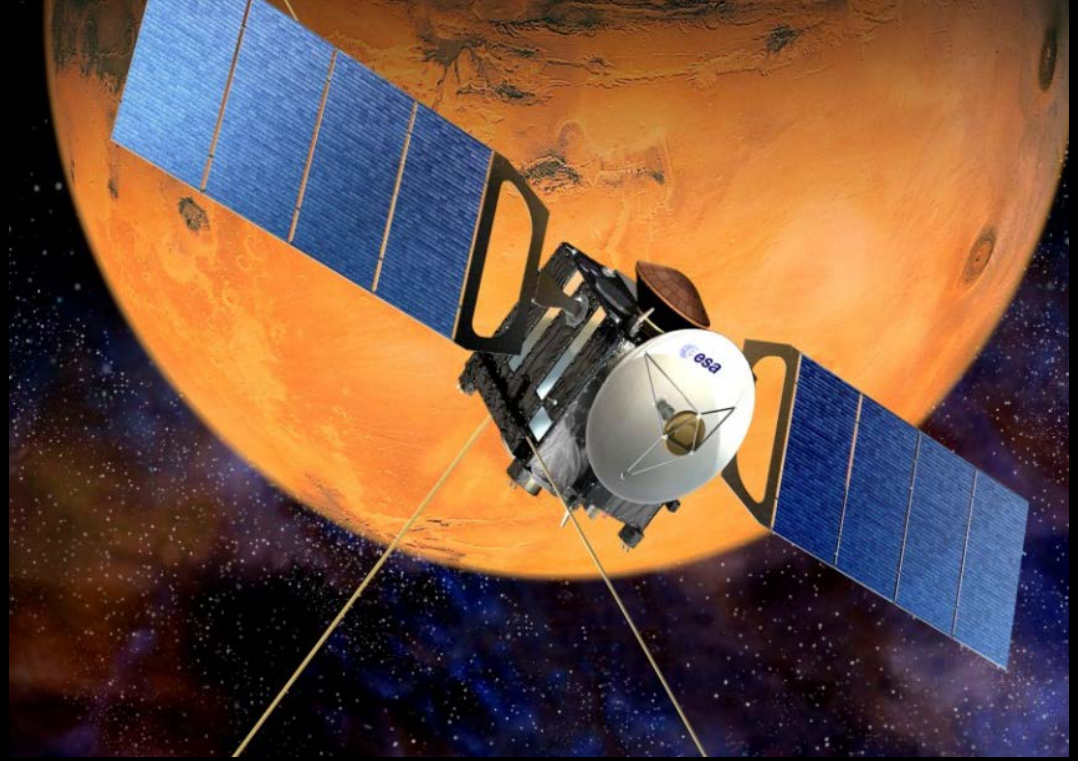
Mars Express atmospheric observations

Dmitrij Titov

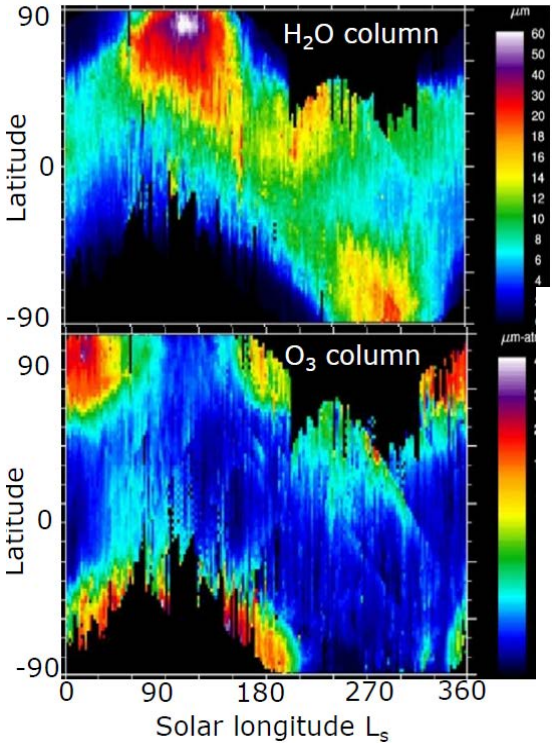
Mars Express Project Scientist
/on behalf of the Mars Express Team/



