

Mars Express: Status and highlights

Dmitrij Titov

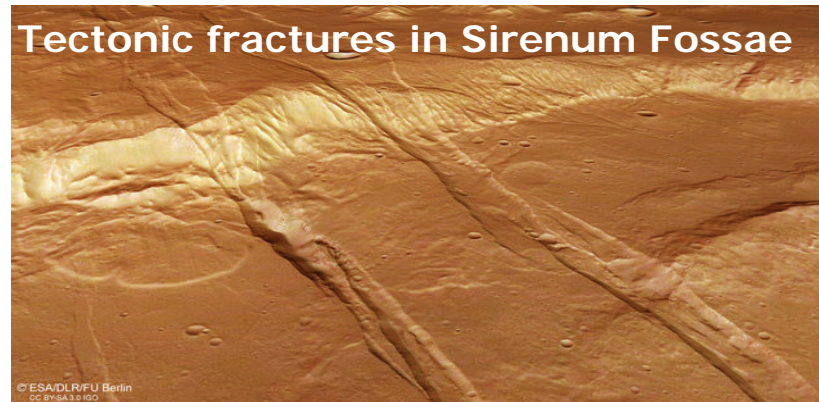
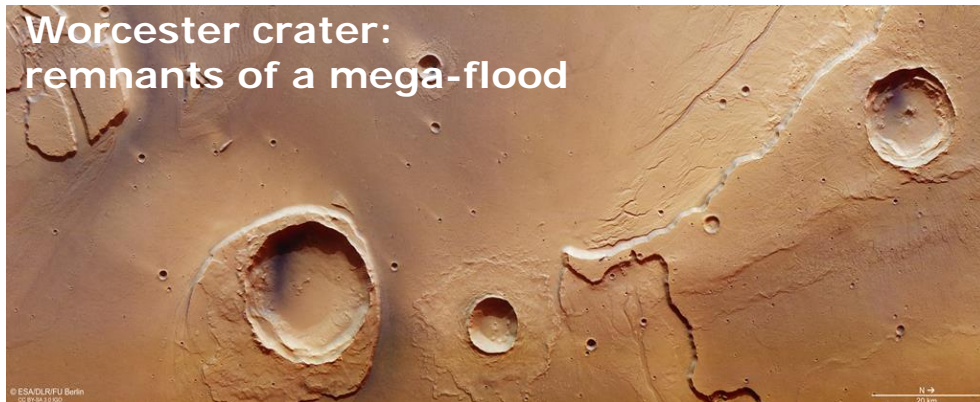
*Mars Express Project Scientist
/on behalf of the Mars Express Team/*

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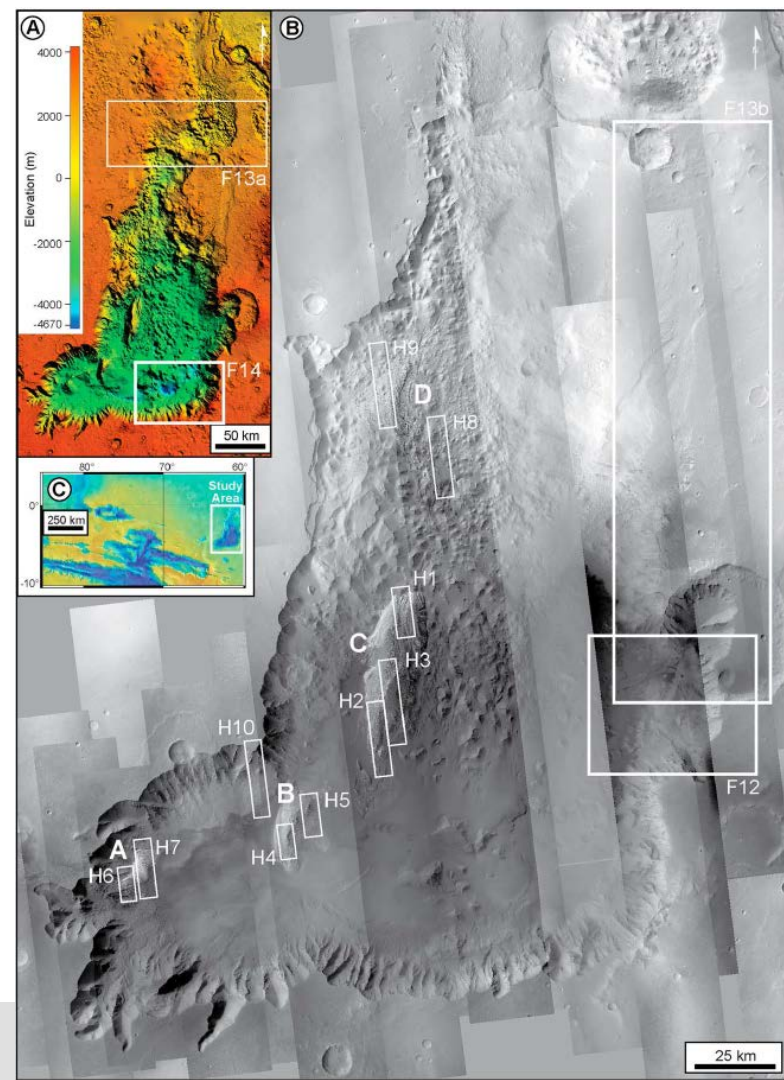
Science "nuggets"

Regional geology and chronology



Geology, interior and history

- **Evolution of Juventae Chasma:**
sedimentation in paleolacustrine environment followed by progressive collapse
- **Fluvial activity in Jezero crater** (NASA Mars-2020 landing site candidate)
- **Sedimentary deposits in Xanthe Terra and Chryse Planitia**

