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Observability of Rembrandt scarp with Mercury Radio Science Experiment

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The radio science experiment of the ESA mission BepiColombo (MORE, Mercury Orbiter Radio science Experiment) is devoted to the estimation of Mercury's gravity field with unprecedented accuracy, by means of highly stable, multi-frequency radio links in X and Ka band, provided by the Ka band transponder (KaT) on-board the Mercury Planetary Orbiter (MPO).
The estimation of gravity field coefficients and planetary tidal deformation with radio science experiment will provide fundamental constraints for modelling planet interior, but additional analysis can be carried out in order to verify whether radio science can give a significant contribution in the study of other physical phenomena, like for example crustal thickening due to tectonic phenomena.
This paper reports on the observability of Mercury scarps and crustal thickening with the Mercury Orbiter Radio science experiment, exploiting the extremely precise radio observables (range rate accuracies of 3 micron/s at 1000 s integration time at nearly all elongation angles, and range observables accuracies of 20 cm two-way).
One of the largest surface structures of Mercury's surface is the Rembrandt scarp, which can be modeled with a length of 1000 km, an average width of 300 km and a height of 5 km, assuming a flat-ramp-flat tectonic geometry for its enucleation. In general, a surface structure can be observed with radio science if the variation in velocity due to the change in the gravitational potential is larger than the accuracy of the signal at an integration time equal to the interaction time between the spacecraft and the structure, e.g. about 100s for the Rembrandt scarp.
Based on our simualtions, the gravity anomalies associated to the Rembrandt scarp can potentially produce effects on the spacecraft orbit that are significantly higher than the expected noise. Therefore, there is an excellent chance that the density contrast generated by the crustal thickness along the Rembrandt scarp will be measurable to a degree of accuracy adequate to derive useful geophysical informations for a better quantitative understanding of the Mercury's largest lobate scarp.