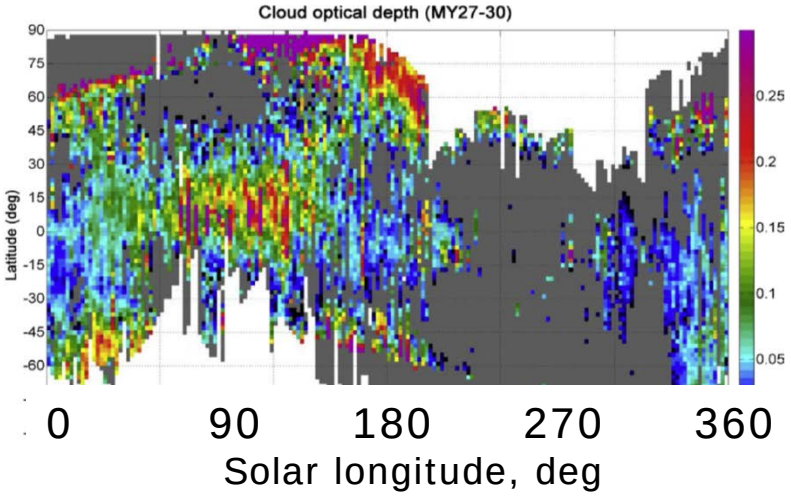
Meteorology and climate

Meteorology and climate

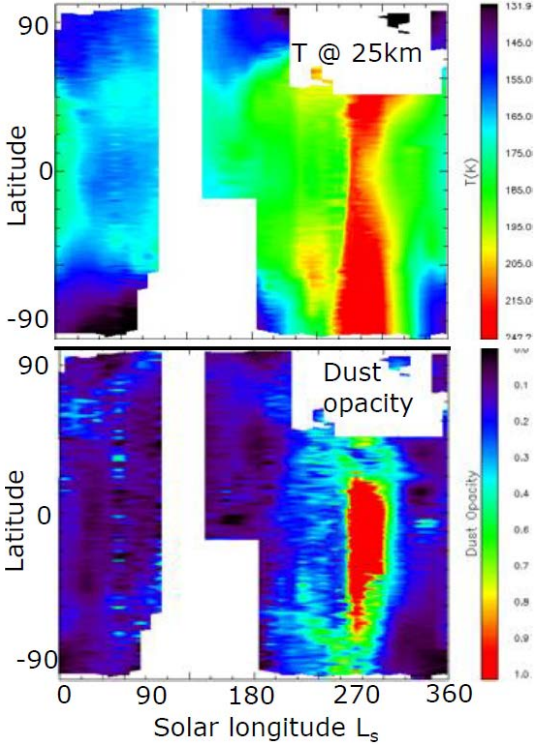
H_2O, O_3 and cloud cycles



- **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**

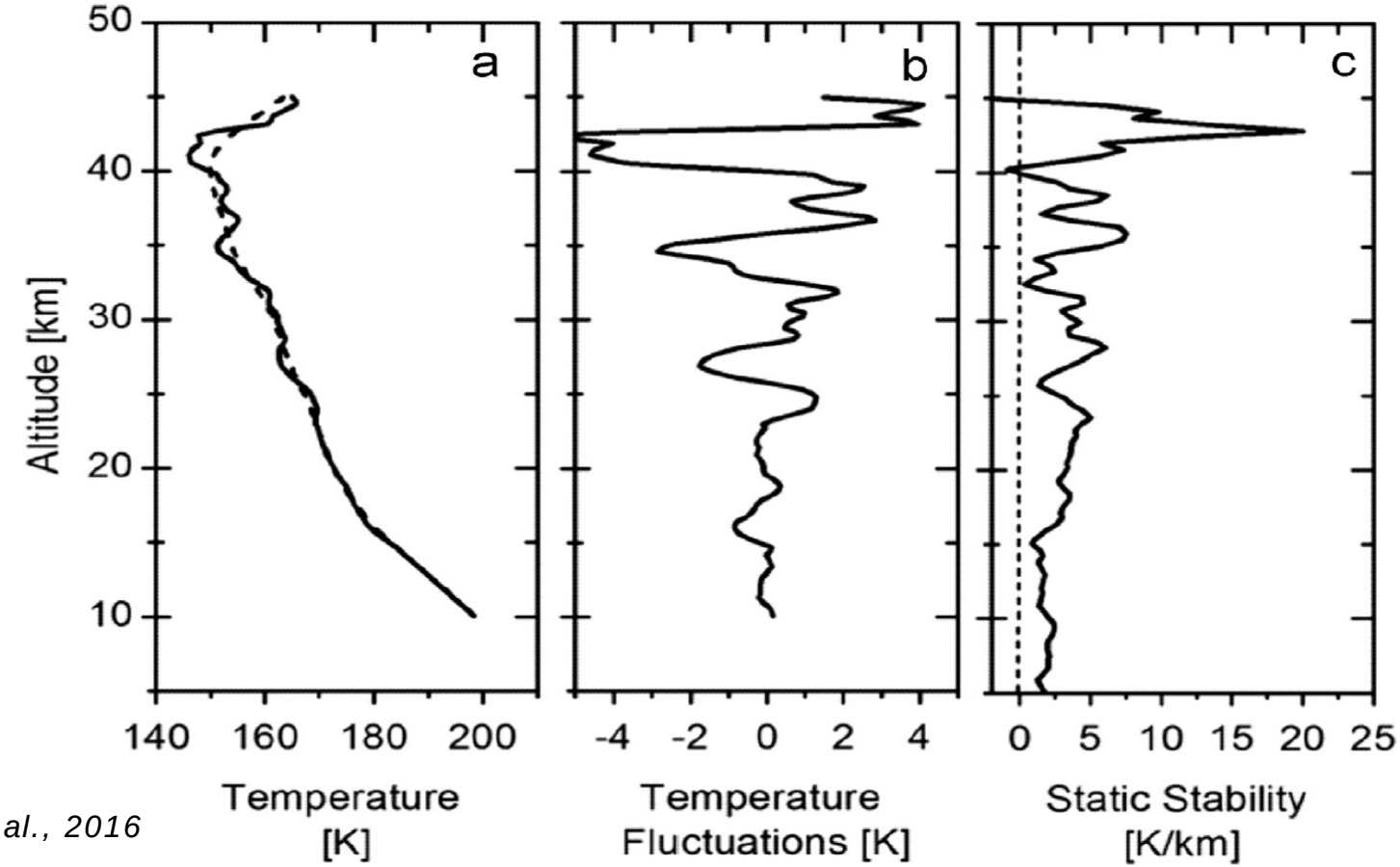


Temperature and dust



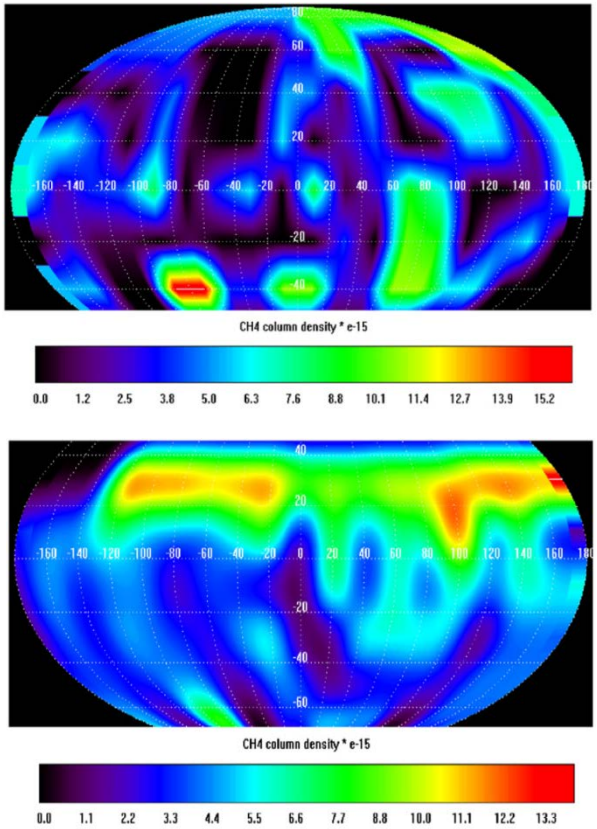
Montmessin et al. 2017; Willame et al., 2017; Wolkenberg et al., 2017; Oliva et al., 2017.

