

ISAE-SUPAERO continues its involvement in the InSight mission and reveals the results of its research from planet Mars

Launched by NASA in May 2018, the InSight mission is pursuing the objective of studying the internal structure of the planet Mars using the SEIS seismometer developed by ISAE-SUPAERO. Three studies, published on July 23 in the journal Science, reveal, for the first time, an estimate of the size of the core, the thickness of the crust and the structure of the mantle of the red planet. Three of the co-authors, Raphaël Garcia, Mélanie Drilleau and Nicolas Compaire, are from ISAE-SUPAERO, and are collaborating on this major seismic exploration project, which represents a significant step in the understanding of the formation and thermal evolution of Mars.

Before this mission, the internal structure of Mars was still poorly understood. The details of the planet's internal structure and the depth of the boundaries between crust, mantle and core were completely unknown.

With the successful deployment of the SEIS experiment on the surface of Mars in early 2019, the scientists collected and analyzed seismic data from one Martian year. By comparing the seismic wave behaviors as they cross the crust before reaching the InSight station, several discontinuities in the crust have been identified: a first one, observed at about 10 km depth, marks the separation between a highly altered structure, resulting from a very old fluid circulation, and a less altered crust. A second discontinuity at about 20 km and a third, less marked at about 35 km, reveal the stratification of the crust under InSight.

In the mantle, the differences between the travel time of the waves generated directly during the earthquake and those generated by the reflection of these direct waves on the surface were analyzed. These differences make it possible to determine the structure of the upper mantle, and in particular the variation of seismic velocities with depth, with a single station.

In the third study, the scientists looked for waves reflected from the surface of the Martian core, whose radius measurement is one of the main results of the InSight mission. After more than two years of Martian seismic monitoring, the first model of the internal structure of Mars is obtained, down to the core.

With the two-year extension of the InSight mission, new data will consolidate and improve these models.

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