EUROPLANET
N2-N7

3&5&8&9 DWG

A. Coustenis

(LESIA, Observ. de Paris-Meudon)

&

M. Toplis

(CESR, Toulouse)

&

O. Grasset, C. Sotin

(LPGN, Nantes)

France

M.L. Khodachenko (IWF, Graz)

K. Kossacki (Univ. Warsaw)

J. Leliwa-Kopystynski (Univ. Warsaw)

M. Küppers (MPG-MPS)

M. Massironi (CISAS, Padova)

W. Schmidt (FMI)

T. Siili (FMI)

Aims	Specific suggestions
1) Define and archive ground-based observations in support of space missions	- Target selections (comets, moons) and landing sites for SMART-1 (on the Moon) - Stereoscopic images of the Moon and other objects -Optimize Rosetta return -Mercury: observe from the ground at the time of Bepi-Colombo to cross-calibrate the mission data Ex: Cassini-Huygens (DWE- Channel C), Galileo And Lander on pole or other site Titan: RADAR measurements of whole surface during extended Cassini mission. Interpretation of high-resolution DISR images in terms of surface activity and surface-atmosphere interactions
Inducing, and optimizing space missions, follow-up or follow a probe entry, support in case of failure, achieve science objectives : cometary, moon and planet surfaces/subsurfaces composition-structure	
Techniques possible only from the Earth	VLBI radio-tracking of a space mission with probe signal during entry or landing Radar search for solid and liquid extents on moon surfaces
Extended temporal monitoring: study diurnal or seasonal effects	Completing planetary objects' lightcurves , evolution of the surface properties
2) Modeling planetary surfaces	List and archive existing data on: -CH4 absorption coefficients -Aerosols/tholins -Minerals -Ices

Aims	Specific suggestions WG3&5
3) Dating planetary surfaces Extended spatial or global coverage with higher resolution Solar system formation Impact hasards on Earth	Study craterization in the Solar System : combine all available data on crater measurements and complete with new artificial crater (on the Moon?) caused by natural or artificial impactor (deflect small asteroid)
4) Better understand the **volcanism** and tectonics on planetary objects (related to interiors -> M. Toplis DWG8 (minerals), O. Grasset (ices)	High-resolution images (in situ) of all surfaces (as for Titan and Europa) in order to identify and interpret features and tie them to models of interior Seismographs, impact studies, stereo, Radar, laser altimetry
5) Interpretation of surface fceatures -> M. Toplis, O. Grasset	Construct/give access to Earth, Mars and Moon analogues through various databases
6) Laboratory experiments O. Grasset, M. Toplis	Impact, crater and rheological studies Systematic studies of Titan aerosol analogues Lab data required in all fields and in particular ices and mineral systems and mixtures

Planet(ary) moons and surfaces

European excellence

Support to the Cassini-Huygens mission etc

The Moon, the moons

Mars: after MarsExpress and the Aurora program

Mercury : Bepi Colombo in 2016

Venus : little will be known by Venus Express: how to complete?

Titan : The surface composition is still a mystery : Post-Cassini, ground-based monitong

Comets, asteroids : Rosetta, Don Quichotte, Deep Impact I and II - what next?

Questions to address :

Interiors and surfaces of satellites

Surface erosion/ evolution

Laboratory experiments and databases to interpret data

Tectonics : what other bodies besides the Earth have plate tectonics ?

Volcanism/cryovolcanism : origin of volcanoes on Venus and Mars

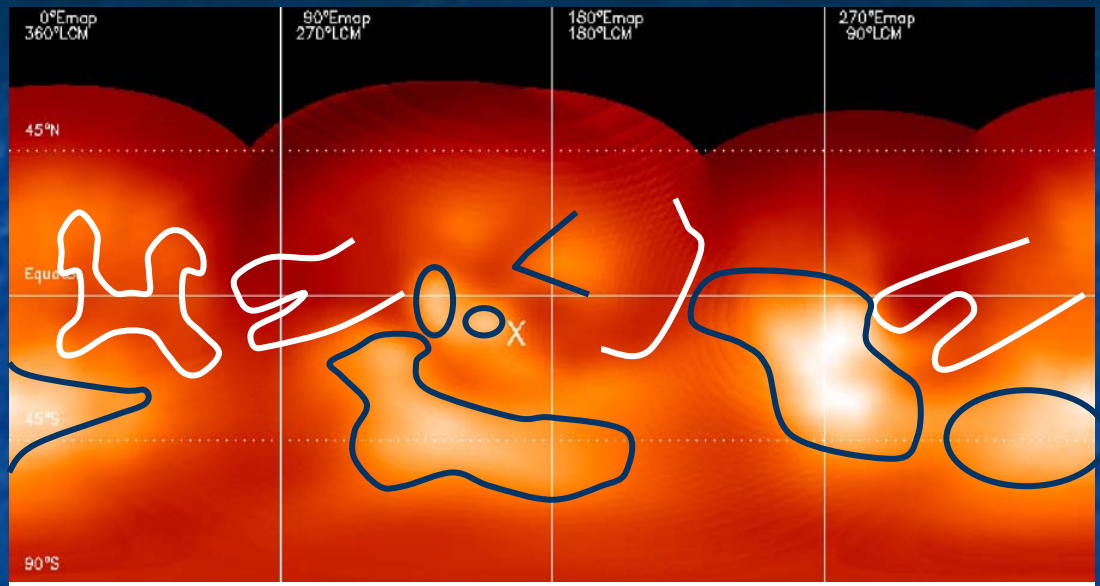
Science case 1: Definition and archiving of ground-based observations in support of space missions

