5µm EMISSIVITY GLOBAL MAP OF MARS FROM OMEGA/MEX

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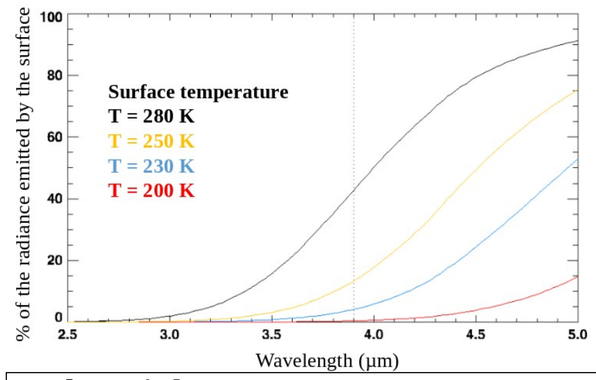
Surface emissivity

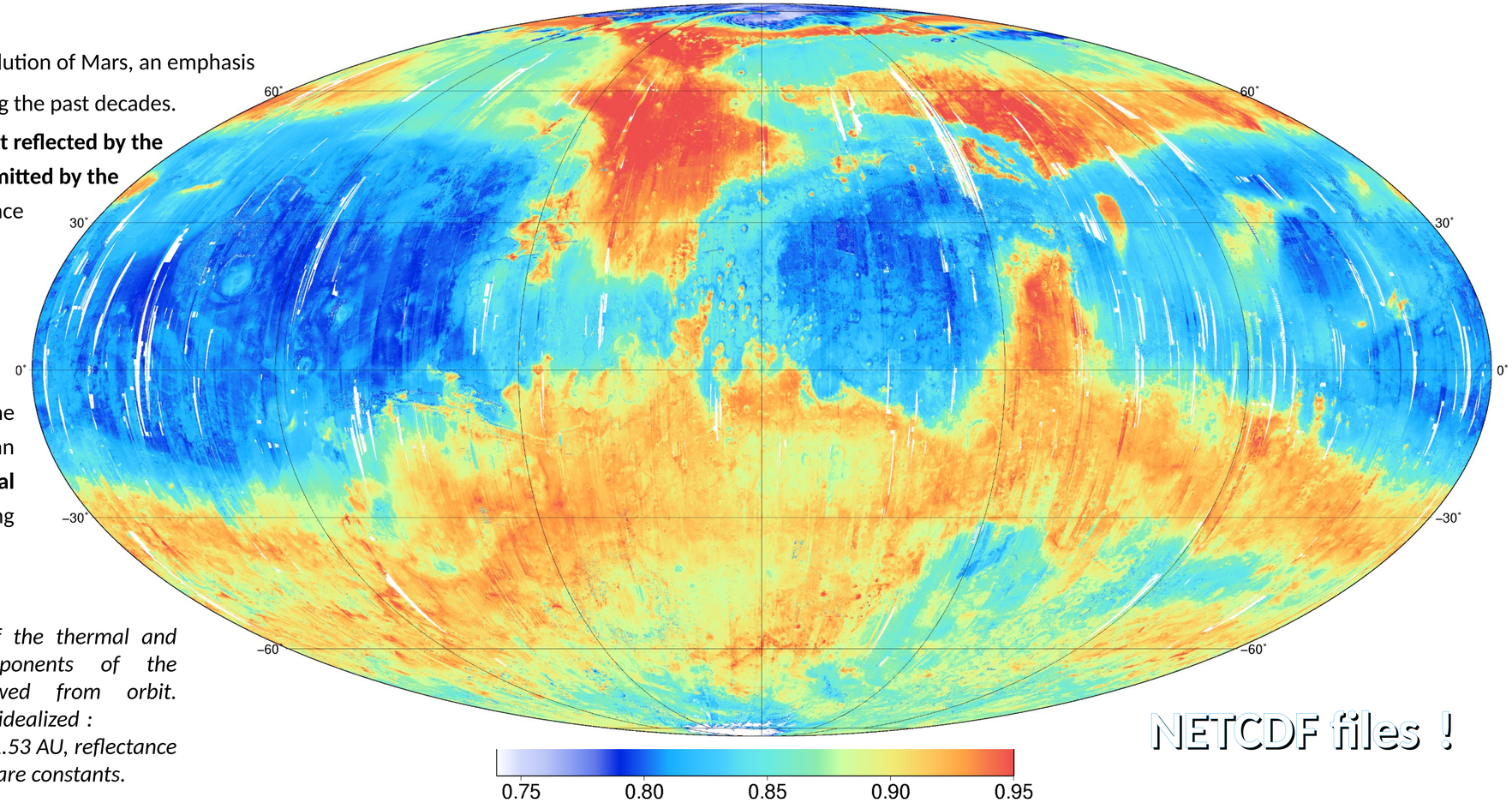
In the community commitment to understanding the history and evolution of Mars, an emphasis has been put on **characterizing the Martian surface properties** during the past decades. Near-infrared spectrometers (like CRISM, <3µm) measure the **sunlight reflected by the surface** and thermal infrared spectrometers measure the **radiance emitted by the surface** (THEMIS, TES > 6µm). In the **transitionnal domain**, the radiance measured from orbit (with **OMEGA, 0.4-5.1µm**) is a **combination of reflected sunlight and thermally emitted radiance** :

