



Correlation of the MSL DAN measurement variability with the local surface morphology and regolith texture along the rover Curiosity traverse.

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During the first 100 sols of the Mars Science Laboratory (MSL) rover Curiosity operation in Gale Crater the Dynamic Albedo of Neutrons (DAN) instrument conducted 58 measurements in the active mode and 113 measurements in the passive mode. Based on the measurements it was found that the thermal and epithermal neutron counts values show distinctive variability from one rover location to another. To understand what possible factors are responsible for observing variability in the thermal and epithermal neutron counts values, we analyzed the correlation of DAN measurements with the local diversity of surface morphology and regolith texture along the rover Curiosity traverse. A map of the different surface types within the rover Curiosity landing site area was compiled based on the HiRISE image ESP_028335_1755. Within the landing site area, twelve surface types have been outlined. For a correlation of the traversed surface types with the DAN measurements we used so-called “quicklook” (QL) parameters created for an initial analysis of the data: QL1- this parameter characterizes the thermal neutrons and is sensitive to both water content in the soil (more counts = more water) and content of such absorbing elements as Cl and Fe (less counts = more abundance of these elements); QL2- this parameter is more oriented towards water detection from the epithermal neutrons (lower value = more water); QL3- this parameter represents the ratio between thermal and epithermal neutrons counts. Comparison of the QL parameters values dynamics along the rover Curiosity traverse with the traversed surface types shows a distinct correlation between the variability of the QL1 and QL3 parameters values and the surface types. The rover Curiosity’s images also show that the present surface of the rover traverse area has been formed mainly by wind deflation, which is confirmed by both the widespread presence of desert pavement and the absence, mostly, of aeolian drift material and ripples. Observing local differences in the degree of wind deflation result in the formation of lag deposits with a variable average size of stone fragments (gravel) as indicated by alternating places with larger and smaller gravel sizes in the lag deposits. Examination of Hazcam and Navcam images show that the rover’s wheel footprints along the traverse have a different shape, being either very shallow or much deeper. Such differences are more likely related to different compactability of the surface soil layer due to various concentrations of rock clasts embedded in (or covering) the surface soil. Our preliminary results indicate that the observed variability of thermal and epithermal neutron counts found during the first 100 sols of the rover Curiosity may suggest a diversity of both the traversed surface micro-morphology and horizontal and vertical inhomogeneities in the surface regolith layer.