Facility/ Instrument	Wavelength	Time of observation	Goal: Attempt to detect the probe entry	Goal: Titan science
Subaru/ HIPWAC	12 μm	Jan13,14,15	No	Zonal wind ethane profile
VLT/UVES	420-620 nm	Jan 7,12,14,15	No	Zonal wind
VLT/NACO	1.2 – 2.5 μm	18-19 Dec 04 Jan 15,16	No	Atmosphere surface
VLT/SINFONI	1.45 – 2.45	Feb 28	No	Atmosphere surface
Keck/NIRC2	1.485-2.299 μm	Jan 14,15,16,17	Yes	Atmosphere surface
WHT/NAOMI-OASIS	0.8 – 1 μm	Jan 10,19,22	No	Atmosphere surface

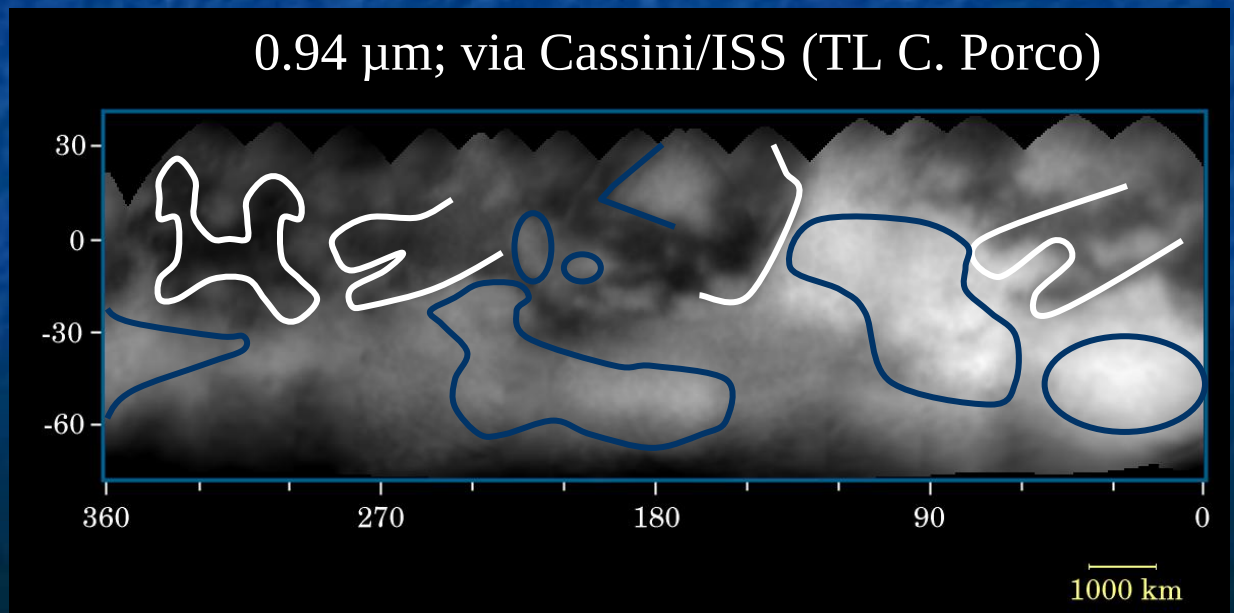
JGR special issue

- Printed version: June 1st 2006
- 14 papers:
  - Overview (Witasse et al.)
  - Zonal winds (Luz et al., Kostiuk et al., Folkner et al.)
  - Ethane profile (Livengood et al.)
  - Atmospheric and surface science (De Pater et al., Adamkovic et al., Hirtzig et al.) : monitoring atmospheric phenomena, deriving surface parameters to complement/extrapolate from the mission.
  - 2-micron spectroscopy of Huygens' landing site (Negrao et al.)
  - Limits to the abundance of surface CO2 ice (Hartung et al.)
  - Huygens Entry Emission: Observation Campaign, Results and Lessons Learned (Lorenz et al.)
  - Aerothermodynamical studies (Magin et al., Caillaux et al.)
  - Titan stellar occultations of November 2003 (Sicardy et al.)