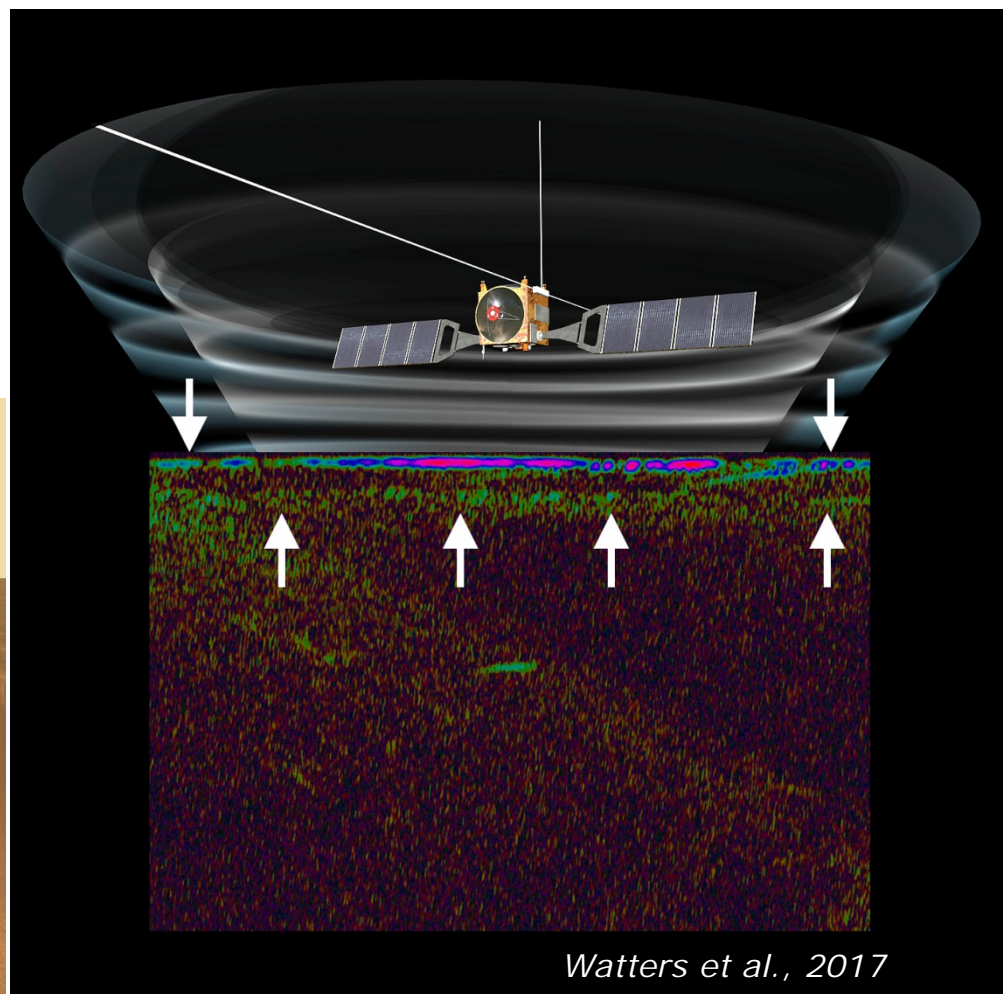
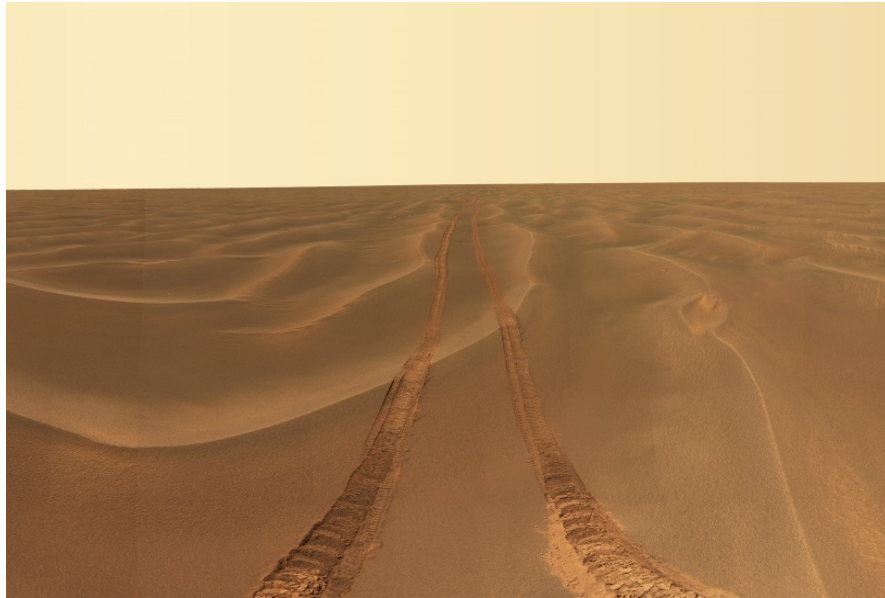


Fueten et al., 2017; Al-Samir et al., 2017.



