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On the relationship between the Martian pressure changes and the MSL/RAD dose rate variations

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The Radiation Assessment Detector (RAD) onboard the Mars Science Laboratory's (MSL) rover Curiosity measures the radiation dose rate at the surface of Mars. With these first-ever measurements on the Martian surface, RAD observed the diurnal variations of the total dose rate and neutron count rate due to changes in atmospheric column mass driven by the atmospheric thermal tide \citep{rafkin2014}.
Variations in the dose rate are shown to be anti-correlated with the changes in atmospheric shielding, while the neutron count rate shows a positive-correlation with the changes of atmospheric pressure.
We have analyzed this cyclic variations in the longer term and discovered a second-order effect of this diurnal correlation which indicates a non-linear pressure-dose rate effect. We also employed a PLANETOCOSMIC simulation which shows as well a non-linear correlation between pressure and particles fluxes on the surface of Mars.