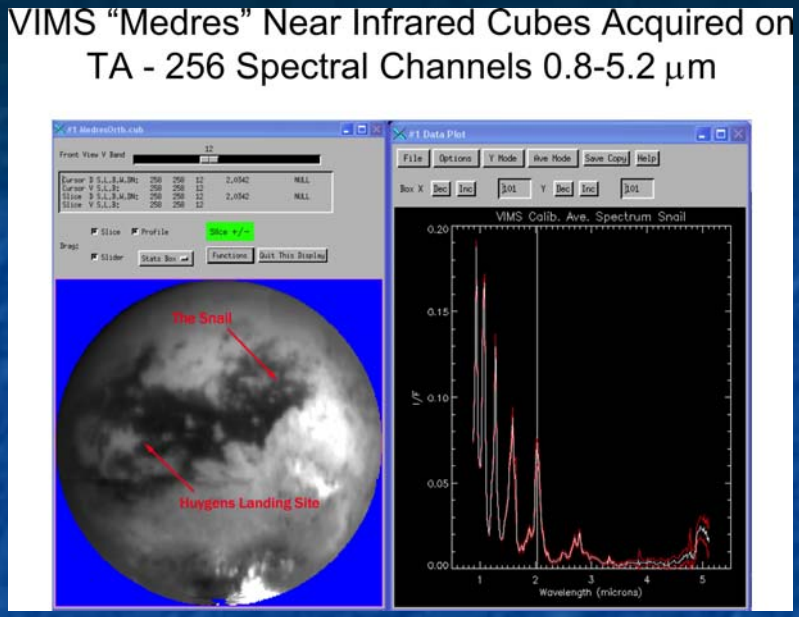
Observations in support of space missions

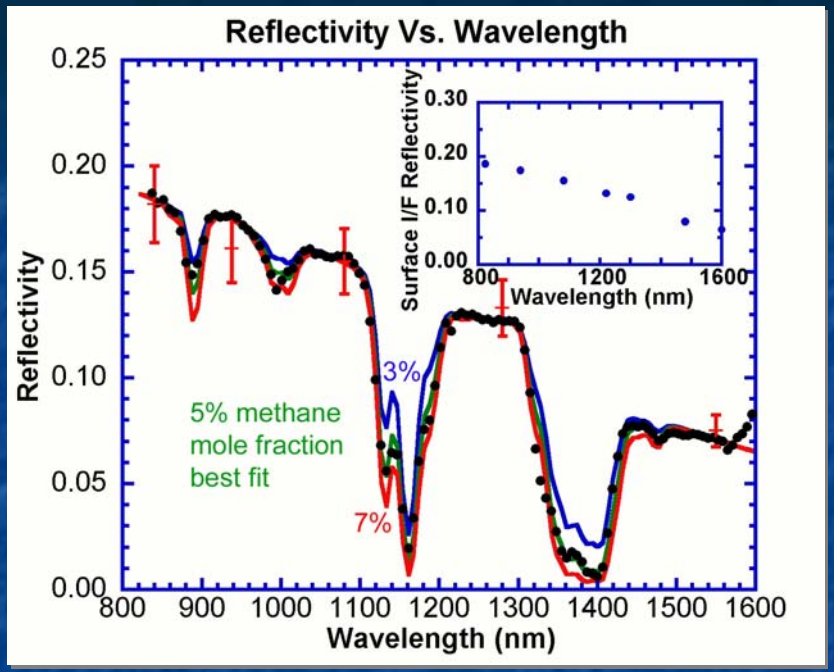


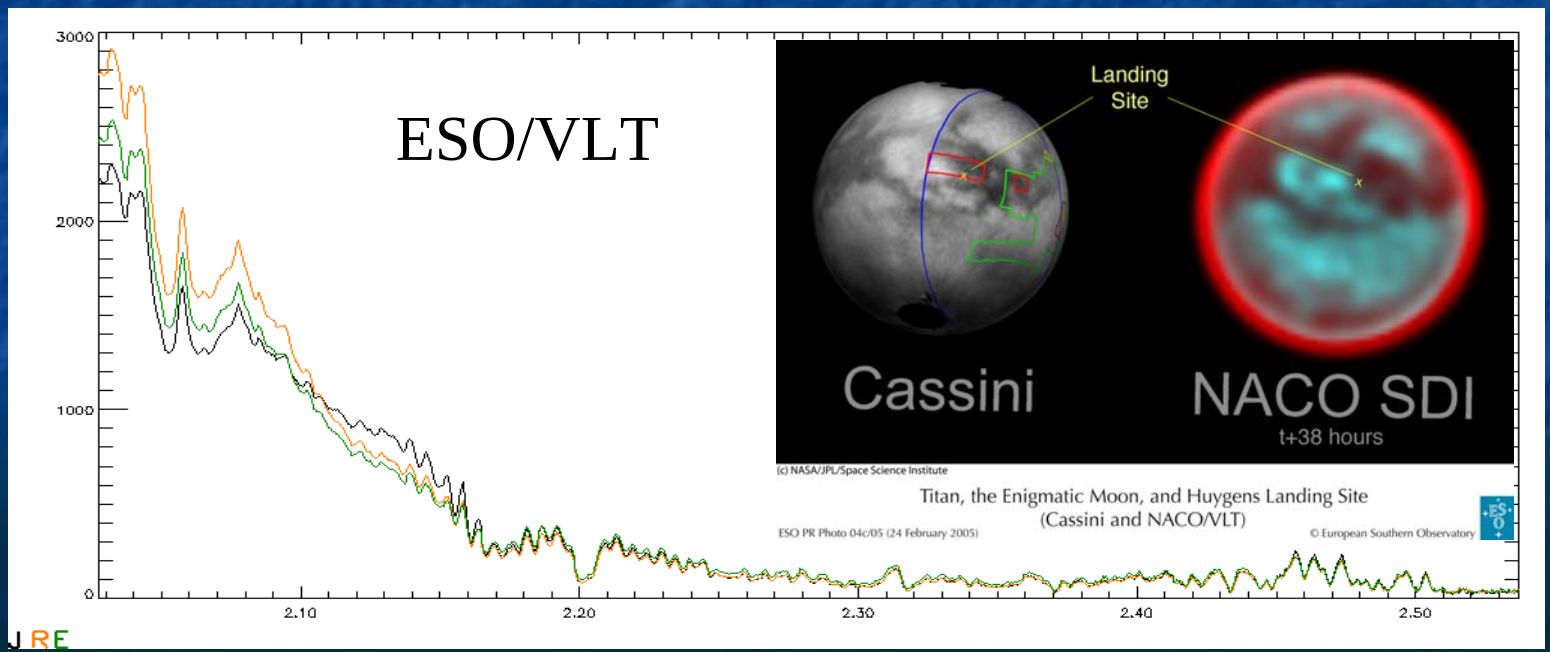
1.28 µm; via NACO (Coustenis *et al*. 2005)



