Title

Numerical modelling of the seismic signals expected at the landing site of the NASA FSS mission on the moon.

Summary

Seven years after the successful landing of the *NASA InSight mission* on Mars, the seismometer *SEIS* allowed the scientific community to make a significant step forward in planetary seismology (first detections of seismic activity and internal structure of Mars ; e.g., Banerdt et al., 2020, Stähler et al., 2021, Ceylan et al., 2022). In 2027, the seismometer *SEIS* will land in the far side of the Moon, in the Schrödinger impact crater *(NASA Farside Seismic Suite mission)*, starting a new era of seismology on the Moon. 50 years after Apollo, the aim is to build a new seismological network thanks to other upcoming international missions (Artemis, Chang'e, JAXA, etc). One the main objective of FSS is to study the seismic activity of the far side and see if it differs from the near side, and study the internal structure of the Moon close to the south pole and permanent shadowed regions.

The InSight mission landed in an ancient impact crater. Besides, the seismological signals recorded showed that resonance frequencies were observed (e.g., Lognonné et al., 2020). The origin of these frequencies has been strongly debated, and is thought to be linked either to the subsurface structure of the crater or to the lander vibrating under the effect of Martian atmospheric activity (or both). The FSS mission plans to land within the large Schrödinger impact crater. The aim of the internship is to characterize numerically, prior to the mission, what the expected resonance frequencies might be at the landing site, both structural and "natural" (morphology of the crater and smaller structures highlighted by mapping) but also "anthropogenic." Unlike InSight, FSS will be attached to the lander, so it will be crucial to take this coupling into account and integrate the transfer function linked to the lander in order to study its possible effects and contributions when a moonquake occurs. This preliminary work will be carried out in 2D before considering a more complex 3D mesh. We will base our modeling on the Spectral Element method, a cutting edge numerical tool well adapted to solve the wave equation in complex topography settings. The HPC computing center (Glicid) based on the Nantes University campus will be used to carry out these numerical experiments. Other simulations may be added later, such as the study of synthetic signals in the model for various sources such as deep moonquakes and meteroid impacts.

Supervisors

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Skills

Seismology, computational geophysics, team work

References

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