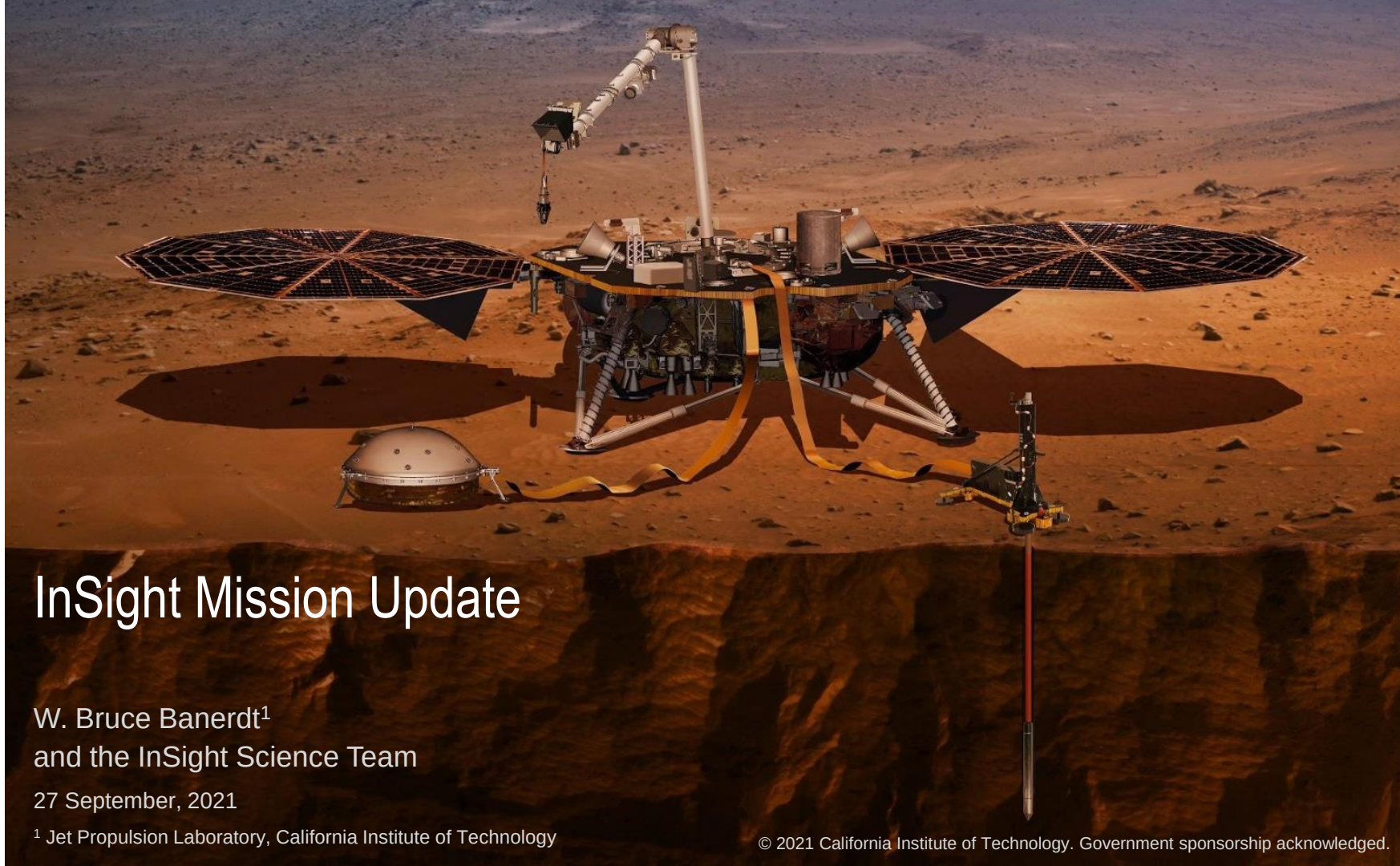

InSight Mission Update

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and the InSight Science Team