Details of the atmospheric structure



Pätzold et al., 2016

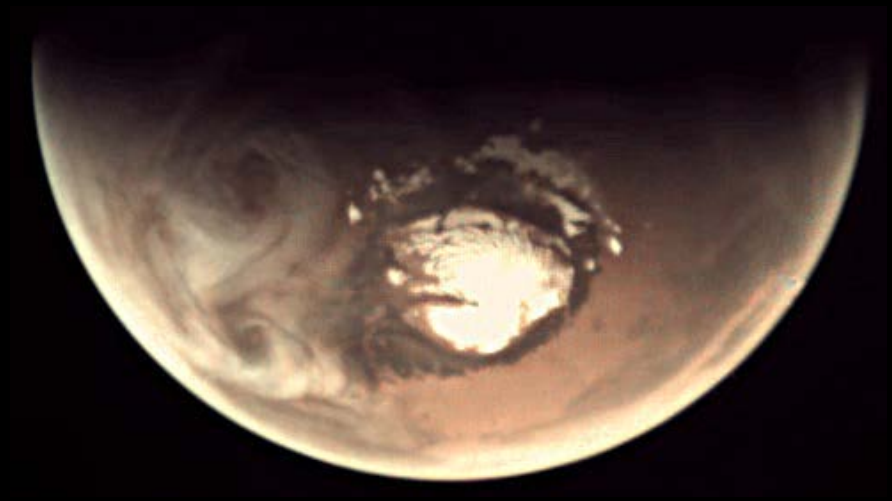
Methane on Mars



- Methane mixing ratio 0-45 ppb
- Non-homogeneous distribution suggesting sources and sinks
- Increase of methane column density occurs in the winter hemisphere
- Observations of methane in Gale crater (Curiosity)
- Looking forward for TGO measurements

