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Heterogeneities of 67P nucleus seen by CONSERT in the vicinity of Abydos

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Since their arrival at comet 67P in August 2014, a number of instruments onboard Rosetta's main spacecraft and Philae lander have been observing the surface of the nucleus and have revealed details of amazing structures. This information was complemented by information about the nucleus internal structure collected by the CONSERT (Comet Nucleus Sounding Experiment by Radiowave Transmission) experiment in order to constrain the nucleus formation and evolution.
The CONSERT experiment is a bistatic radar with receivers and transmitters on-board both Rosetta's main spacecraft and Philae lander. The instrument makes use of electromagnetic waves at 90 MHz that propagated, during the First Science Sequence, between Philae and Rosetta through the small lobe of 67P over distances ranging from approximately 200 to 800 m depending on the spacecraft location. The data used here have been collected at depths that reach a maximum of about one hundred of meters nucleus in the vicinity of Abydos.
The data collected by CONSERT provide an estimate of the permittivity mean value and information about its spatial variability inside the sounded volume. Thanks to the 10 MHz frequency bandwidth of the signal used by the instrument a spatial resolution around 10m is obtained inside the sounded volume of the nucleus. In this paper, we specifically focus on local variations in the nucleus subsurface permittivity. A number of electromagnetic simulations corresponding to the CONSERT operations have been performed for a variety of subsurface permittivity models. The effect of local vertical and horizontal large scale variations as well as smaller scale random fractal structure of the permittivity values around the landing site will be presented and discussed in comparison with CONSERT's experimental data collected in the same configurations. Possible interpretations of the results will be presented as well as potential consequences for the nucleus structure in connection with observations made available by other instruments.