27 September, 2021

[1] Jet Propulsion Laboratory, California Institute of Technology

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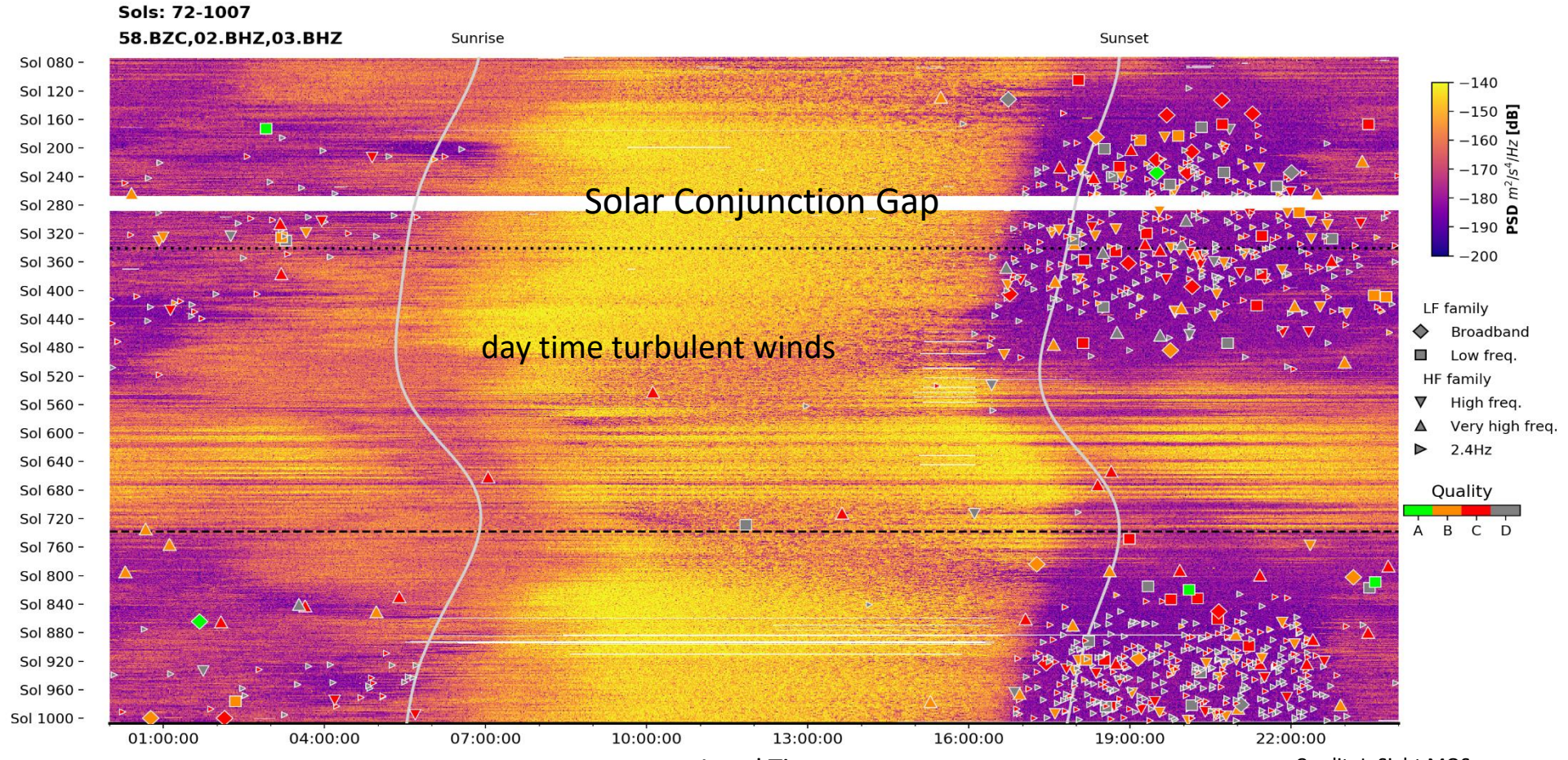
InSight Overview

- The InSight spacecraft is just now finishing its 1009th sol on Mars and is still operating almost flawlessly. We are nine months into our extended mission.
- All instruments and sensors are still operating at full capability, with the exception of the heat flow portion of the HP3.
- InSight is experiencing anticipated solar energy issues due to dust.
- InSight has satisfied all of its Level 1 requirements (essentially crust, mantle and core structure).
- All data is being released through the PDS within 3-6 months of acquisition. Raw images are released within minutes of receipt on the ground.