Geminale et al., 2011

Global monitoring of the planet

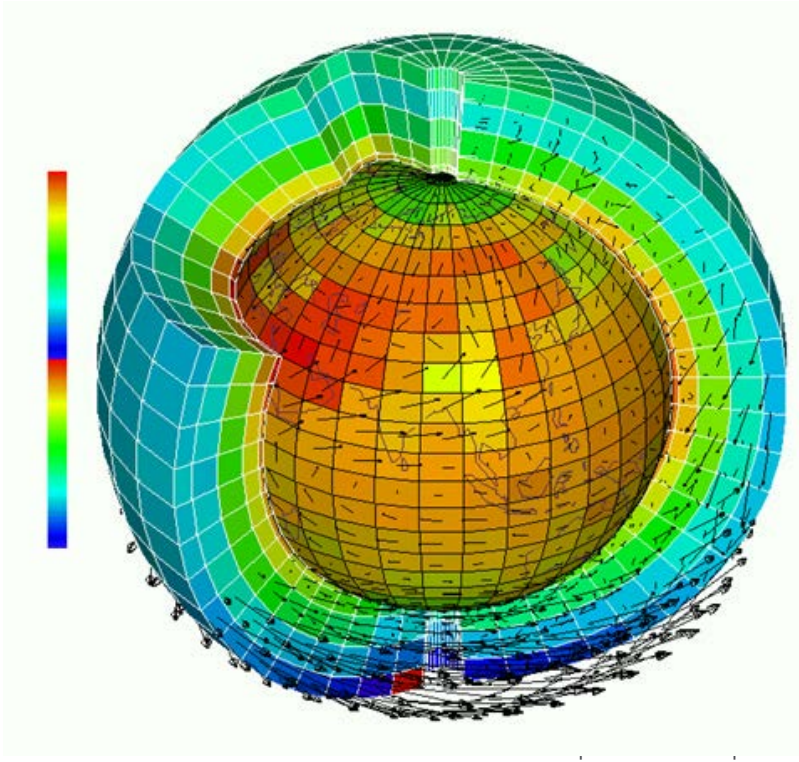


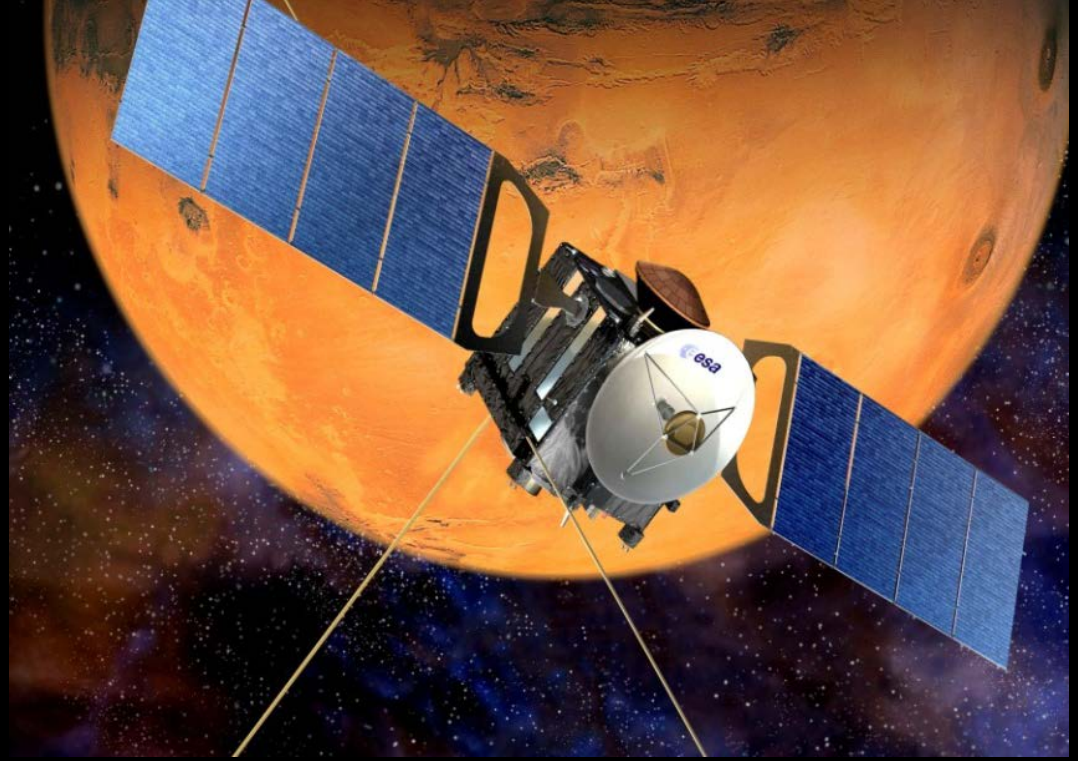
Sanchez-Lavega et al. 2017

Mars climate modelling

Dataset	
Temperature & Pressure	5
Aerosols & Clouds	15
Water vapour	7
Chemical species & ions	16
Surface frost	3