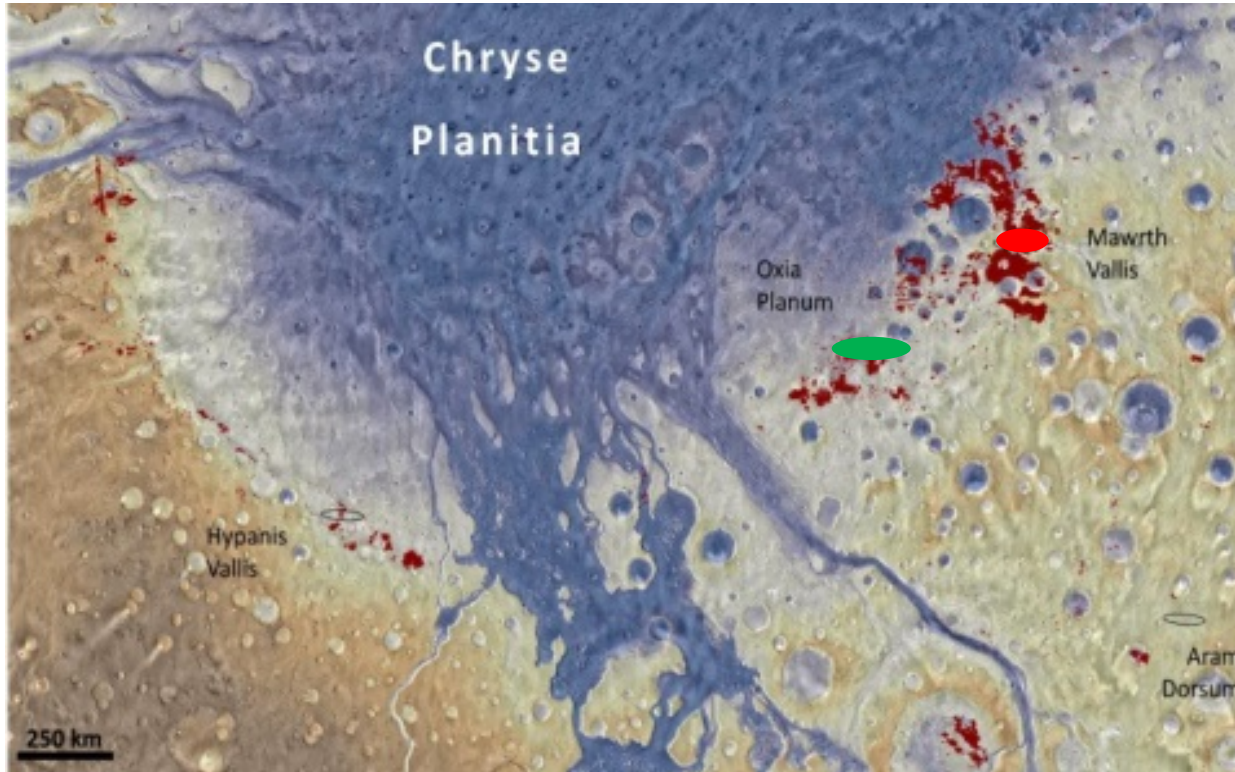
Geology, interior and history

Ice-free compact sand deposits in Meridiani Planum



Watters et al., 2017

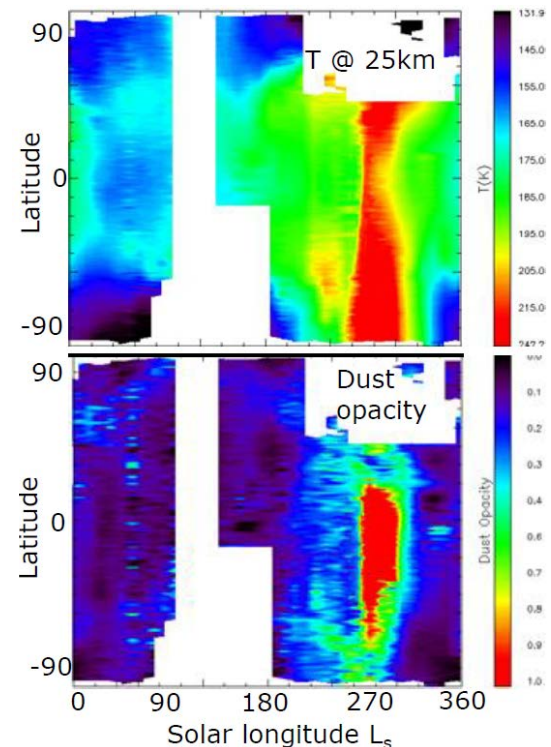
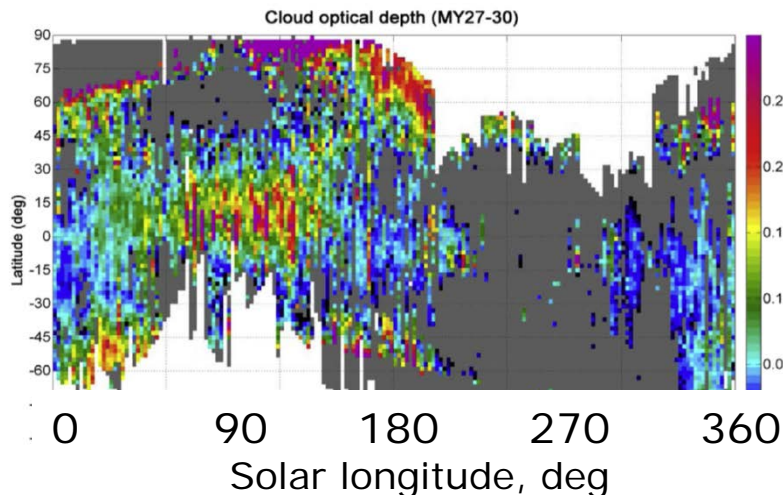
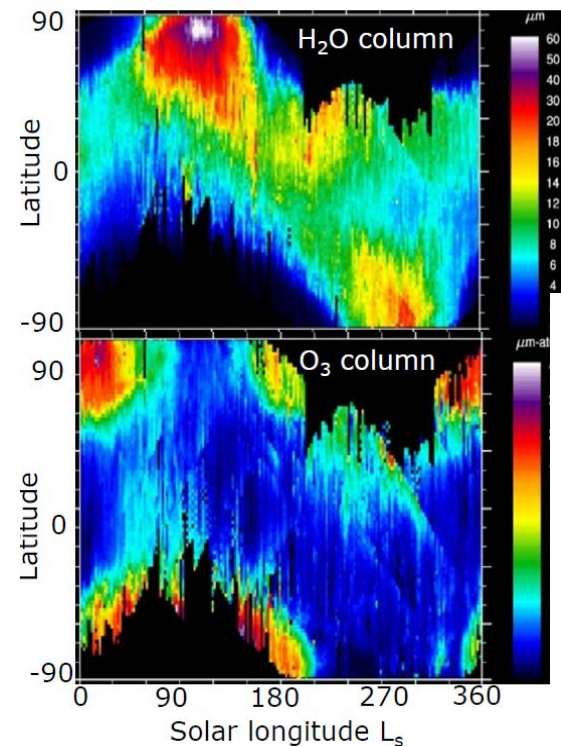
Characterization and selection of ExoMars-2020 landing sites