All Seismic Data as of Yesterday (Sol 1007)



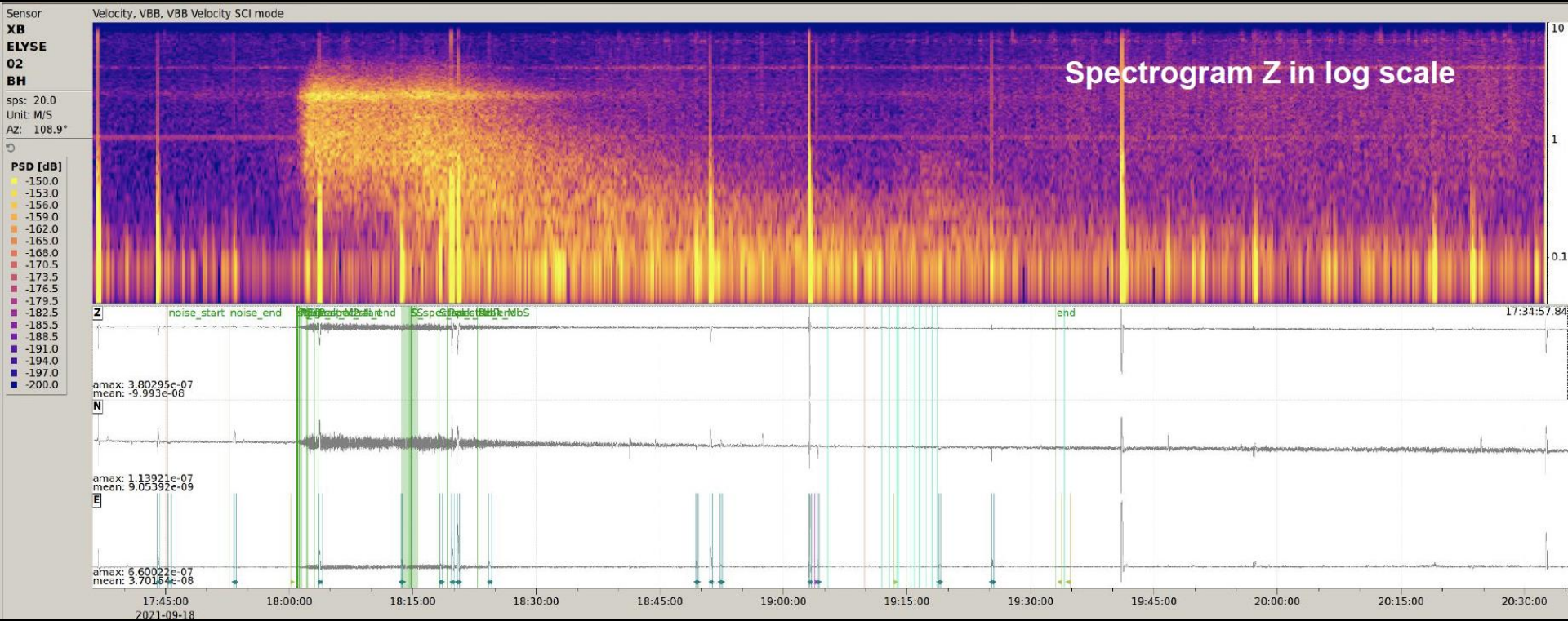
Credit: InSight MQS

InSight Event List (9/25/2021)

- Currently there are 936 events in the InSight catalog.
  - 5 Quality A (clear seismic phases [e.g. P and S] and polarization)
  - 131 Quality B (clear seismic phases, but no clear polarization)

- The three largest quakes of the mission occurred within the past month.
  - One VF (very high frequency) magnitude 4.1, ~900 km distant.
  - Two LF (low frequency) quakes, both magnitude 4.2, both ~8200 km distant.
    - Note that these latter two are in the core ”shadow zone”.

Marsquake S1000a



Three Papers Published on the Interior Structure of Mars

Knapmeyer-Endrun et al., Thickness and structure of the Martian crust from InSight seismic data