Global Climate Model

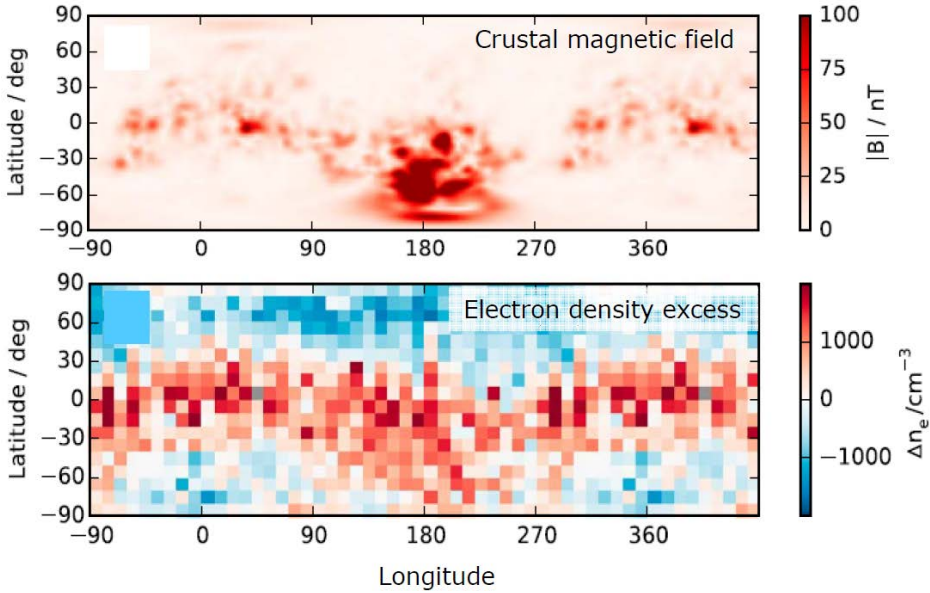




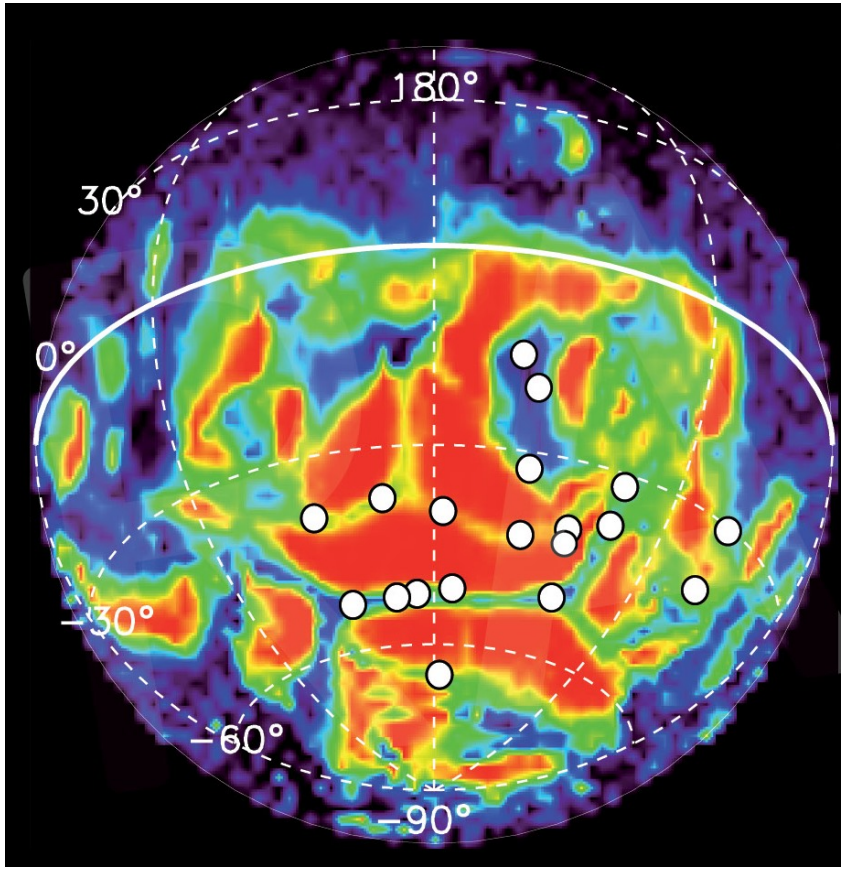
Upper atmosphere and escape

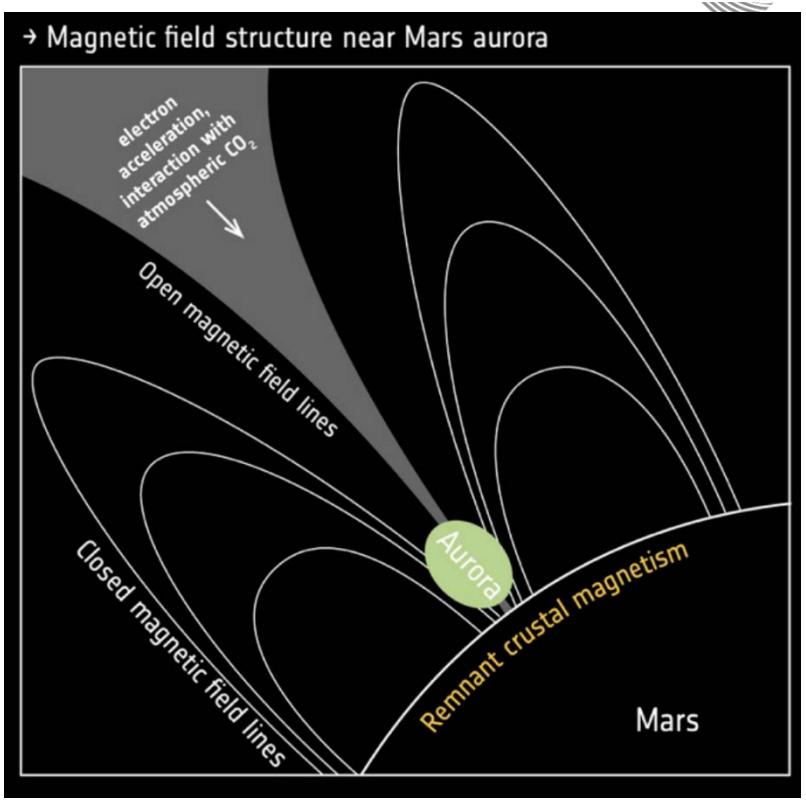
Ionosphere

- Ionospheric structure is affected by the crustal magnetic field, solar wind, EUV flux and meteors
- Discovery of transient layers during the encounter with comet Siding Spring



