Salt Kinematics and InSAR

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As part of a long-term attempt to learn how the climatic and tectonic signal interact to shape a steady state mountain monitored displacements of a small viscous salt fountain extruding onto the Central plateau of Iran. The marker displacements relate to the first InSAR interferograms of salt extrusion (980913 to 990620) calculated Earth tides, winds, air pressures and temperatures.
In the first documented staking exercise, hammered wooden stakes vertically through the surgical marl (c.10cm deep) onto the top of crystalline salt. These stakes installed in an irregular array elongate E-W along the c.50 m high cliff marking the effective SE terminus of the glacier at Qum Kuh(Central Iran) , just to the E of a NE trending river cliff about 40 m high. We merely measured the distances between pairs of stakes with known azimuth about 2 m apart to calculate sub horizontal strain in a small part of Qum Kuh. Stakes moved and micro strains for up to 46 pairs of stakes
(μ strain= ((length1-length2)/length1) ×10-1) was calculated for each seven stake epochs and plotted against their azimuth on simplified array maps. The data fit well the sine curves expected of the maximum and minimum strain ellipses. The first documented stakes located on the SE where the InSAR image show -11 to 0 mm pink to purple, 0 to 10mm purple to blue, and show high activity of salt in low activity area of the InSAR image (980913 to 990620).Short term micro strains of stake tie lines record anisotropic expansions due to heating and contraction due to cooling. The epochs (measurement period) changed between 7 to 117 days (990928 to000116), showed 200 to 400 micro strain lengthening and shortening. The contraction and extension existed in each epoch, but the final strain was extension in E-W in Epoch 1and 6, contraction in E-W direction during epochs 2-3-4-5 and 7. In a daily measurement 2 stakes of the SE Mountain (passive area of InSAR image) showed that, distances between stakes generally increased as the temperature rose and decreased as the temperature fell. The second pair of stakes hammered about 20 cm deep into the deep soils(more than 1 m) , near summit, where the colors change between 19 to 29mm(active area) in InSAR image(980913 to 990620).The horizontal distances between stakes generally shrank as the temperature rose and increased as the temperature fell. The distances between all 3 stake-pairs were large during high air pressure and small during low air pressure (measurements at 9-10 may2002).Both stake pairs are related to the faults. The second pairs was in the upwelling zone of the salt with height of 1345 m asl.The first pair of stakes was in the area which , salt was free to move. The measurements in daily cycle showed that, the free zone area of salt have a positive relationships with temperature, and the upwelling zone have a negative relationships with temperature(and positive with pressure).This means that the

upwelling area might be block by faults in a shallow taper shape. The wedge shape salt sank during expansion and up built during contraction (rise and fall of temperature respectively).The soil of the wedge shape salt displaced in opposite directions in second pair. The active area between 23 to 28mm interpreted as upwelling zone and salt come up from the vent into this pull-apart system. The analogue models suggest that salt upwelling zone might be related to a pull apart system of faults. The South east part of the mountain (glacier termination) in the passive area of InSAR showed high activity. These suggest the complexities in the nature (of InSAR).The daily measurements suggest that the high activity area and related faults are mainly affected by climatic changes. The other higher points in the Qum area seems to be very active in the InSAR (19 to 29mm). All of the higher points in the area mapped and are related to faults. Reprocessing of the InSAR base on new topographic database (from SRTM, the shuttle radar topography mission) showed that the upwelling zone in salt dome is very active (similar color with higher points of the country rock in South of salt dome).In the similar times at 2003-2004 we measured the second pair again and gave similar conclusions.

We merely concluded that high topographic points, which are very active in the InSAR may affected by climatic signals.

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