GEOLOGICAL MAPPING IN THE ZONE OF CHOTTS, TUNISIA, USING ALOS SENSORS.

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The *Advanced Land Observing Satellite* (ALOS) spacecraft system was launched from Tanegashima Space Center on January 24, 2006. ALOS, the largest satellite ever developed in Japan, is a pathfinder mission for global environmental monitoring. It carries three sensors: the *Phased Array L-band Synthetic Aperture Radar* (PALSAR), the *Panchromatic Remote-Sensing Instrument for Stereo Mapping* (PRISM), and the *Advanced Visible and Near-Infrared Radiometer type 2* (AVNIR-2). The satellite is placed in a near-polar orbit at 691 km, with a local equator pass time at about 10:30 (morning descending pass) and 22:30 (evening ascending pass), with a 46-day repeat cycle.

The Zone of Chotts, Tunisia, is one of the test sites selected in the frame of the *ALOS Data European Node (*ADEN no 3643) GEMS '*Geological Mapping of Sensitive Environments*' project supported by the *European Space Agency* (ESA) and the *Japanese Exploration and Aerospace Agency* (JAXA). The Tunisian chotts, region of the Presaharian Sahara in central and southern Tunisia, are situated in a series of tectonically controlled depressions that lie between the Atlas Mountains and the Saharan Platform, along a structural line, the famous *Sillon des Chotts*, linking the Tripolitania trough to the East, to the Chott Merouane-Chott Melrhir (Algeria) to the West. In the chotts, subsidence phenomena are superimposed to the evaporation and deflation processes, whereas the surrounding mountains forming the Cherb belt show evidence for a polyphased Cenozoic tectonics also characterized by a modern seismic activity. The present study focuses on the Chott El Djerid, the larger chott of Tunisia, and the Chott El Fedjaj, the easternmost chott, and their northern border. For the Chott El Fedjaj, a maximum of only 18km large is encountered between Seftimi and Bir Rekeb, this cross-section representing our main area of interest because of the presence of a road crossing the chott. It is bordered to the south by the Jebel Tebaga extended from Kebili to El Hamma. From the one hand, the emphasis is on the seasonal variability of the chotts and, from the other hand, on the tectonics of the Cherb belt extending E-W to the North of the chotts, from Tozeur to Gabès.

PALSAR can be operated in five different observation modes and operates in L-band (?=23.6 cm). For the present study, *Fine Beam Single* (FBS) and *Fine Beam Dual* (FBD) modes were evaluated and compared. For each of them, the swath width is 70 km and the off-nadir angle is 34.3°, which corresponds to an incidence angle range of 36.6°-40.9° from near to far range. No full polarimetric data (PALSAR PLR) were available at the end of December 2008. The single polarization available with both FBS and FBD modes is horizontally transmitted, horizontally received (HH), whereas dual polarization (HH + HV) is acquired in FBD mode. The pixel size is 6.25m in FBS mode and 12.5m in FBD mode, corresponding to a nominal resolution of 10 and 20m, respectively. Other sets of radar data have been used, such as SIR-C/X-SAR data from the 1994 campaign and ERS 1 data. These latter were also processed to build an interferogram to characterize the recent movement in the mountain belt.

PRISM is a panchromatic radiometer working in the range 520-770nm, with 2.5-metre spatial resolution. The radiometer comprises three independent optical systems for nadir, forward, and backward looking to achieve along-track stereoscopy. The forward and backward telescopes are inclined from nadir +24° and -24°, respectively. The fully overlapped three-stereo (triplet) images are 35km width. One data set acquired on November 23, 2007 is still under investigation to extract a digital elevation model (DEM) on one area in the North of the Chott El Fedjaj. The DEM will be compared to other DEMs extracted from ASTER and SRTM data.

AVNIR-2 is a multispectral radiometer with 10-metre ground resolution and four spectral bands. ALOS AVNIR-2 bands 1-4 cover the spectral range 420-500nm (violet-blue), 520-600nm (green-yellow), 610-690nm (orange-red), and 760-890nm (near infrared), respectively. The ALOS multispectral sensor was compared to other high resolution sensors such as ASTER on board Terra and Enhanced Thematic Mapper on board Landsat 7.

The spatial resolution of ALOS AVNIR-2 is suitable for geological mapping of the main lithological units. The swath and the repeat-cycle are also suitable to monitore the evolution of the chotts, a very changing place at the scale of the month and at the scale of the year. Unfortunately, the AVNIR-2 spectral range is limited to the visible-near infrared domain and does not allowed to discriminate some important lithologies such as gypsum. The ASTER sensor with its detailed Short Waves Infrared (SWIR) bands is better to map gypsum in the lithological series or at the surface of the chott in association with halite. The relatively high off-nadir angle of ALOS-PALSAR is correct to map geological structures in mountainous areas. Thus, the ALOS spacecraft system represents a good trade-off to map environmental and geological items in the arid context of the Tunisian Chotts. In the near future, we expect to evaluate DEM extraction using PRISM data and test the full polarimetry of the PALSAR sensor.