H₂O, O₃ and cloud cycles

- More than a decade long record of key climatological parameters
- Mars Climate Database (MCD 5.3) was released in 2017
- Collaboration within MEX team and with MAVEN and TGO

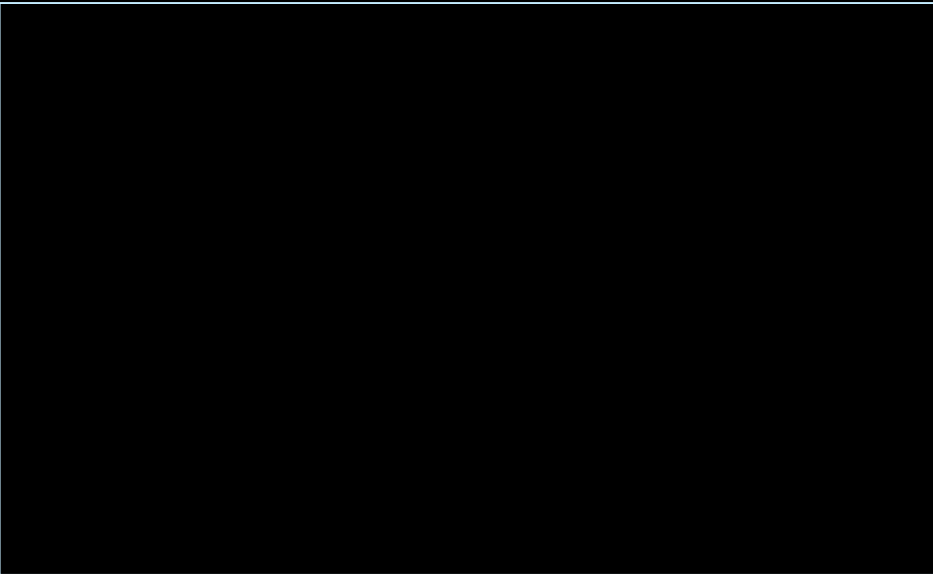
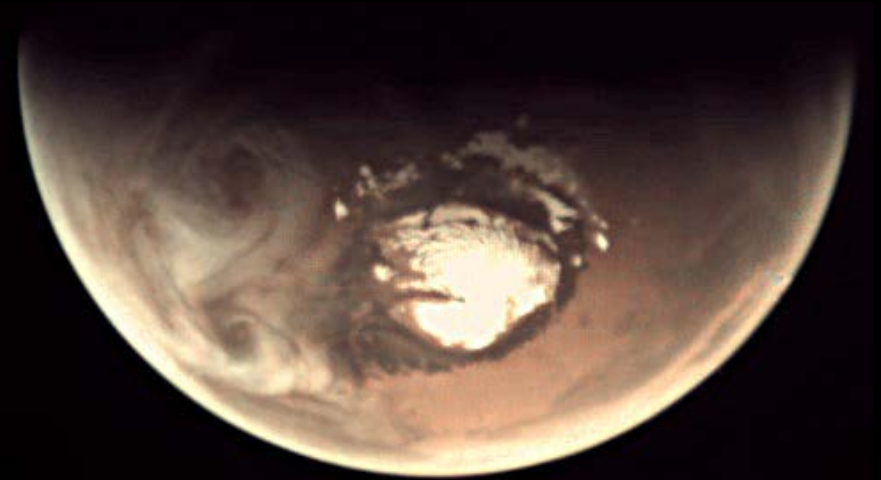
Temperature and dust



Montmessin et al., 2017; Willame et al., 2017; Wolkenberg et al., 2017; Oliva et al., 2017.