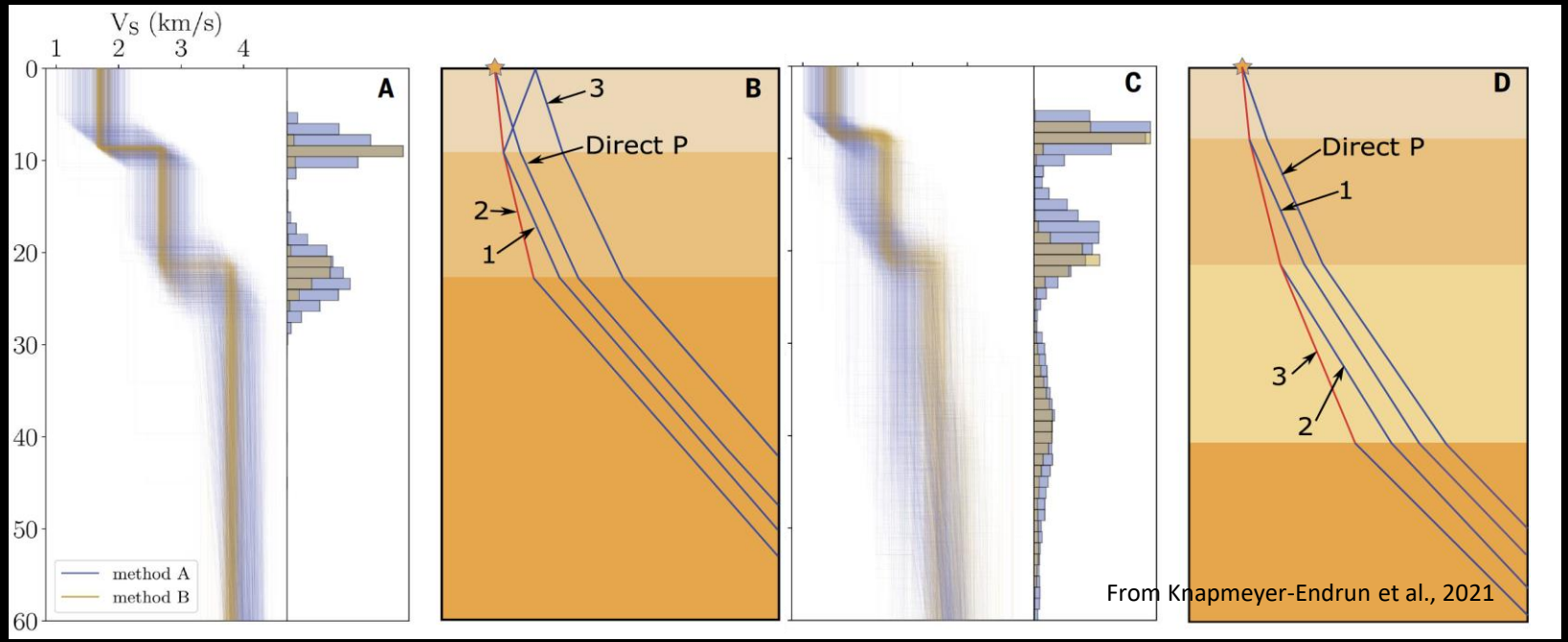
Khan, et al., Upper mantle structure of Mars from InSight seismic data

Stähler et al., Seismic detection of the Martian core

Thickness of the Crust

InSight has measured the thickness of the crust using receiver function and autocorrelation analyses.

Both techniques utilize reflections, refractions, and phase conversions (from P to S) at seismic boundaries to extract information about depths.