Intercombine data from missions and ground-based







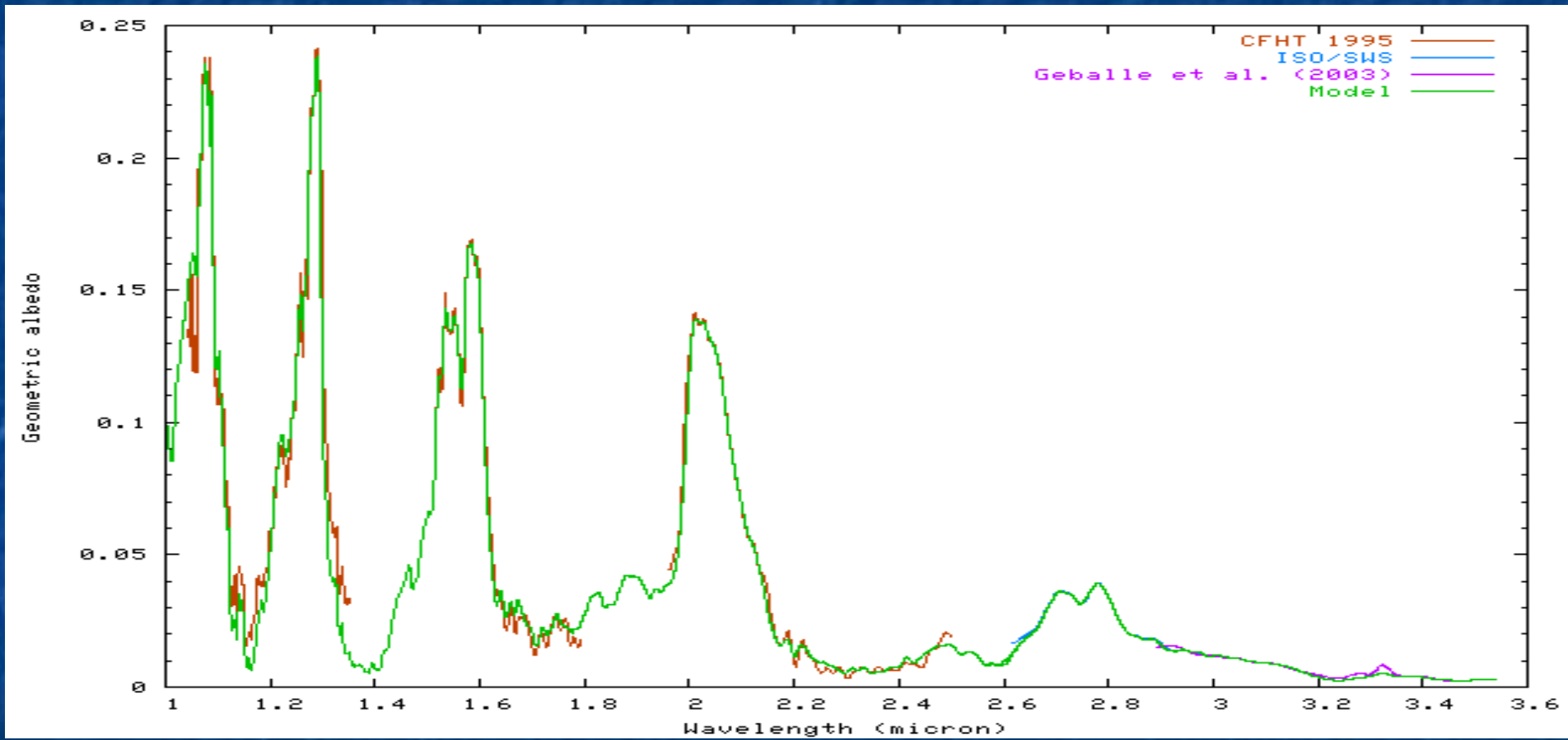
Where to find the data?

