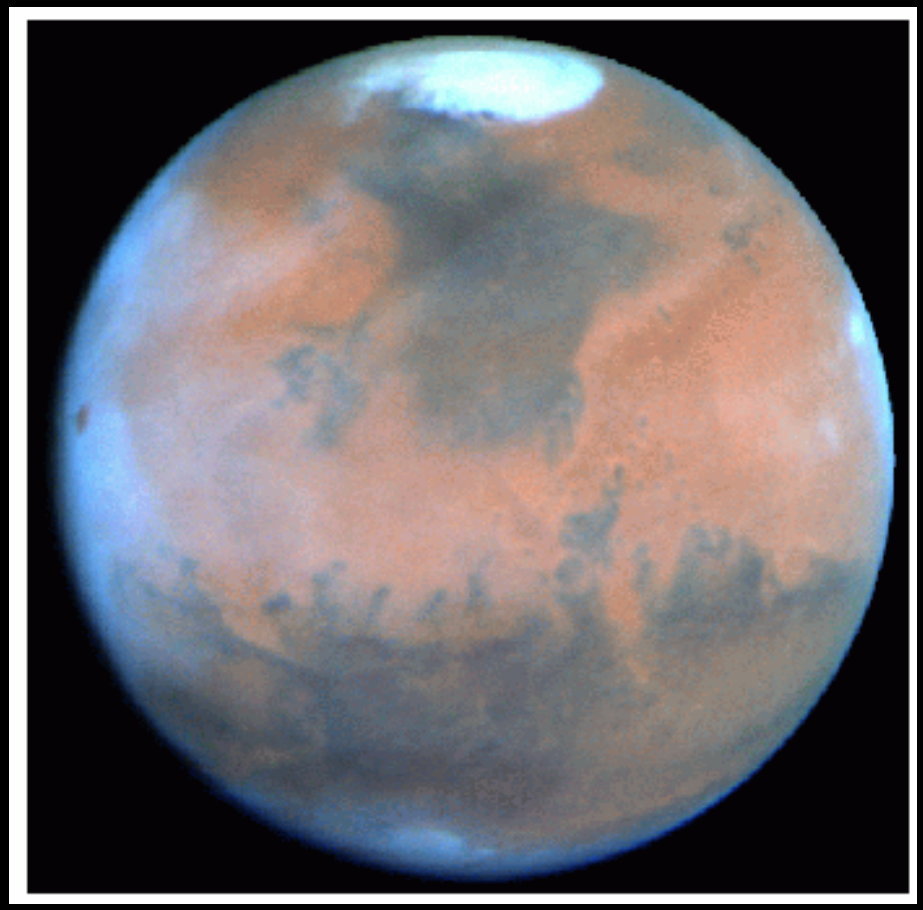
LMD-CNRS

AOPP

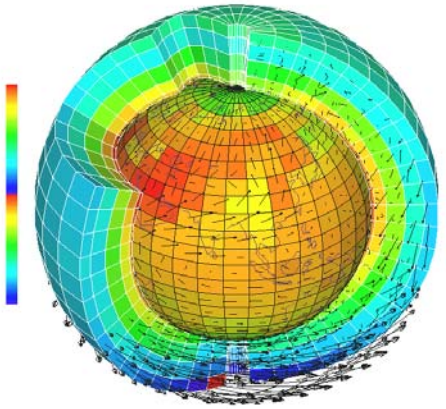
CNES

ESA



A model based Mars Climate Database for Mission design:

Why a model based climate database ?



- The Martian environment is highly variable

- Observations coverage is far from complete:
  - mostly temperature profiles up to 60 km, many with coarse vertical resolution (TES)
  - limited local time coverage
  - a few in situ observations

- GCMs (Mars General Circulation Models = Global Climate Models) can predict main aspects of the observations

→ **Models can be used to extrapolate the observations**

Mars Climate Database v3.1
Who uses it ? (~60 users !)

- **Data analysis** :
  - **Mars Express : PFS** data inversion (IFSI), **Spicam** (SA), **Omega** (LESIA, LPG)
  - **Mars Odyssey GRS** (LPL), **Infrared Space Observatory** (LESIA, IKI) , **Phobos 2 ISM** (IAS, LESIA), **MGS Mars Odyssey accelerometer** (NASA Langley), **ISO** (LESIA-IKI), **Anglo-australian Observatory**
- **Mission design**
  - **MSL** (JPL) , Study for **Aurora** program (Astrium UK, CEA, Graz University of Technology, Alenia)
  - **Beagle 2** (Open University, Martin Baker Aircraft ltd, DLR), **Mars Express** (Astrium, ESTEC) , **Netlander** (CNES, Alcatel, CEA, Babakin, Astrium, OHB-System, Institut fuer Planetologie, Münster), Entry study (Surrey Space Centre, Canadian Space Agency, Mars Horizon project (
- **Instrument design:**
  - **PFS Mars Express** (IFSI, Observatory of Capodimonte) , **Neige-Netlander** , **Mars Atmosphere Microwave sounder**
- **Science studies:**
  - **Isotope cycle** (NCP, Canada**),** (**Mesoscale model** (University of Helsinki), **Geodesy** (JPL, Royal Observatory of Belgium), **Wave analysis** (University of Boulder), **Photochemistry** (Centro de astrobiologia)