Aurora and the crustal magnetic field

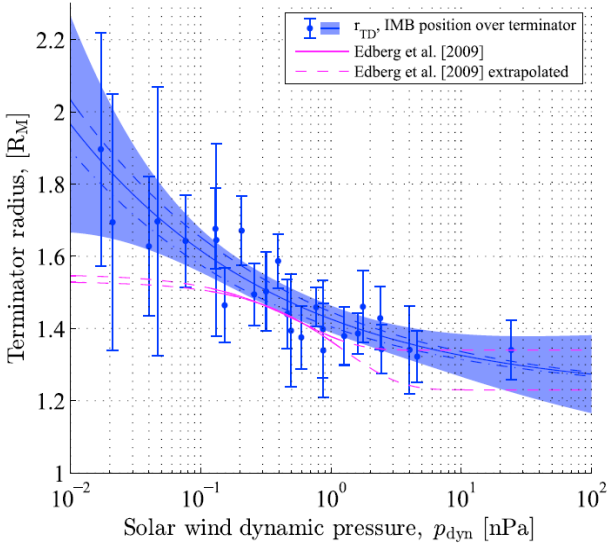


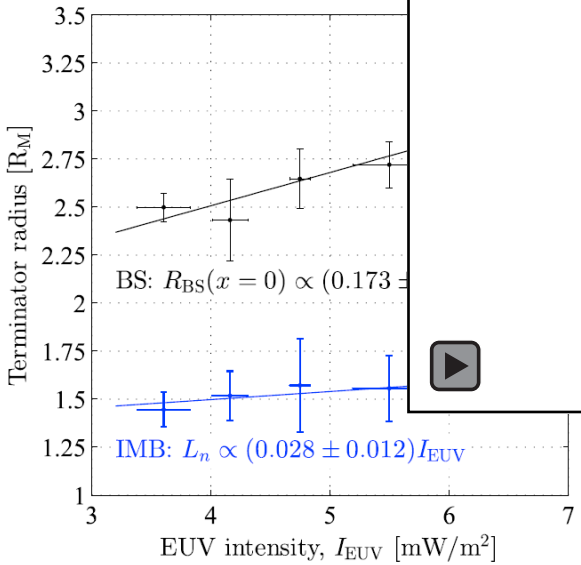


Gerard et al., 2015

Plasma environmen

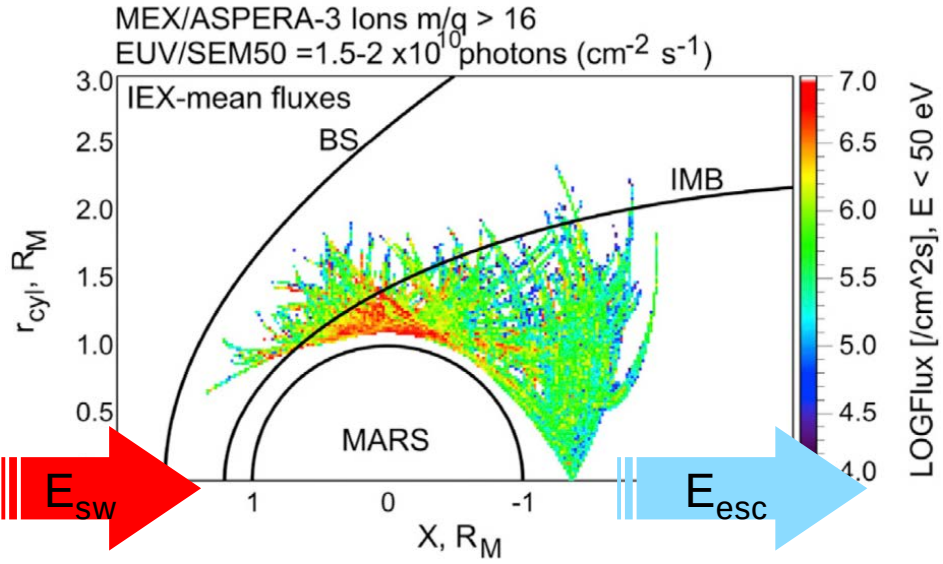
- Statistical description of plasma boundaries
- Size of the plasmosphere decreases with sola wind pressure and increases with EUV
- Study of vertical and lateral electron distribut and their variations