- ESO archives
- Mauna Kea Observatories
- Radio ground-based observatories, etc
- Amateurs : call

-> SYNERGY WITH N3

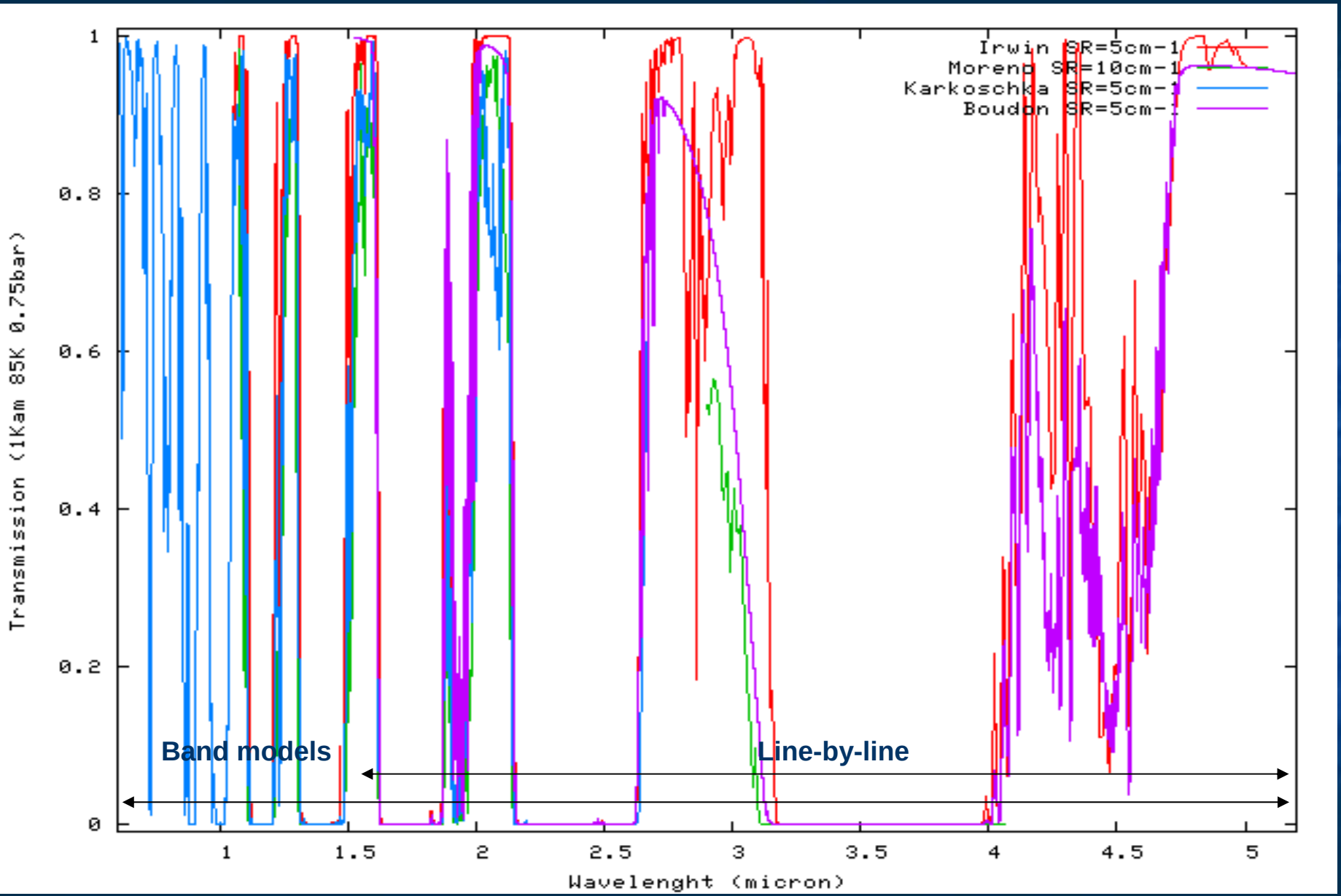
Science case 2:
Catalogue of IR and Raman spectra of gas CH4 coefficients, organics, minerals and ices

Spectrum of Titan in the near-IR 1-3.5 μm: Modeling gives access to the surface composition



CFHT/FTS, VLT/ISAAC and ISO: (Coustenis et al., 2006; Negrao et al., 2006a,b)