New release MCD v4.0

The new Mars Climate database MCD v4.0

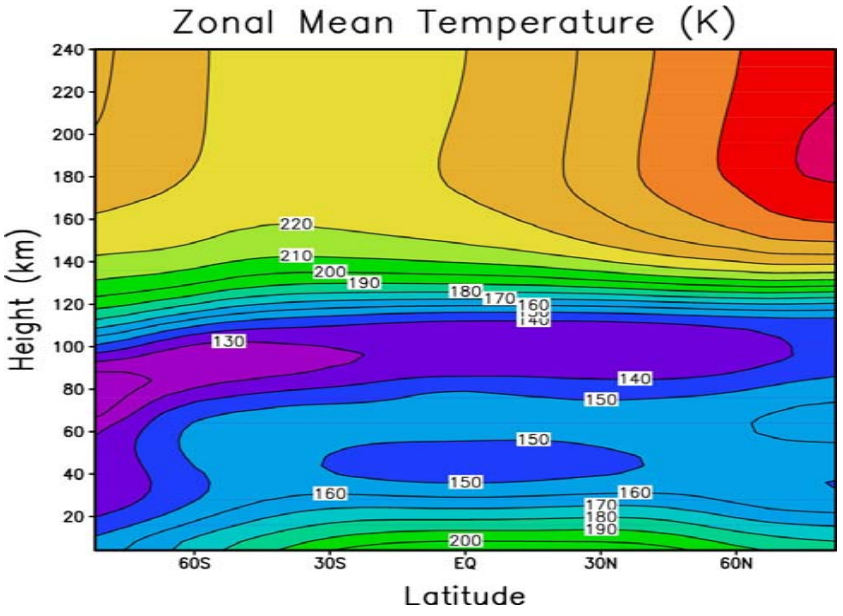
MCD v4.0: what's new ? 1/3

Extension to the thermosphere: up to 250 km

Monica Angelats i Coll

Above 100 km database v4.0 will also include 3 scenarios to describe solar cycle (Extreme UV input) : "solar mean", "solar maximum" , "solar minimum"

Use of hybrid coordinates



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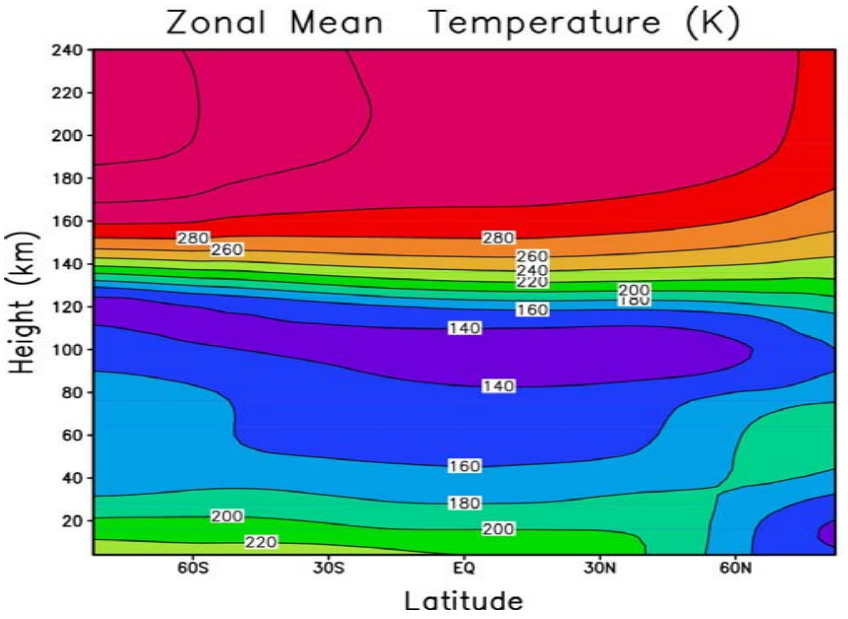