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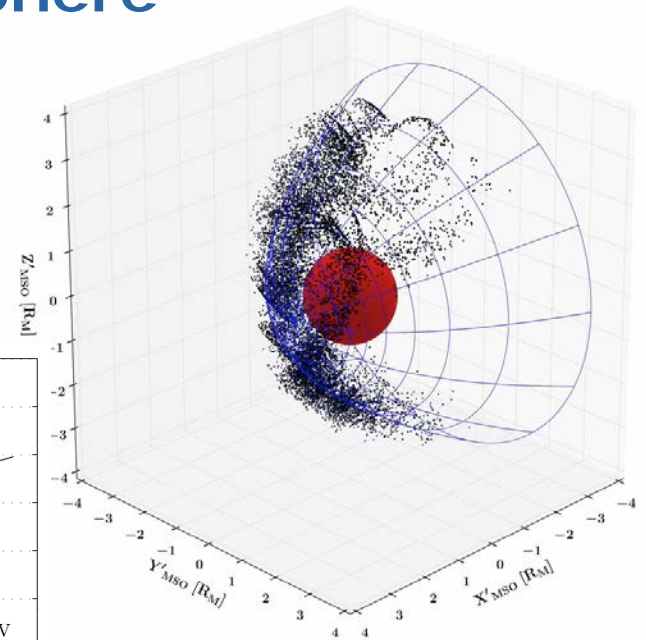
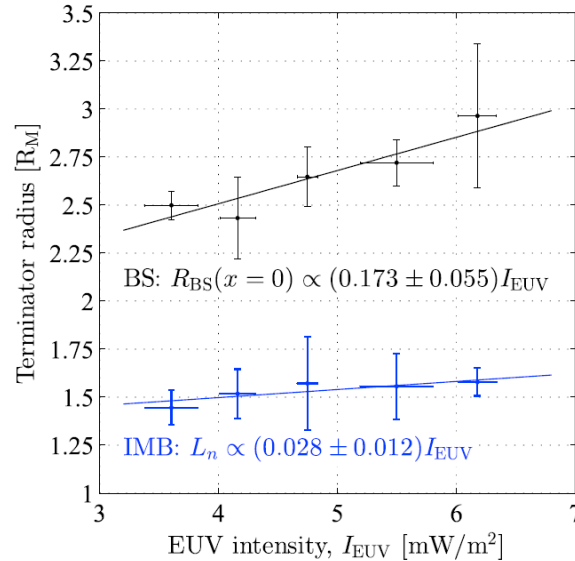
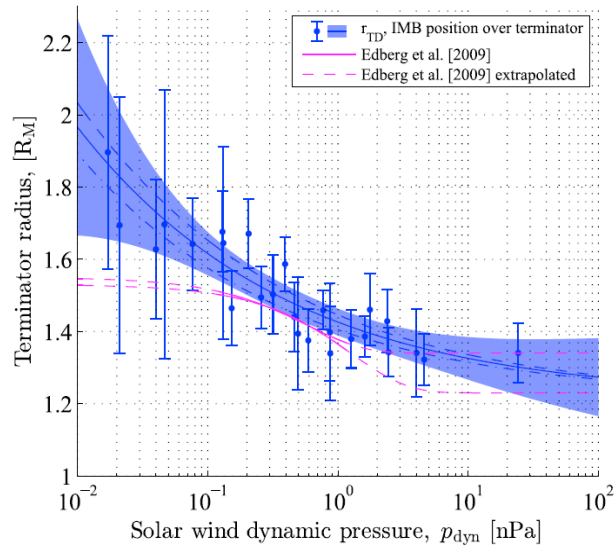
VMC first publications



Sanchez-Lavega et al. 2017

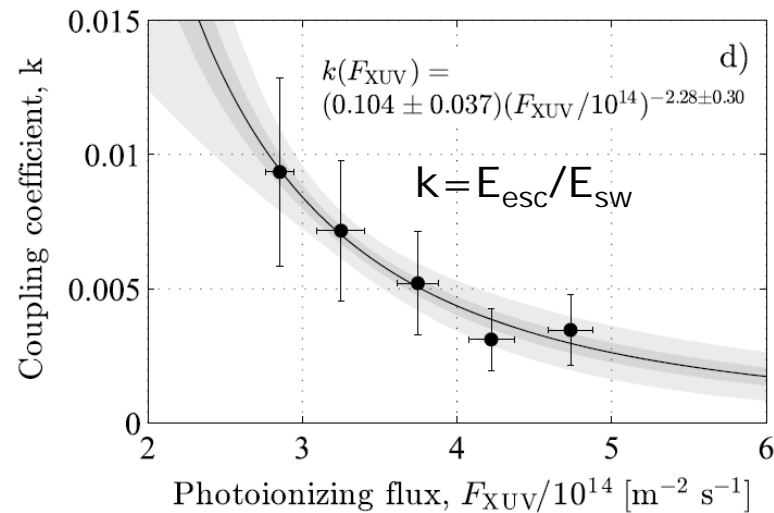
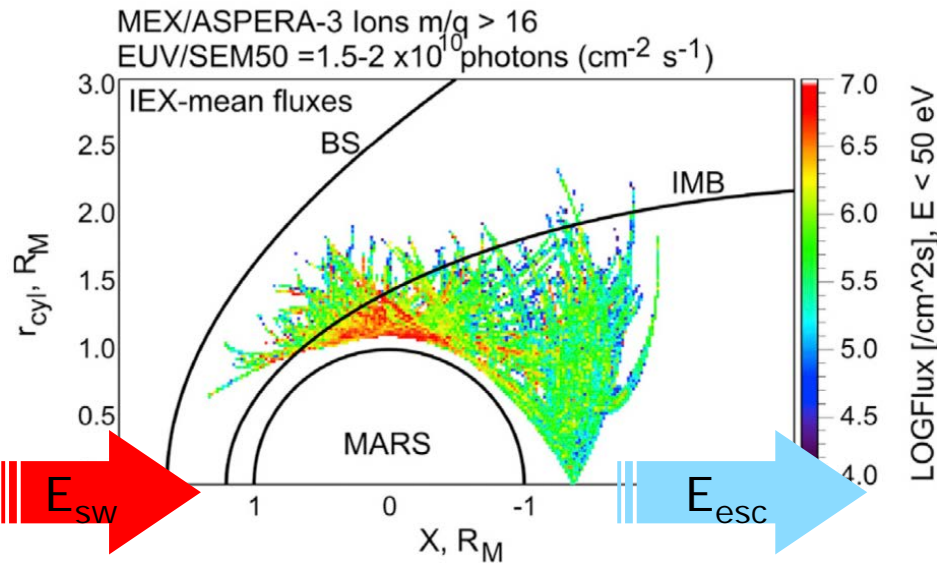
Plasma environment and ionosphere

- Statistical description of plasma boundaries
- Size of the plasmosphere decreases with solar wind pressure and increases with EUV
- Study of vertical and lateral electron distribution and their variations