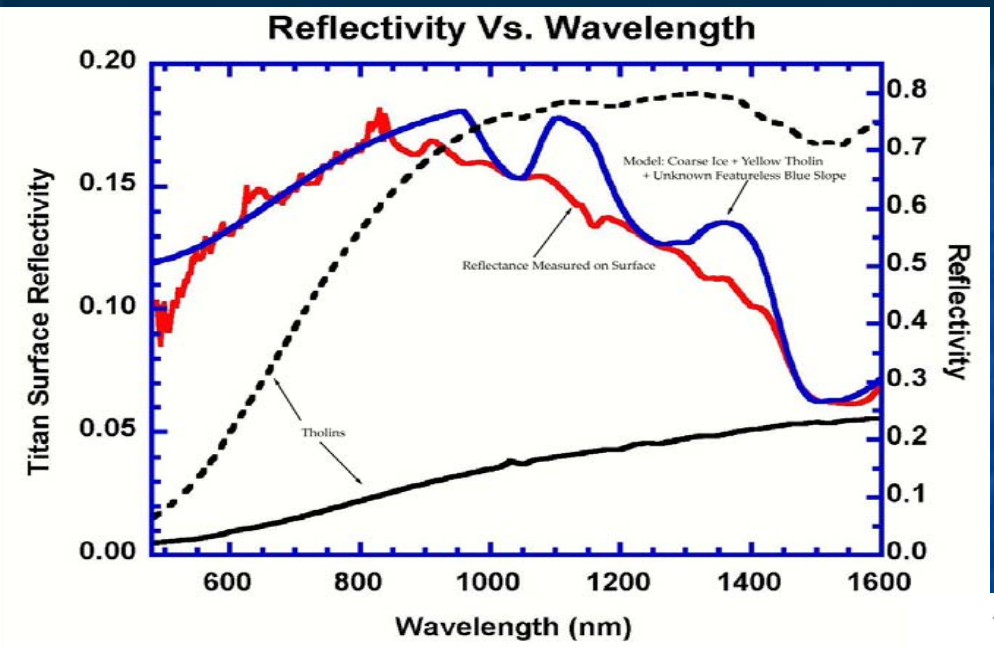
Methane absorption coefficients



Path-lenght: 1 km.am ; **Temperature:** 85 K ; **Pressure:** 750 mbar

Negrão, Coustenis *et al.* (2006a)