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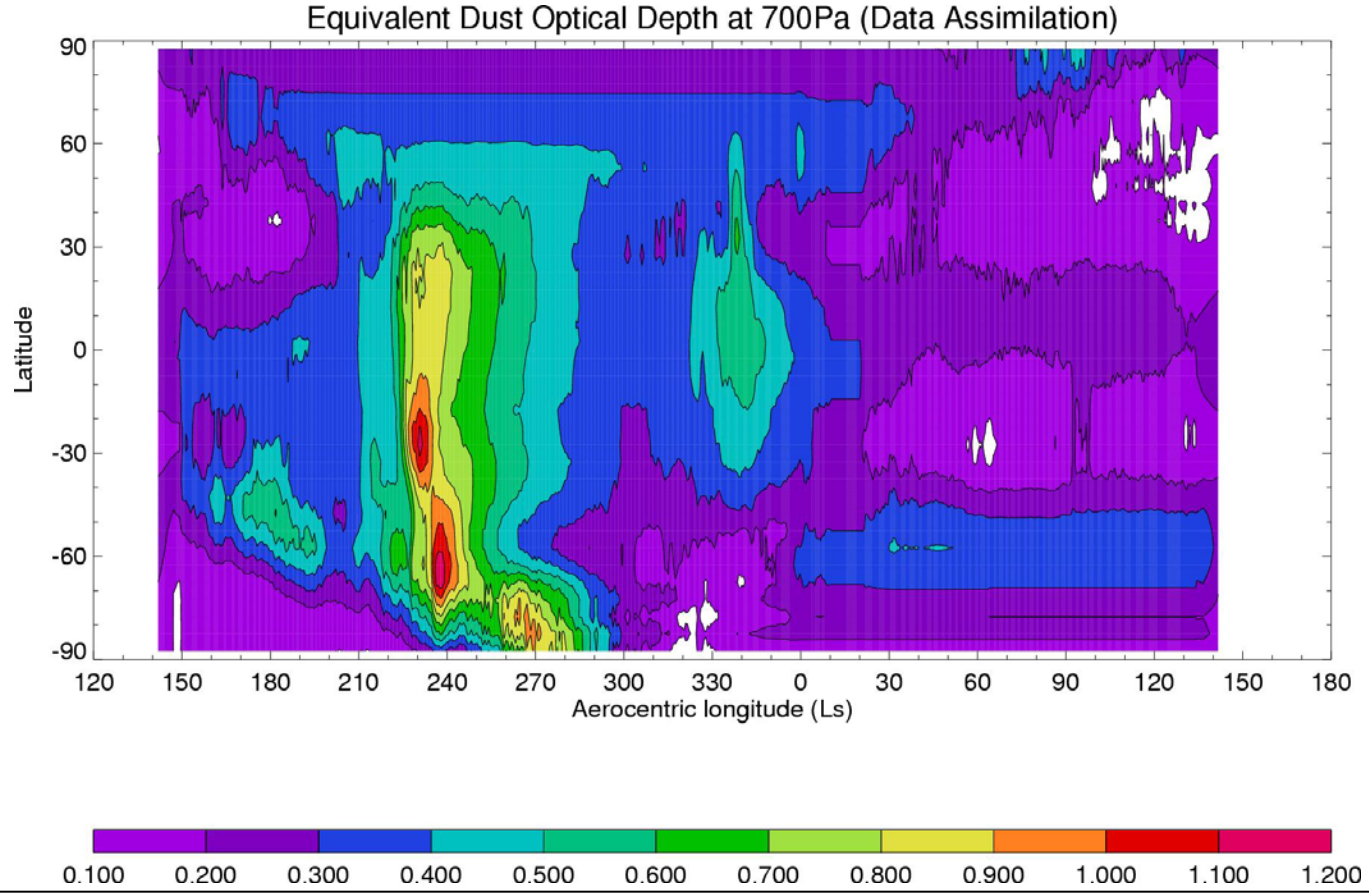
MCD v4.0: what's new ? 2/3

New dust scenario to represent the dust variability

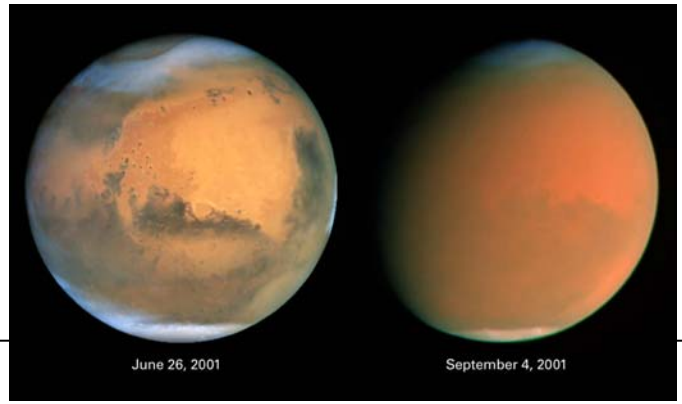
- "Best" dust scenario (Scenario « **MY24** » based on assimilation) topped by 3 solar EUV conditions: solar min, solar mean, solar max