$$I_{sat}(\lambda) = H_{atm}(\lambda) r(\lambda) I_{Sun}(\lambda) \cos(i) + H'_{atm}(\lambda) \epsilon(\lambda) I_{Planck}(\lambda, T)$$

In this work, we perform a **computation** and **mapping** of the **emissivity of the Martian surface at 5 to 5,1 µm**, using more than four Martian years of **OMEGA data**. We produce four **40 ppd global maps**, **filled at more than 98 %**. These maps can help interpreting other instruments data and are distributed to the community



Comparison of the thermal and sunlight components of the radiance viewed from orbit. Conditions are idealized : i=30°, Dmars=1.53 AU, reflectance and emissivity are constants.



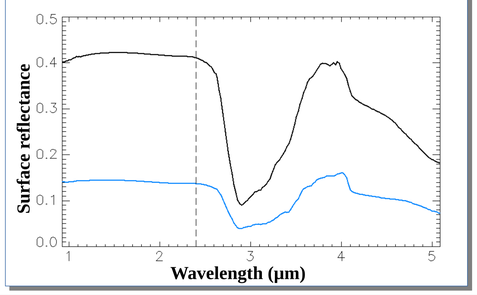
NETCDF files !

Surface emissivity at 5.03µm. 40 ppd (~1.5 km/pixel at the equator), Mollweide projection. Similar maps are available at 5.05, 5.07 and 5.09 µm. White indicate no data, global coverage is 98 %.

Algorithm

Method 1

Comparison of 2.4 µm reflectance with Erard and Calvin (1997) composite spectra and extrapolation at 5 µm



Method 2

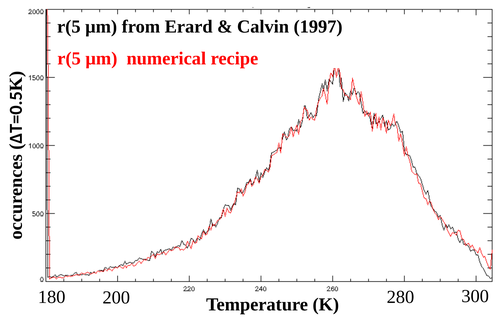
Numerical solver

For each of the four last spectels of OMEGA, we have :

$$I_{sat}(\lambda) = H_{atm}(\lambda) r(\lambda) I_{Sun}(\lambda) \cos(i) + H'_{atm}(\lambda) \epsilon(\lambda) I_{Planck}(\lambda, T)$$

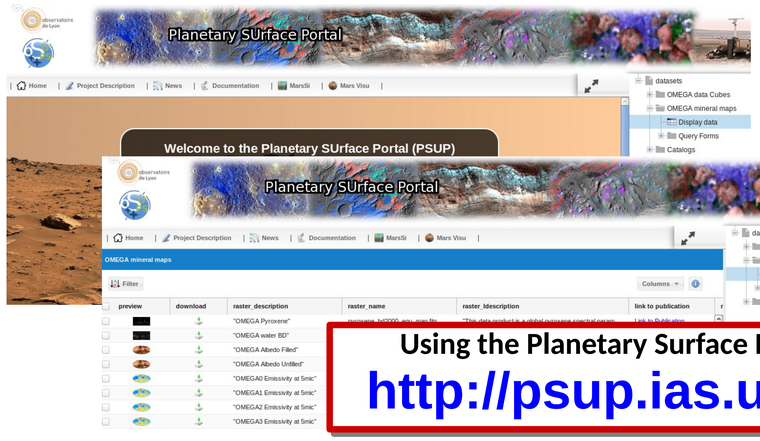
4 equations, 5 unknowns (1 is shared)
→ a simplex can solve for emissivities and temperature

If 2.4 µm data is reliable and if 5 µm data has low signal to noise ratio, use method 1. Otherwise, use method 2. **Excellent agreement** between the two.



global maps at 5.03, 5.05, 5.07 and 5.09 µm

Download and use the maps !



Using the Planetary Surface Portal PSUP at

http://psup.ias.u-psud.fr/