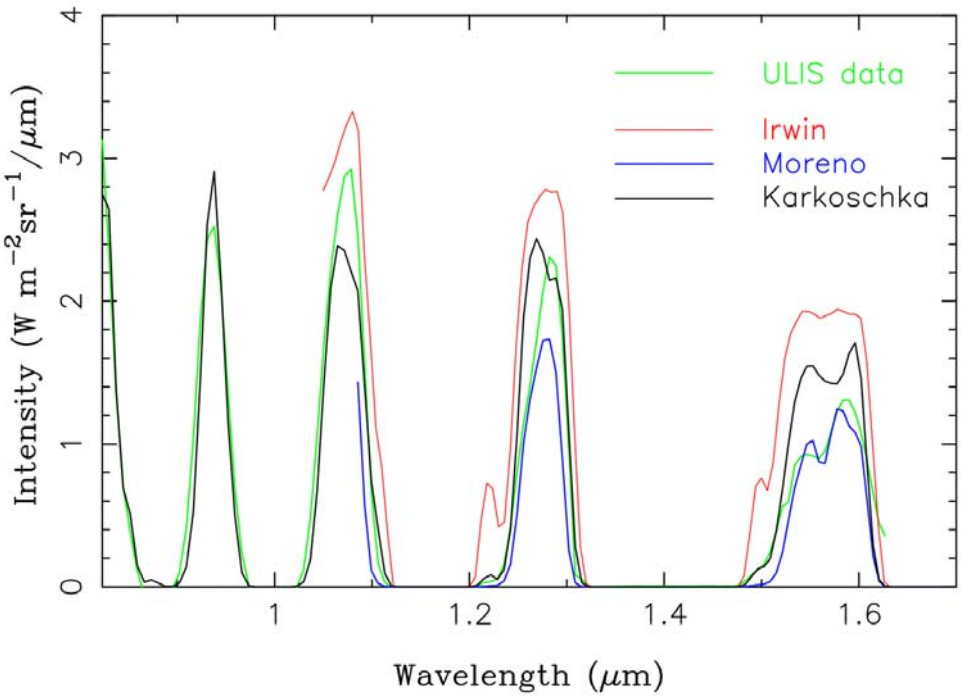
Fit of the DISR data: 0.8-1.6 micron



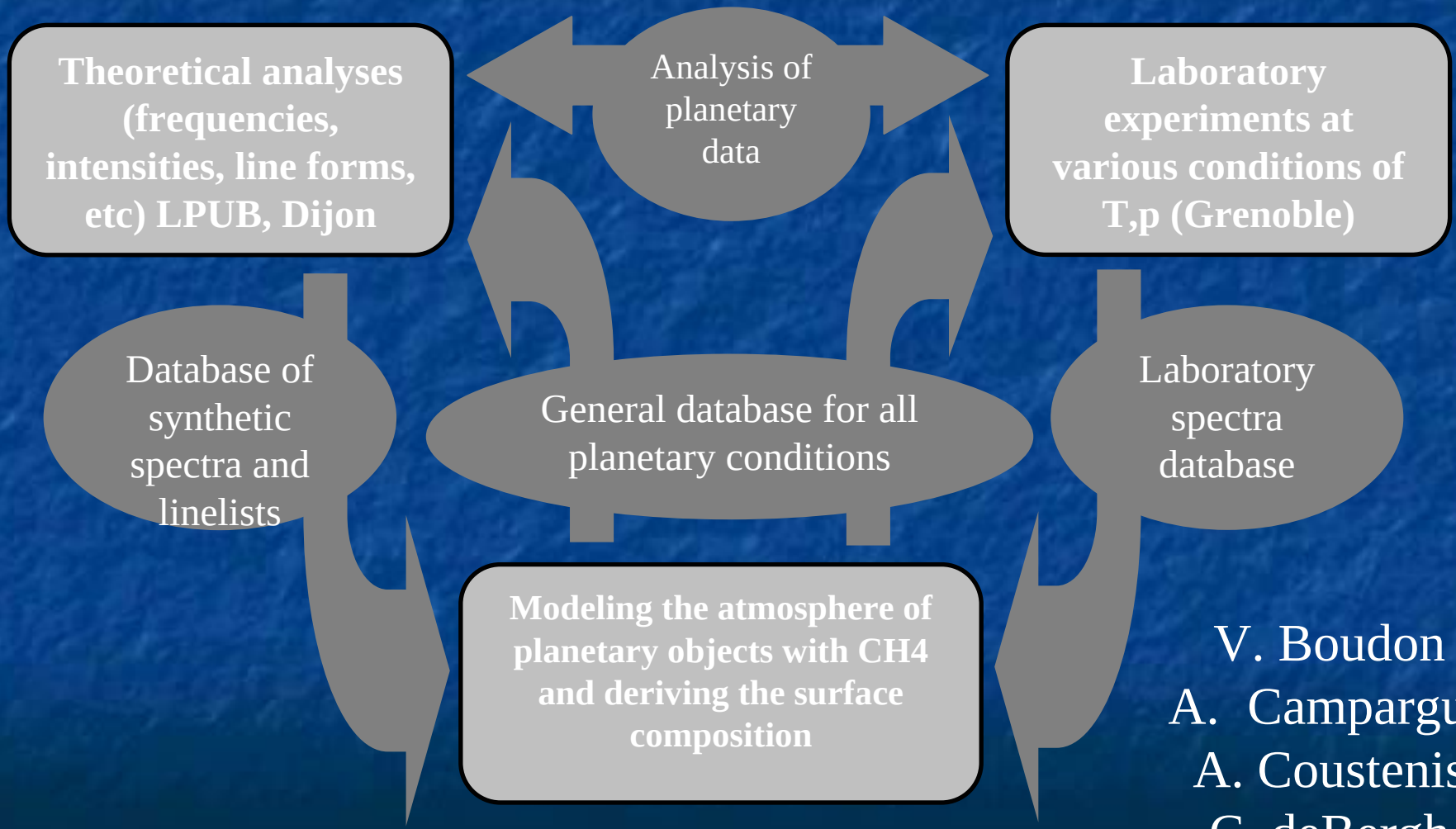
Surface reflectivity as measured by DISR (in red) (Tomasko *et al.*, 2005)

No adequate laboratory spectra for CH_4 on Titan: large pathlengths and low temperatures

No linelists for CH_4 for $\lambda < 1.6$ micron



Methane absorption coefficients : Bringing together the data available



V. Boudon
A. Campargue
A. Coustenis
C. deBergh

Tholin material : black, yellow, etc
For Titan, Triton, etc

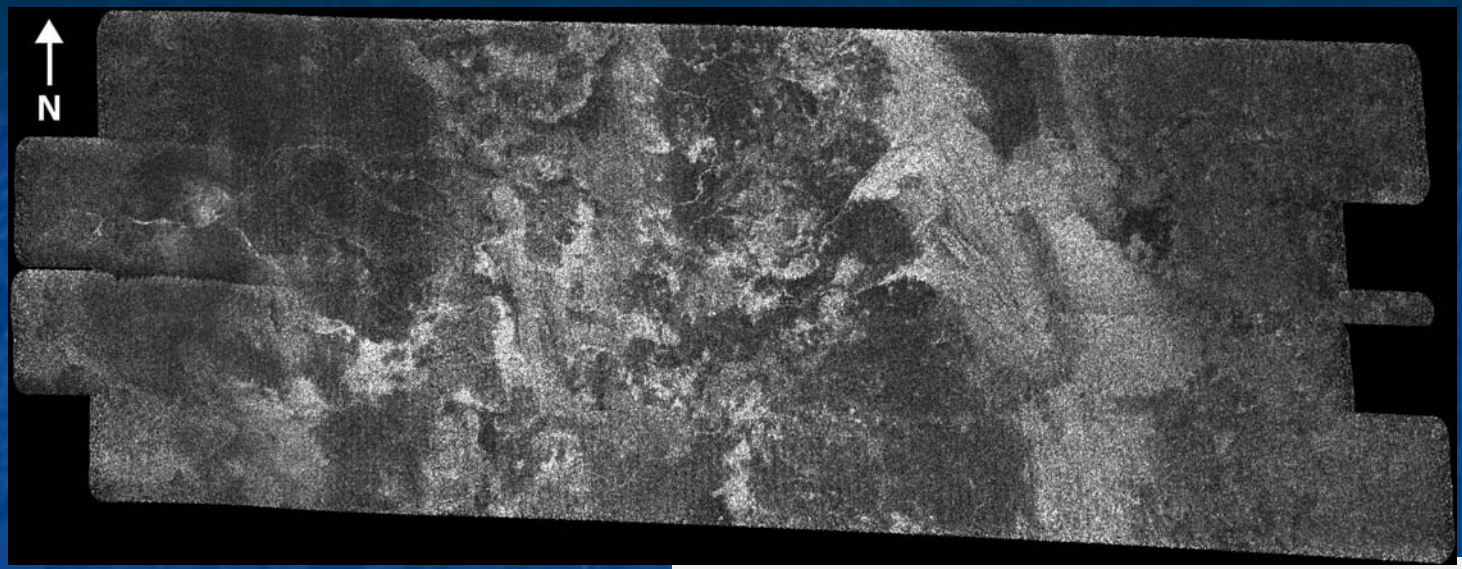
Khare et al.
Imanaka et al.
Raulin, Coll, Bernard et al.