MCD v4.0: what's new ? 2/3

New dust scenario to represent the dust variability

- "Best" dust scenario (Scenario « **MY24** » based on assimilation) topped by 3 solar EUV conditions: solar min, solar mean, solar max
- One dust storm scenario (Constant visible optical depth = 3) for 6 seasons from Ls=180 to Ls=360 (season 7 to 12) topped with 3 solar EUV conditions: solar min, solar mean, solar max
- Warm scenario : our traditional "Viking Lander dust scenario" + topped with a solar max thermosphere
- Cold scenario : our traditional "Low dust scenario" topped by a solar minimum scenario



MCD v4.0: what's new ? 3/3

Content : stored Variables

- **mean variables** (12 local times per season – 12 seasons)
  - temperature, surface pressure, winds, atmospheric density
  - atmosphere turbulent kinetic energy, CO2 ice cover
  - thermal and solar radiative fluxes
  - below 120km: Dust mixing ratio
  - below 120km: [H2O] volume mixing ratio, H2O ice
  - above 100km: [O], [O2], [CO], [H], in volume mixing ratio
  - above 100km: Vertical wind

- add RMS variables
  - surface temperature, surface pressure, CO2 ice cover
  - temperature, winds, atmopsheric density

Simulation of Water ice clouds

Montmessin et al. , LMD GCM

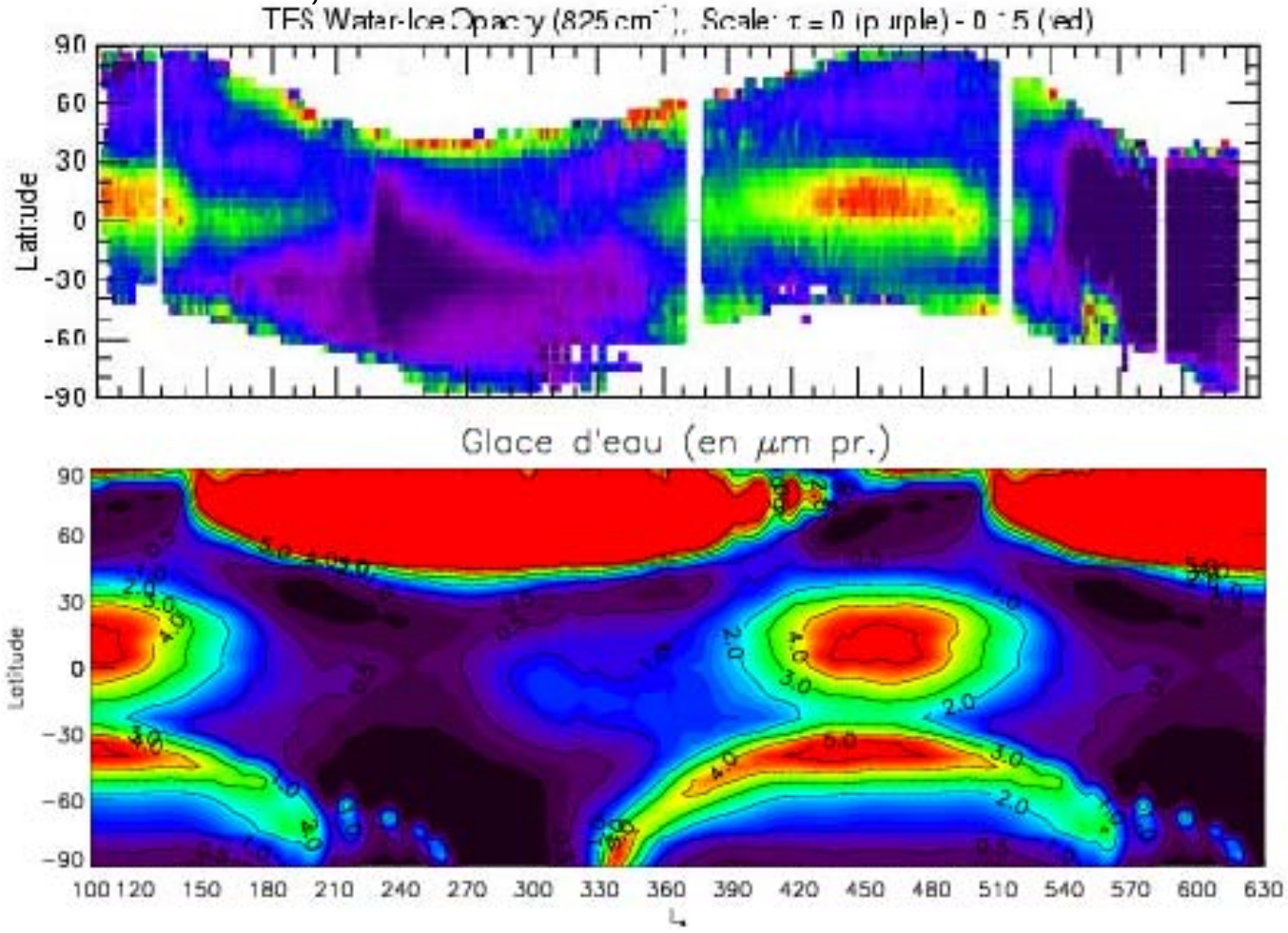
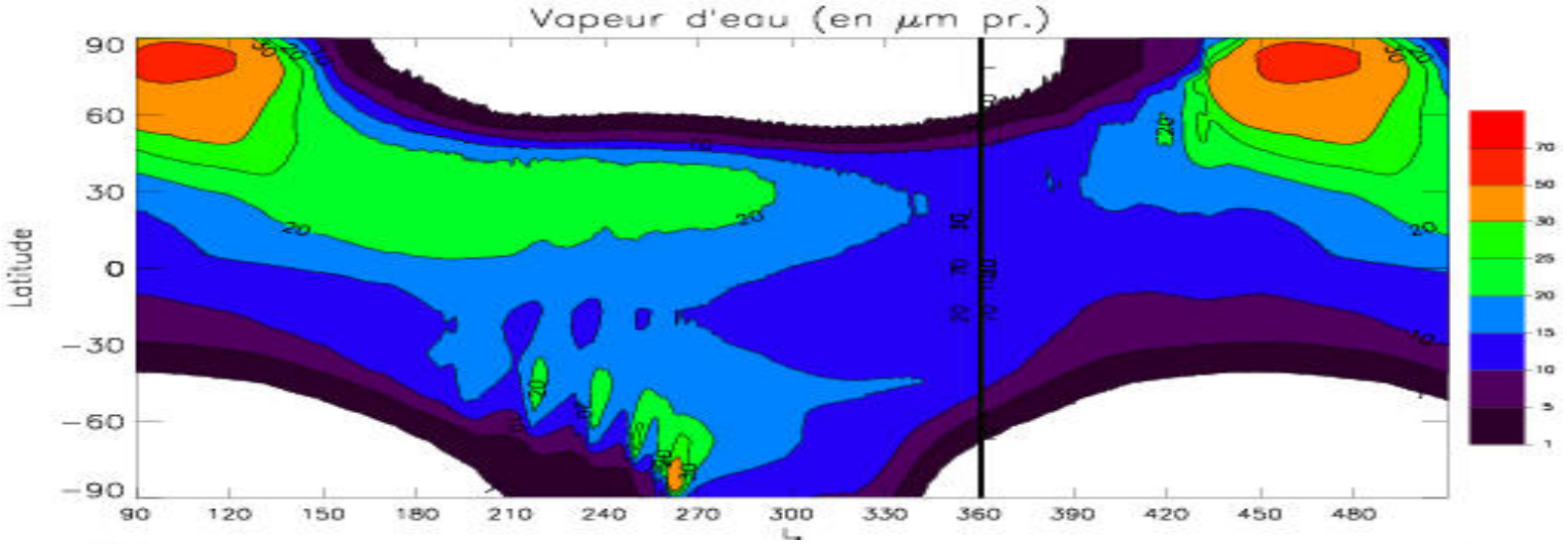
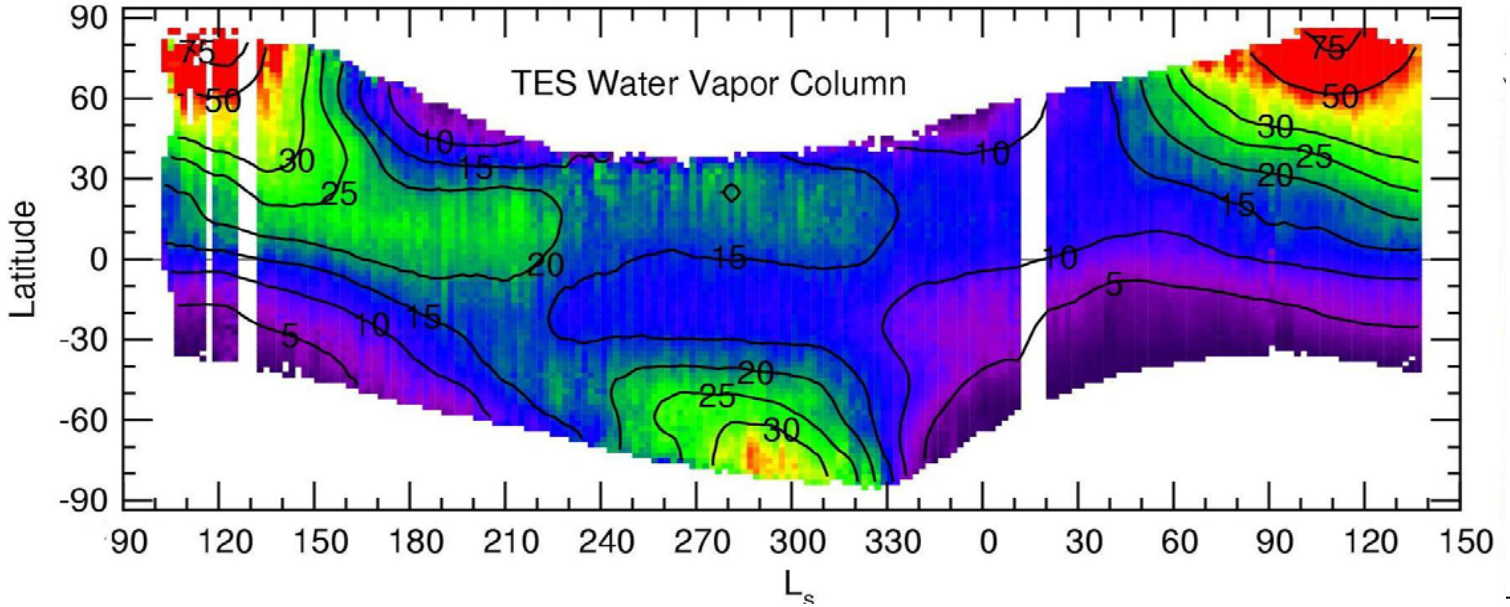