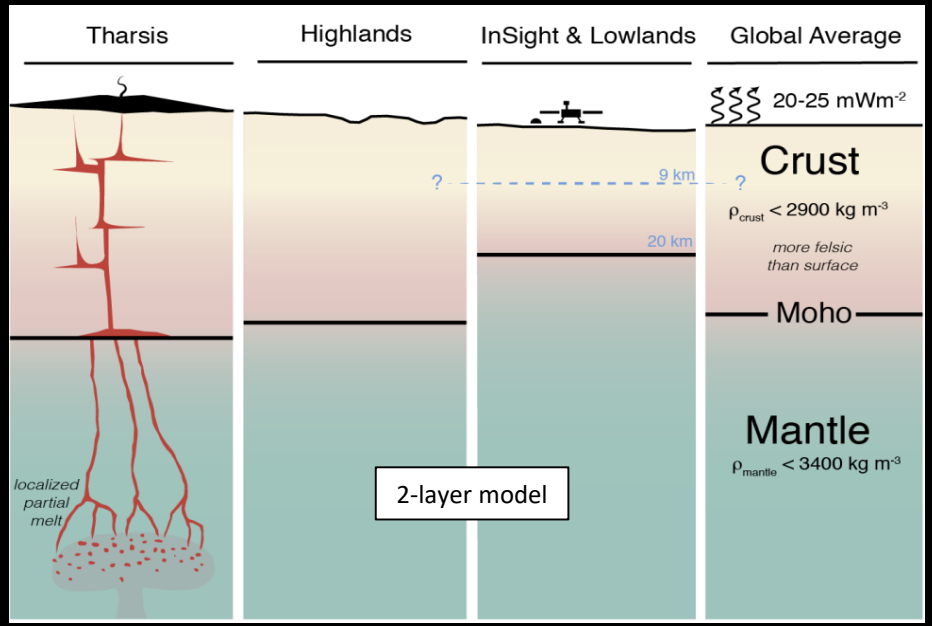


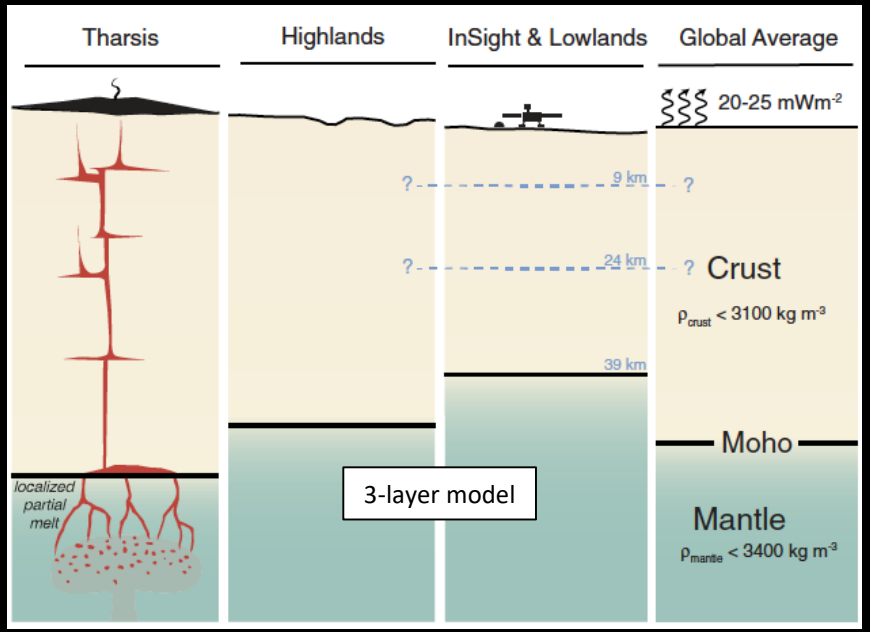
From Knapmeyer-Endrun et al., 2021

Thickness of the Martian Crust

2-layer model: t_c = 20 ± 5 km; internal layer at 9 km depth

3-layer model: t_c = 39 ± 10 km; internal layers at 9 km and 24 km depth

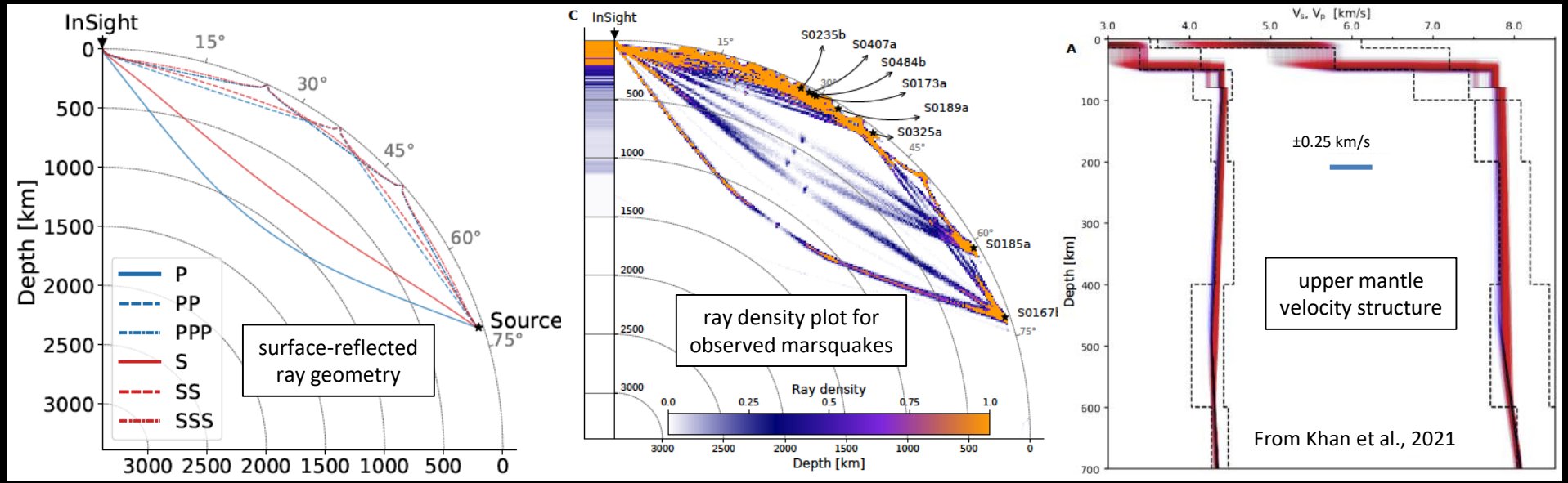




From Knapmeyer-Endrun et al., 2021

Structure of the Upper Mantle

- Used multiple arrival-time observations of direct (P and S) and surface-reflected (PP, PPP, SS, and SSS) body wave phases from 8 marsquakes to constrain upper mantle seismic velocity structure.