Hall et al., 2016; Ramstad et al., 2017

Atmospheric escape vs solar wind conditions and EUV flux

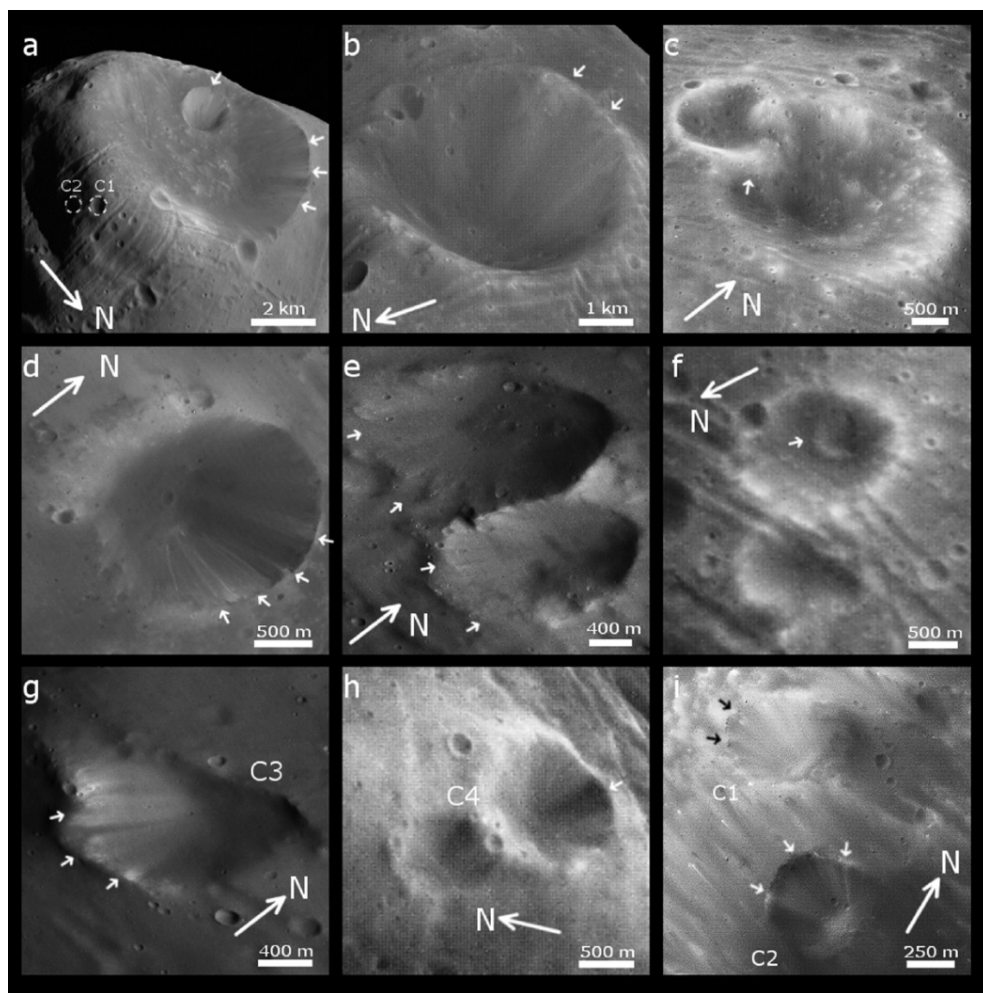


- Ion escape at Mars is production rather than energy limited
- Heavy Venus vs light Mars ?

Dubinín et al., 2017; Ramstad et al., 2017

Phobos studies

- mass wasting features in craters on Phobos
- locations of the observed landslides correlate with slope increase by tidal effects