FIGURE 5.19 : Figure du haut : Variation temporelle et géographique de l'épaisseur optique des nuages de glace d'eau telle que déduite des mesures TES au nadir. **Figure du bas** : Distribution spatiale et saisonnière de la glace d'eau atmosphérique prédite par le modèle.

Simulation of Water ice cycle

Montmessin et al. , LMD GCM



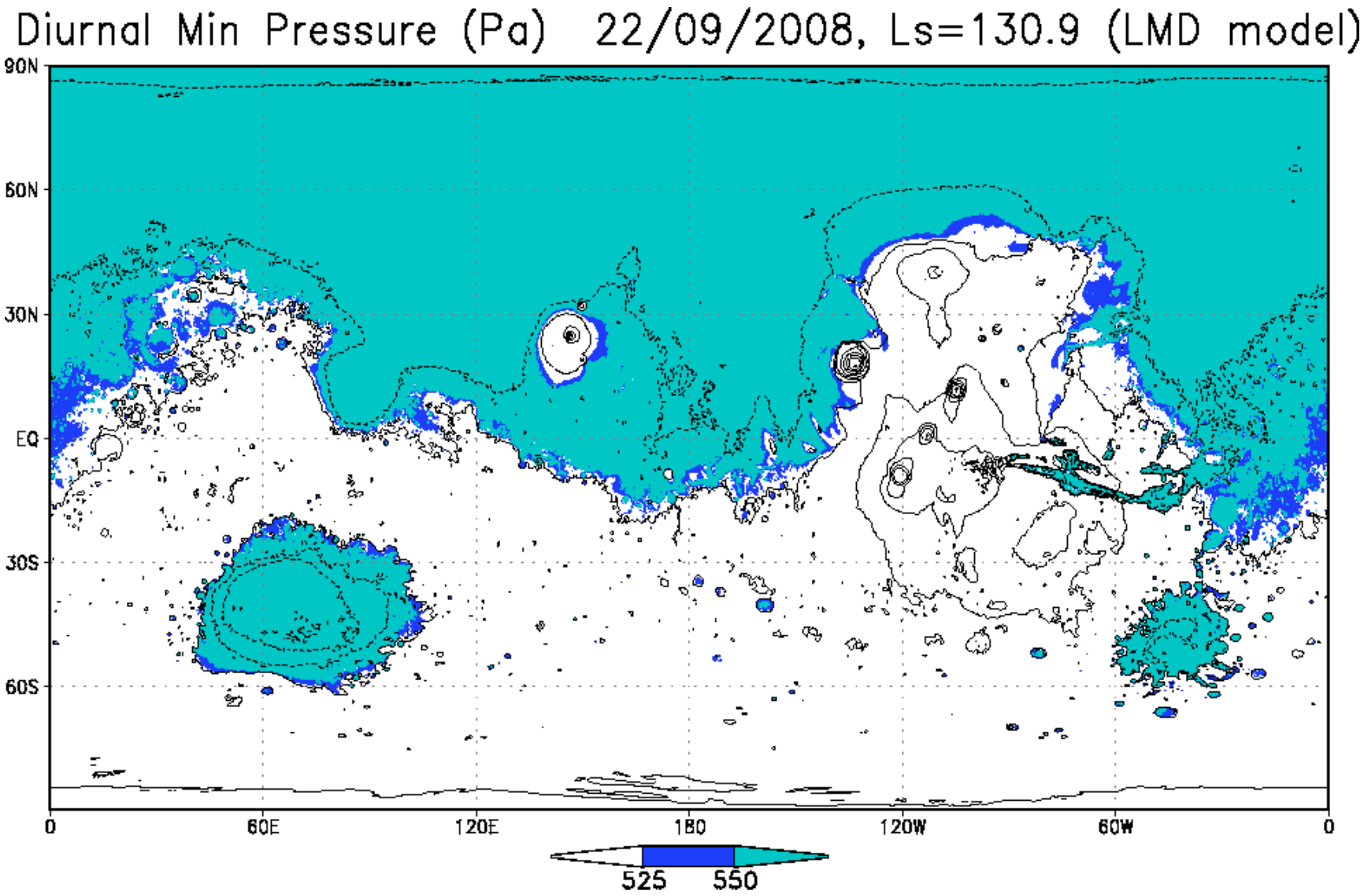


A new tool for surface pressure prediction

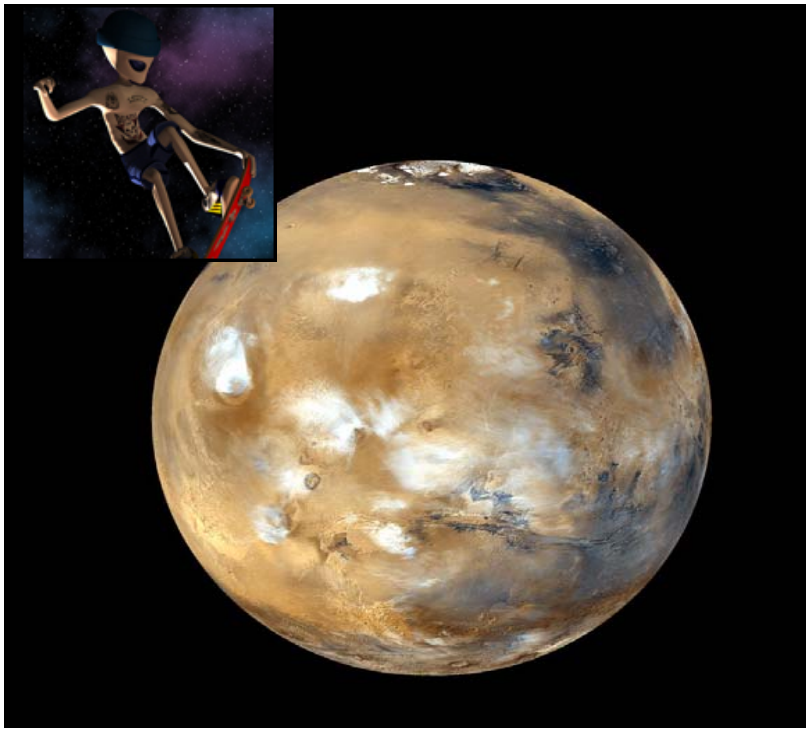
The best possible guess of surface pressure on Mars.

It combines:

- reference pressure measure of Viking lander 1 site at a given seasonal date.
- large scale spatial variation due to meteorology (including thermal tides at a given local time) from the GCM climate database.
- small scale variations due to topography, using 1/32 degree MOLA data


Diurnal Min Pressure (Pa) 22/09/2008, Ls=130.9 (LMD model)
90N
60N
30N
EQ
30S
60S
0
60E
120E
180
120W
60W
0
525
550

Acces to the database MCD 4.0



How to access the database ?

- For intensive use (Fortran subroutines designed for Monte-Carlo re-entry studies):
  - MCD v3.1 on 2 CDroms provided with datafile (NetCDF) and softwares. ⇒ 60 copies currently used !!
  - MCD v4.0 on 1 DVDrom