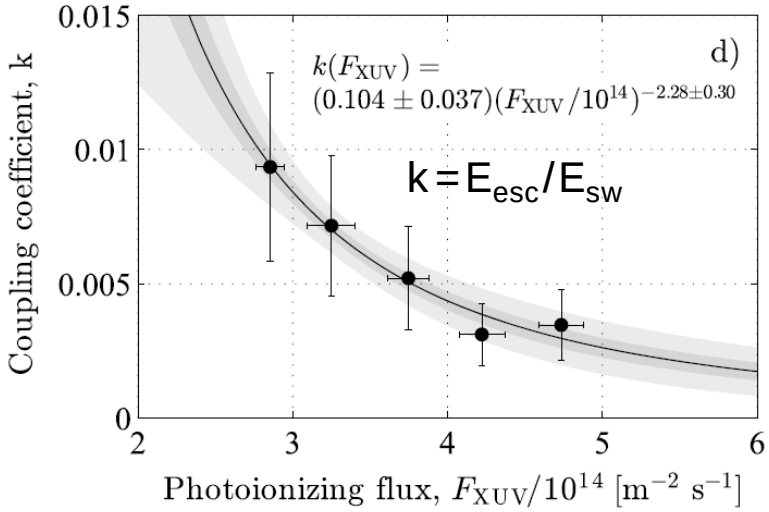




Hall et al., 2016; Ramstad et al., 2017

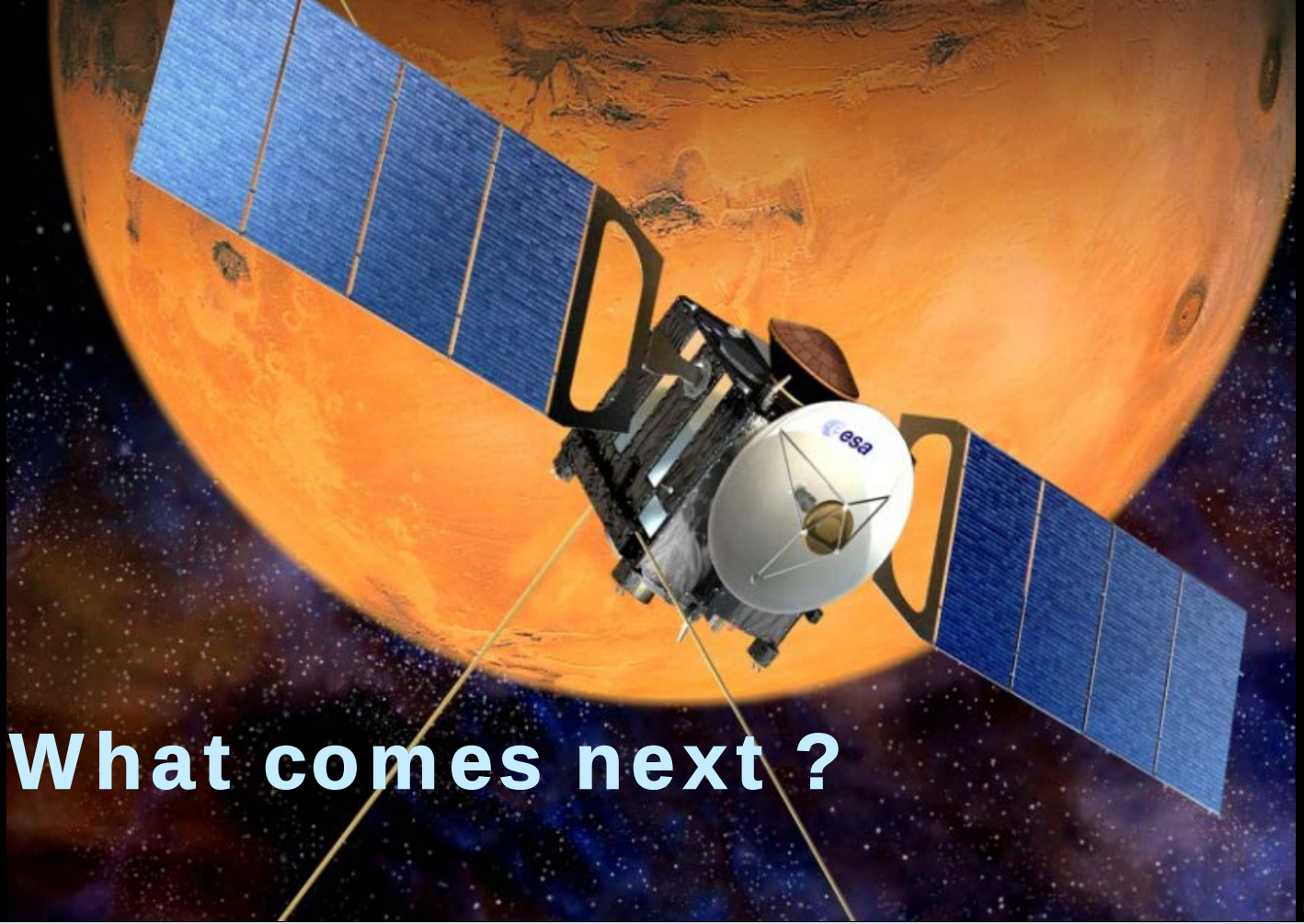
Atmospheric escape





- **Ion escape at Mars is production rather than energy limited**

Dubinin et al., 2017; Ramstad et al., 2017



What comes next ?