- The distance (and corresponding ray penetration depth) distribution of events allows resolution of the interior structure to depths of more than 900 km.
- From seismic velocity we can get estimates of composition and temperature vs.depth.

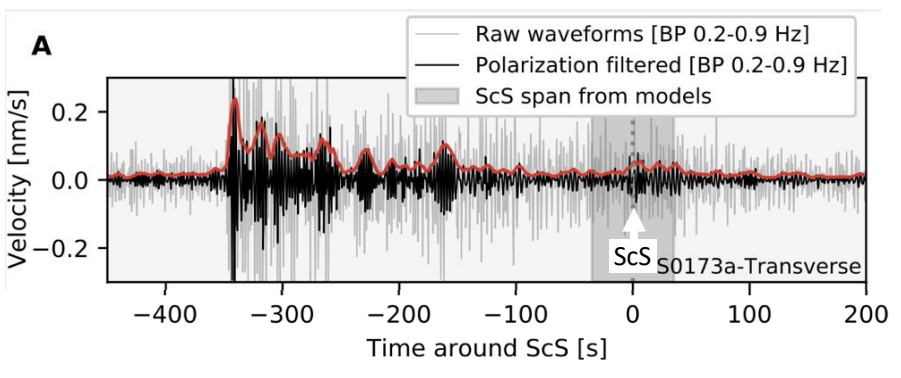


Core Size from Seismic Reflections

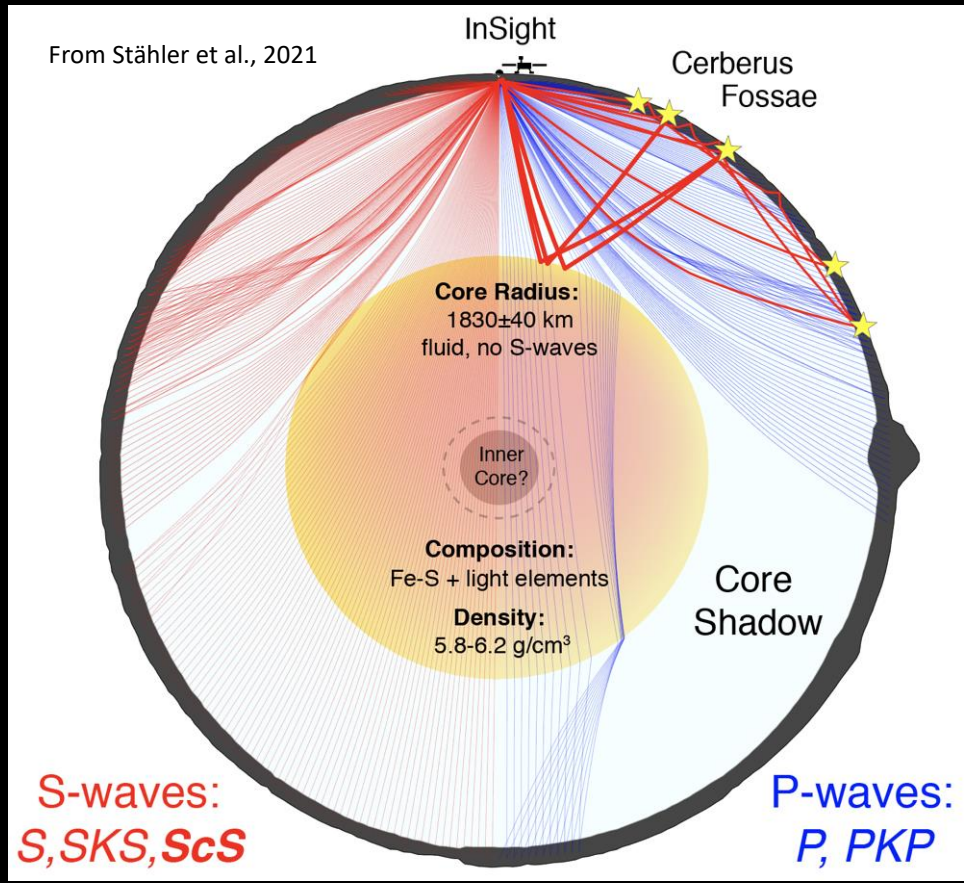
InSight has measured the depth to top of the core using the timing of S waves from five marsquakes that bounced off the core-mantle boundary (ScS phase).