→ Ask the LMD forget@lmd.jussieu.fr for copies of the database

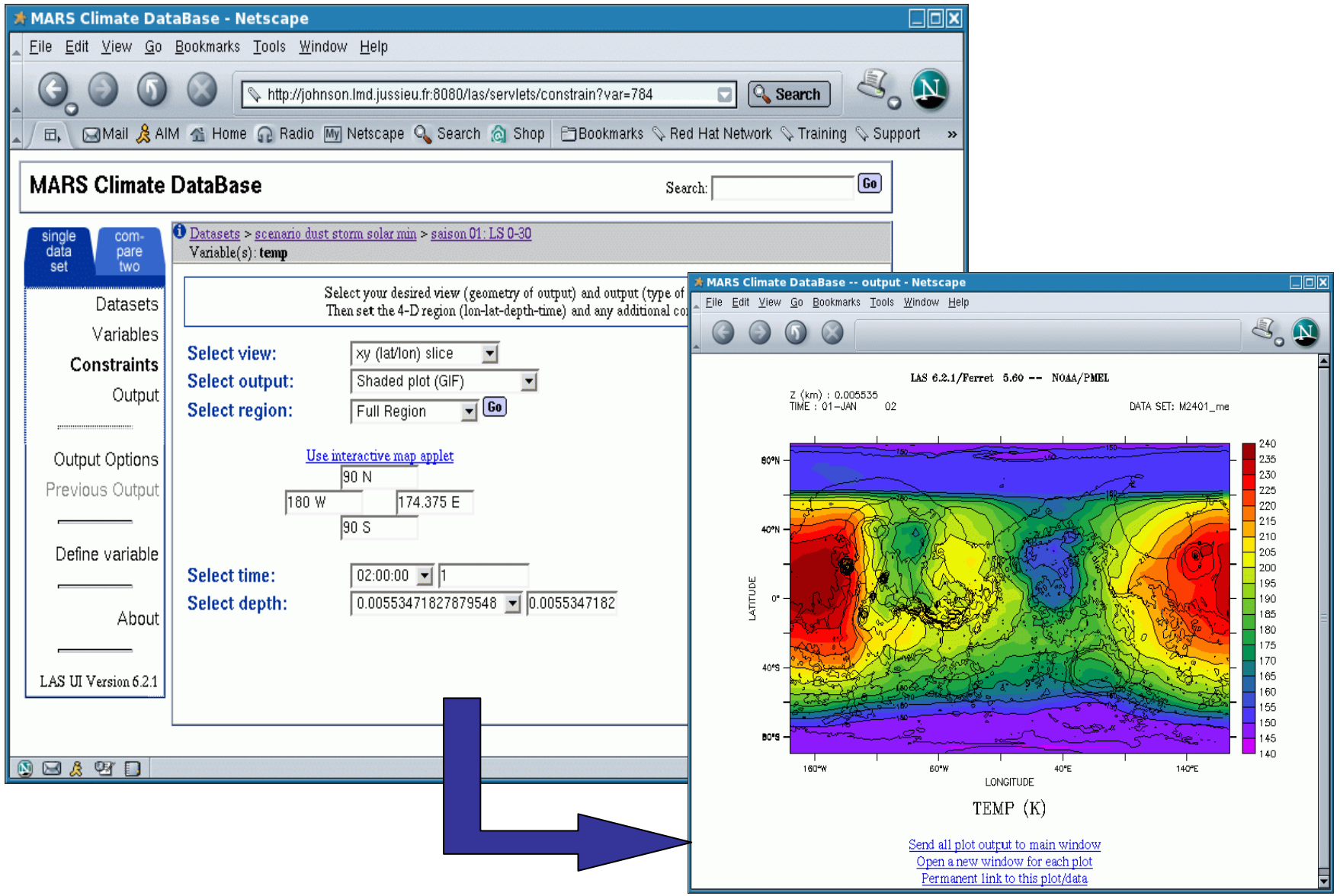
- For moderate use : interactive web site :
  http://www-mars.lmd.jussieu.fr/
  same address for MCDv4.0

New web access

Live Access Server v6.2.1

- acces to all new variables, with all possible scenarios, up to 250km
- Vertical coordinate : altitude above areoid, pressure level, altitude above surface
- allow output comparaisons
- averages, min, max, sum, variances
- numerous output formats (gif, ps, text, netcdf, arcview gridded, ferret script, fortran formatted text…)

Delivery automn 2004


MARS Climate DataBase - Netscape
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Constraints
Output
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Previous Output
Define variable
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LAS UI Version 6.2.1
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Then set the 4-D region (lon-lat-depth-time) and any additional co
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Select output:
Shaded plot (GIF)
Select region:
Full Region
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180 W
174.375 E
90 S
Select time:
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1
Select depth:
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0.0055347182
MARS Climate DataBase -- output - Netscape
File Edit View Go Bookmarks Tools Window Help
LAS 6.2.1/Ferret 5.60 -- NOAA/PMEL
Z (km) : 0.005535
TIME : 01-JAN 02
DATA SET: M2401_me
80°N
40°N
0°
40°S
80°S
LATITUDE
160°W
80°W
40°E
140°E
LONGITUDE
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TEMP (K)
Send all plot output to main window
Open a new window for each plot
Permanent link to this plot/data