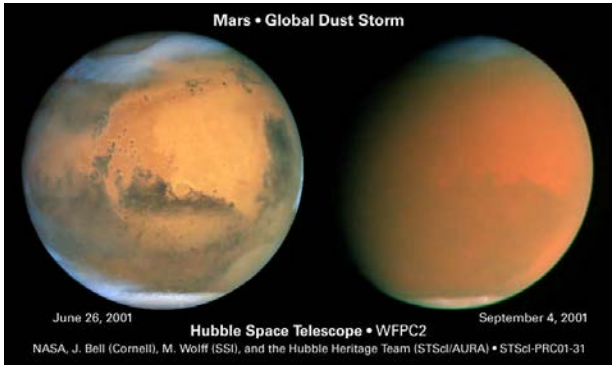
Mars Express status

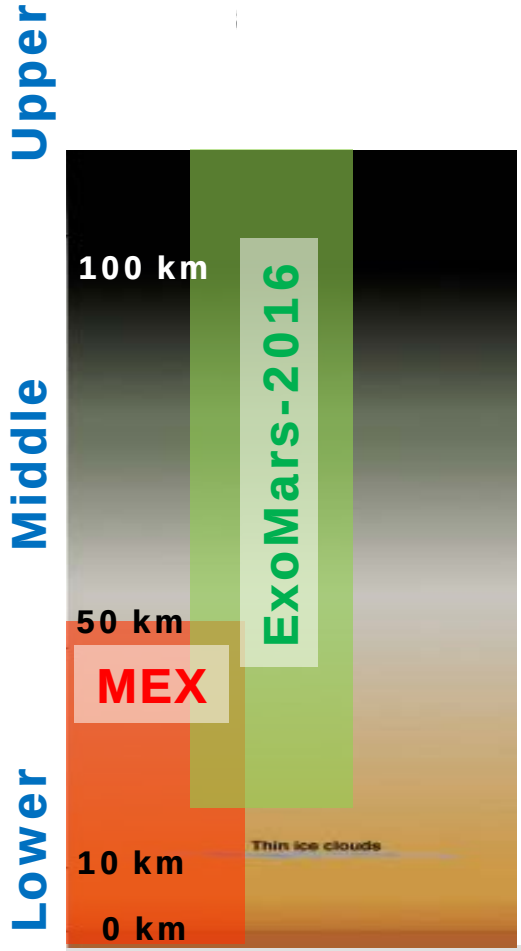
- **Mission extension**
  - *Extension till the end of 2020 is approved*
  - *In 2018: technical and science evaluation and request for mission extension 2021-2022*
- **New ideas are highly welcome**
- **MEX Legacy Archive: high level science products**
- **Collaboration with TGO and MAVEN**

Extension science case 2019-2020

2. Meteorology and climate

- Filling gaps in the meteorological parameters coverage (late night – early morning)
- Impact of dust on the atmospheric state
- Transient phenomena on the surface and in the atmosphere (cyclones, waves, “plumes”)
- Couplings between the lower and middle atmosphere (in collaboration with ExoMars-2016)

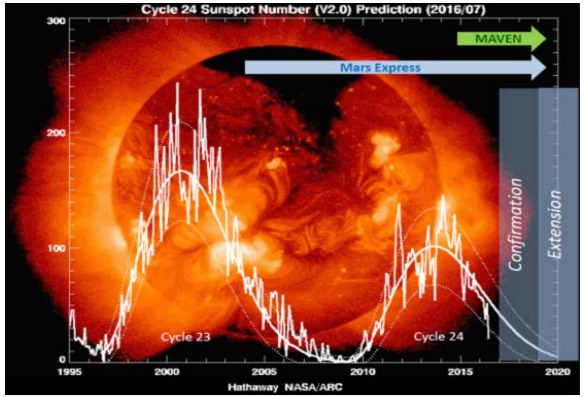


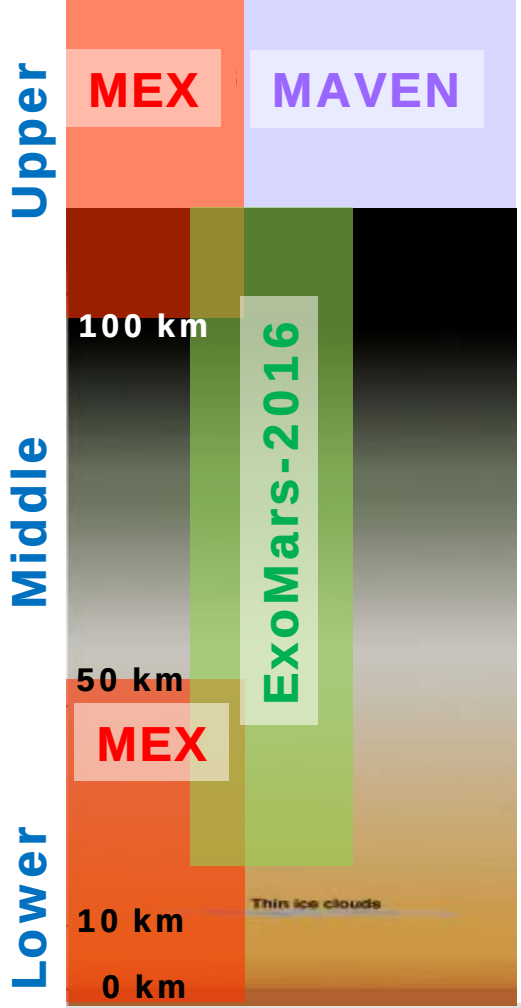


Extension science case 2019-2020

3. Aeronomy, plasma environment and escape

- Augmenting the ionospheric coverage in latitude, longitude, season and local time
- Continue monitoring the plasma environment
- Aeronomy, ionosphere and escape in the solar minimum #24 compared to the cycle #23
- Coupling between the lower/middle and upper atmosphere (in collaboration with MAVEN)





Conferences and workshops

- **ESLAB#52 Symposium on Comparative Aeronomy and plasma environment of terrestrial planets, ESTEC, 14-18 May, 2018**
- **Mars Express 15 years at Europlanet Congress**

Thank you !