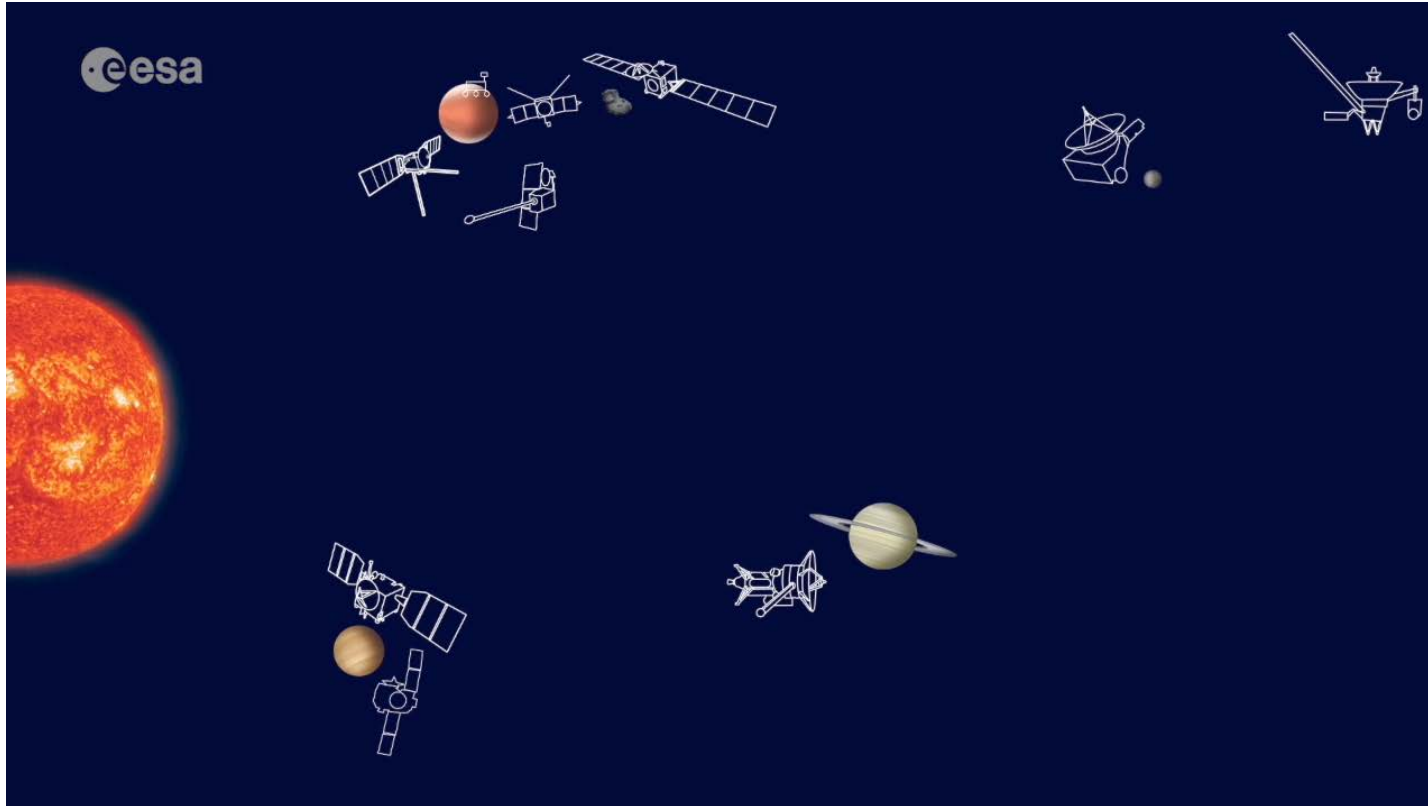


Shi et al., 2017



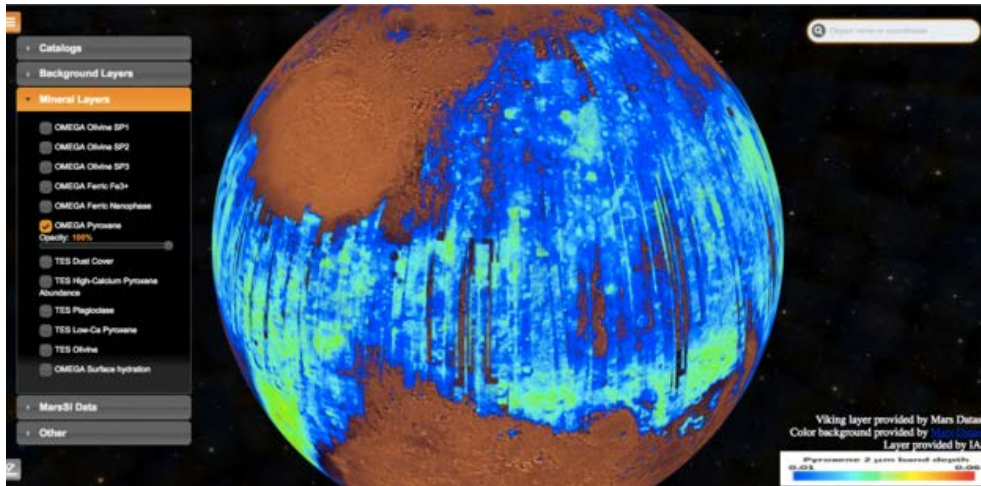
Interplanetary media

➤ Propagation of Coronal Mass Ejection (CME) through the Solar System

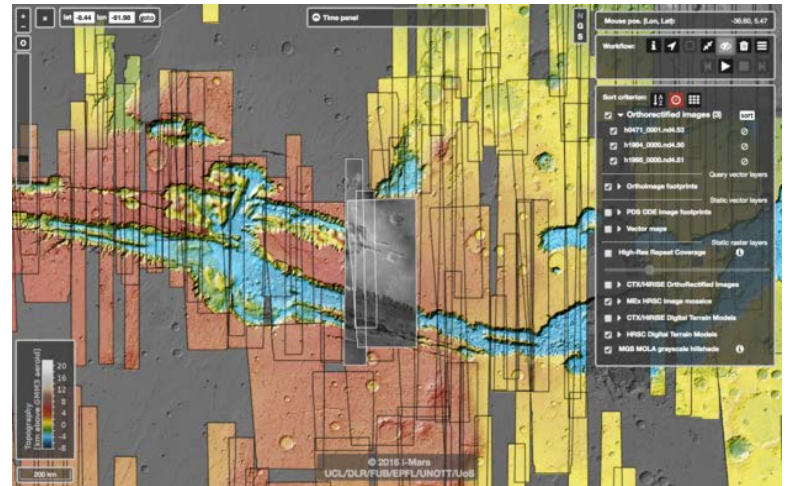


Witasse et al., 2017

Planetary Surface Portal (PSUP) (Observatories of Paris-Sud & Lyon)



iMars Surface (UCL/FUB/EPFL/UNOTT/UoS)



➤ Visualisation of the surface properties

- Web-based geographic information system
- Identifying surface changes

Poulet et al., 2017

Mars Express status

Mars Express status



➤ **Spacecraft, operations and archiving are nominal**

- *15 years of MEX operations in orbit*
- *Successful implementation of "gyroless" AOCS mode*

➤ **Mission extension**

- *extension till the end of 2020 is indicatively approved, to be confirmed in 2018 on the basis of MEOR*
- *2018: technical evaluation and science case for the mission extension 2021-2022*

➤ **Archiving of high level science products**

- *MEX legacy archive (led by IDSs)*
- *project supported activities*

➤ **Publications:** 1120 papers and 144 PhD theses

Geology, interior and history

- *High-res stereo coverage to 84%*
- *Multi-orbit DEMs (50m/pixel)*
- *High-res subsurface sounding of the polar layered deposits*
- *Detailed investigation of potential landing sites*

Meteorology & climate

- *Impact of dust on the atmospheric state*
- *Couplings between the lower and middle atmosphere*
- *Transient phenomena on the surface and in the atmosphere (cyclones, waves, "plumes")*

Aeronomy and plasma environment

- *Continue monitoring ionosphere and plasma environment*
- *Aeronomy, ionosphere and escape in the solar minimum #24 vs #23*
- *Coupling between the lower/middle and upper atmosphere*

Phobos

- *Completion of the surface coverage*
- *From global mapping to detailed investigation of selected sites*
- *MEX orbit adjustment*

Ideas for 2021-2022 extension



Geology, interior and history

- *High-res stereo coverage to 90% (tbc)*
- *Multi-orbit DEMs (50m/pixel)*
- ***High-res radar sounding of the polar layered deposits***

