related due to the activation of the Angela-Angelina platform.