Data exist :

Create a database with all the existing data
Illustrate compatibility with observations
Highlight lacks

Science case 3: Dating planetary surfaces from cratering processes: formation of the solar system

Craters in the solar system: age of planetary surfaces



-CRATERS :

craterization of a planetary bodies

-=> formation and evolution, erosion processes, towards a precise chronology,

distribution of impact densities in the Solar System

=> formation and evolution of the Solar System

-Centralize, catalogue and give easy access to all measurements of cratering processes in the solar system

-Suggestions: complete space or Earth-bound surface mapping of planetary moons and surfaces with the larger ground-based telescopes offering higher spatial resolution than previously

Surface structure and composition :

new observations to complete mapping and composition: RADAR for objects with an atmosphere (Titan) and high-resolution full coverage spectroscopy (Europa)

lightcurves, higher-resolution mapping, better spectral coverage

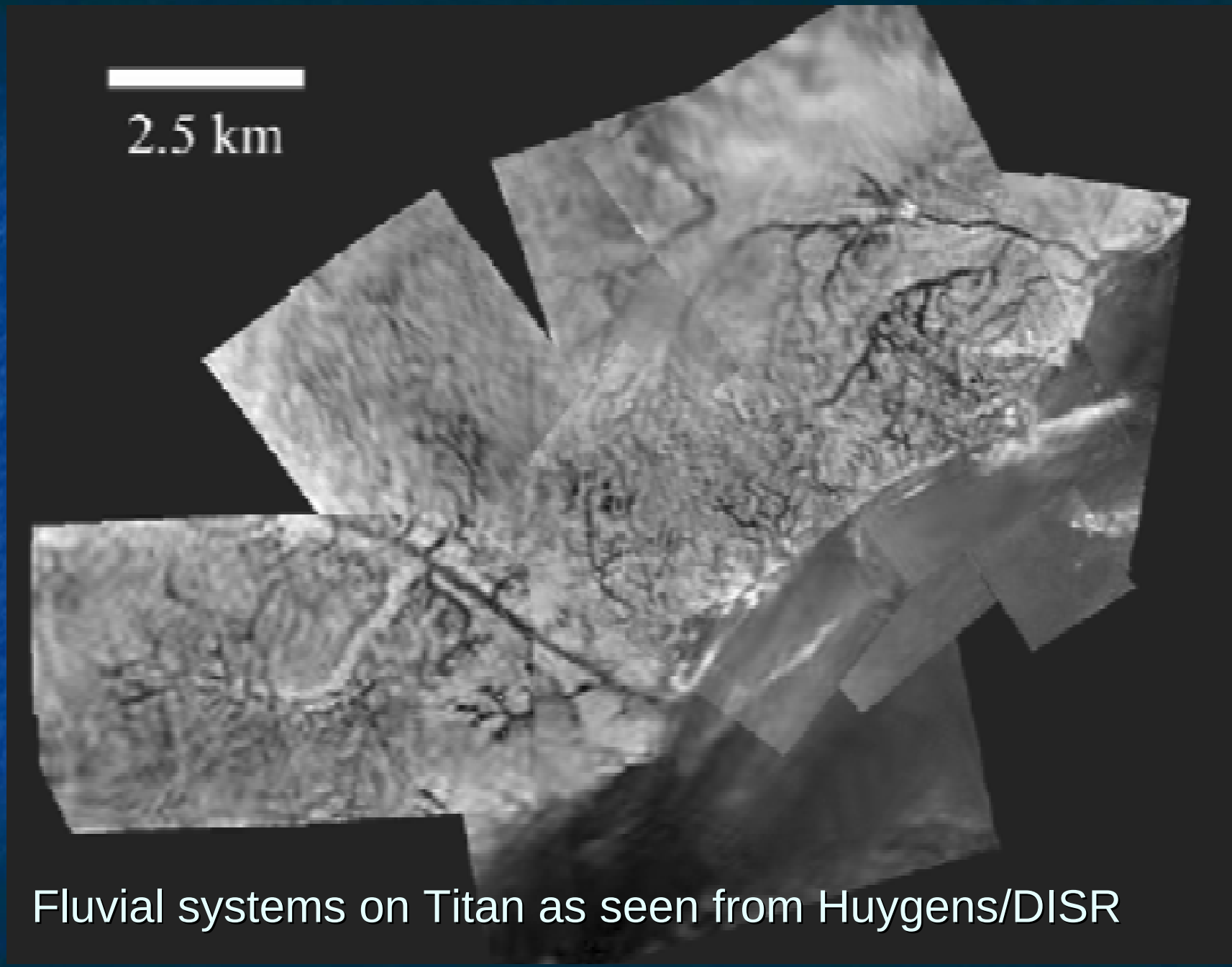
Identification of observed features

Interpretation of planetary data:

-images require identification of Earth analogues or use Mars and Moon features to interpret features on other planetary objects : Titan, etc :

gain access to data from SPOT, LANDSAT, ASTER (commercial :for N7? Can EUROPLANET invest money or create conventions with ESA, etc?)

- spectroscopic lab databases on ices and minerals and mixtures



Fluvial systems on Titan as seen from Huygens/DISR

Connection with other fields

Ground-based observations