Meteorology & climate

- *Impact of dust on the atmospheric state*
- *Couplings between the lower and middle atmosphere*
- *Transient phenomena on the surface and in the atmosphere (cyclones, waves, "plumes")*
- ***MEX-TGO radio occultations and collaboration on atmosphere***
- ***full-fledged VMC observations***

Aeronomy and plasma environment

- *Aeronomy, ionosphere and escape in the solar minimum #24 vs #23*
- *Coupling between the lower/middle and upper atmosphere*
- ***Local plasma sounding by ASPERA during MARSIS operations***
- ***Collaboration with MAVEN and Chinese HX-1 mission***

Phobos

- *Completion of the surface coverage*
- *From global mapping to detailed investigation of selected sites*

ExoMars-2020

- *Collaboration with the rover*

Collaborations



➤ Trace Gas Orbiter (ESA-Roscosmos)

- *Instruments cross-calibration*
- *Support of each others observations*
- *Couplings between lower and middle atmosphere*

➤ MAVEN (NASA)

- *going well: joint observations and data analysis*
- *JGR special issue followed Mars Aeronomy conference*
- *ESLAB 52 Symposium on Comparative aeronomy and plasma environment of terrestrial planets*

➤ HX-1 Mars mission (China)

- *ASPERA and MARSIS data workshops in China*
- *Collaboration on HX-1 landing sites selection, subsurface sounding and plasma investigations*

➤ MMX mission (Japan)

- *support for JAXA MMX mission (WG led by T. Duxbury, MEX-IDS)*

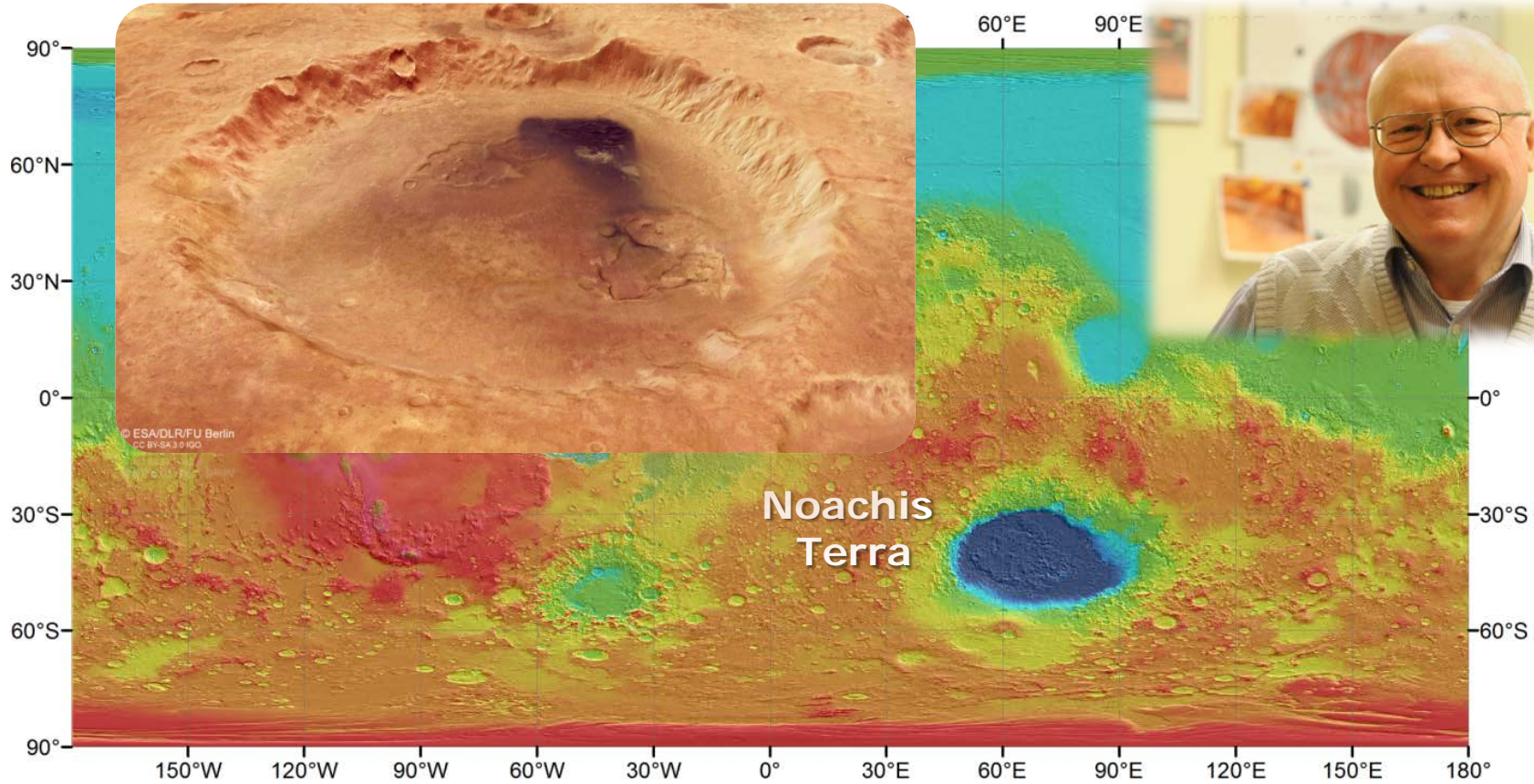
Conferences and workshops



- Regular sessions at EGU, EPSC, COSPAR
- Mars atmosphere modelling and observations WS, Granada, 2017
- Mars Aeronomy conference, Boulder, USA, 15-19 May 2017
- From MEX to TGO, ESAC, 27 Feb–1 Mar, 2018
- **ESLAB#52 Symposium on Comparative Aeronomy and plasma environment of terrestrial planets, ESTEC, 14-18 May, 2018**
- **"15 years of MEX" at EPSC Congress (Sept 2018, Berlin)**



A crater is named after Prof. Gerhard Neukum



Thank you !