Core radius = 1830 ± 40 km

Core density = 6000 ± 300 kg/m^3

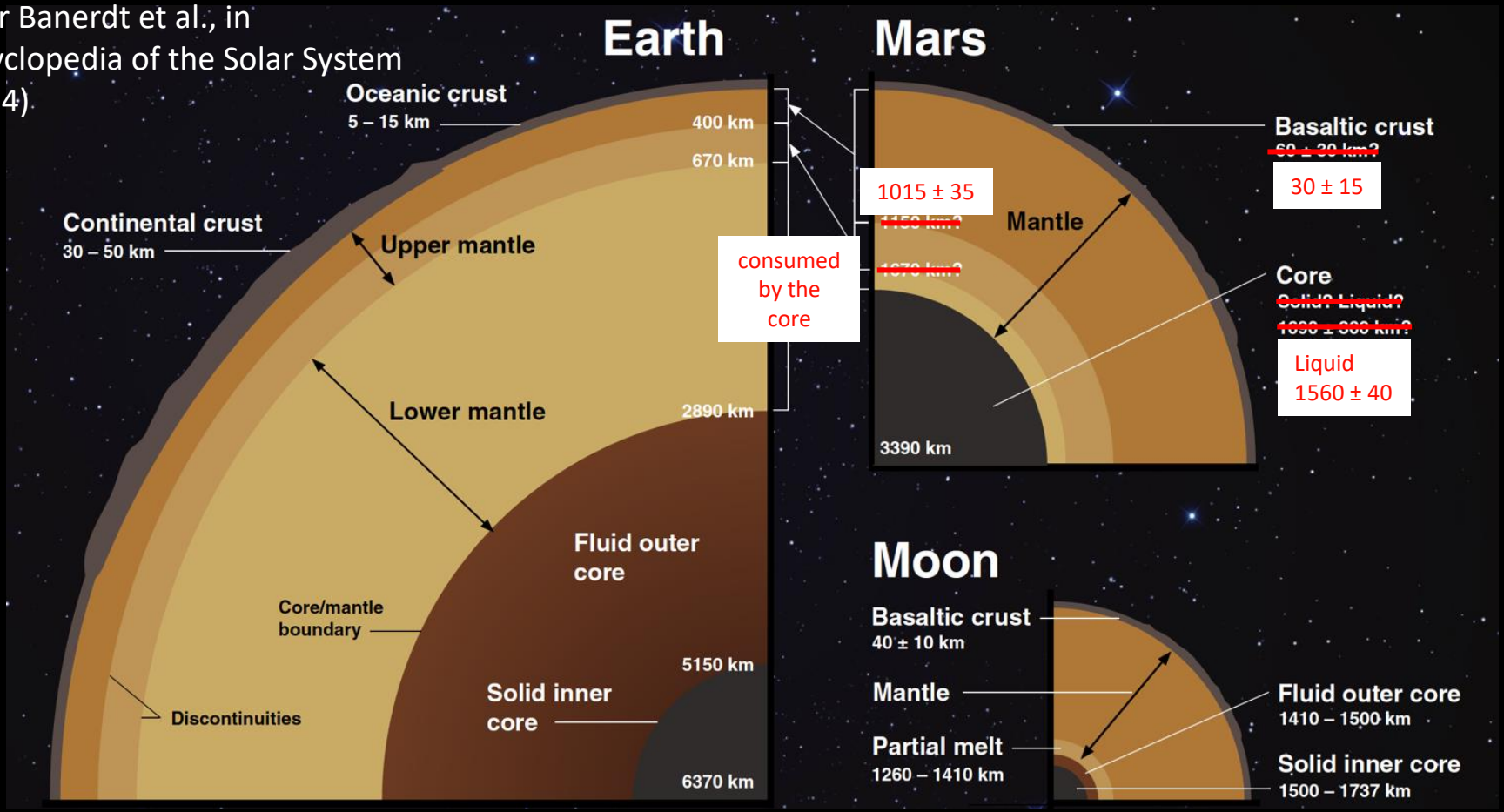


From Stähler et al., 2021



Mars Structure Compared to Earth and Moon – Post-InSight

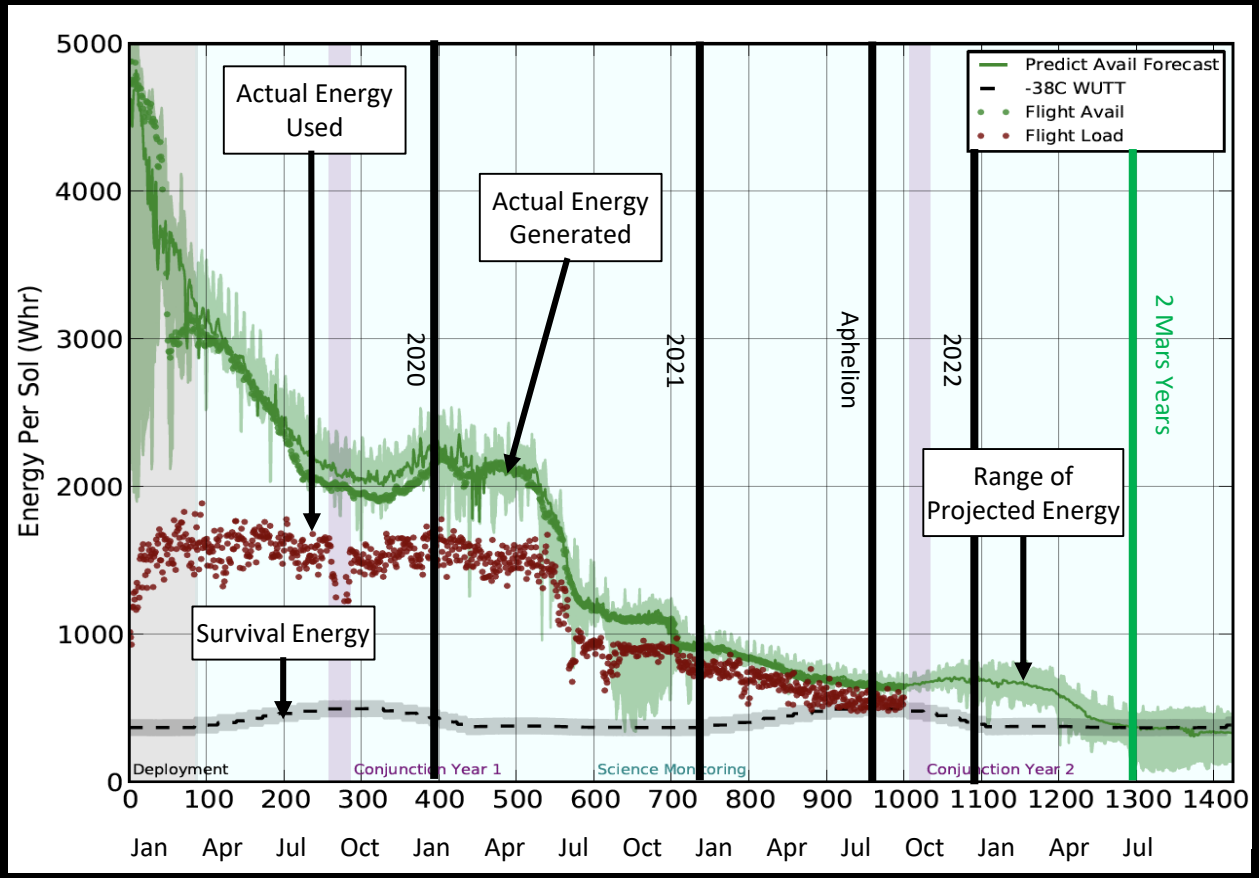
After Banerdt et al., in Encyclopedia of the Solar System (2014)



InSight Status

- The seismometer is operating around the clock on sols that do not have special activities, and will continue to do so through conjunction. All other sensors have been turned off.
  - We expect to be able to return to partial operation of atmospheric and magnetic sensors after conjunction.
- Dust accumulation on the solar arrays has been considerable (~80% obscuration), and is continuing. This is in line with predictions.
  - InSight has not experienced any natural cleaning events. This is not in line with expectations.
  - We have passed the minimum insolation/temperature point for this year, and anticipate slightly increasing energy for the next few months.
- Our current projections indicate energy dropping below operational minimums in the May-June timeframe.

InSight's Energy Situation




Sunset over Elysium, sol 145