

# PLANETARY ATMOSPHERES NODE

## IPSL ACTIVITIES IN EUROPLANET FP6 and FP7

Alain Sarkissian



**IPSL:** Institut Pierre-Simon Laplace includes SA, LMD, LISA and CETP laboratories developing space experiments and atmospheric models related to planetary atmospheres.



# ATMOSPHERE



At Service d'Aéronomie (SA)

IDIS Planetary Atmospheres Node

Coordinators: Alain Sarkissian (SA)

3 Science Cases (4)

60 experts, 12 countries, 20 labs

Access: <http://idis.ipsl.jussieu.fr>

The Planetary Atmosphere Node of EUROPLANET



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## Introduction to the thematic nodes of IDIS

This website is dedicated to the thematic field of Atmosphere as part of the Integrated and Distributed Information Service (IDIS) developed during the EUROPlaNet Project. In General the IDIS System is divided into four thematic nodes and one technical top node.

The EuroPlaNet IDIS thematic science node "Atmosphere" is hosted by the **Centre de données of the Institut Pierre Simon Laplace (IPSL)** and is established in close cooperation with the **Service d'Aéronomie**.

The four EuroPlaNet IDIS thematic science nodes (Planetary Surfaces and Interiors, Atmospheres, Plasma Science and Small Bodies) are dedicated to open a web window to the status of solar system research and provide an effective information management system for scientists and interested persons about solar system knowledge, databases and scientific tools.

The main aim of the Atmosphere node will be to:

- support collaborative work in the field of Atmosphere
- provide information about data bases and scientific tools in this field
- establish an scientific information management
- define and develop Science Cases regarding IDIS

Actually the specific **science cases** related to Atmosphere are under construction:



- Science case 2.1 : Titan Ion Chemistry
- Science case 2.2 : Spectro of CH<sub>4</sub>
- Science case 2.3 : Spicam + GCM
- Science case 2.4 : Super-Rotation

### Contact addresses for this IDIS node:

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Eric Chassefiere, (Eric.Chassefiere(at)aerov.jussieu.fr)



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## Science Case 2.1 : Problem description

- CASSINI/INMS observations of Titan upper atmosphere indicate the presence of ion and molecules which were not expected:
  - which are the key ion-neutral reactions?
  - what are the roles of transport and dynamic?
  - which is the main driver: photons, electrons...?
- Coupling of a complex chemistry model with even 1D transport model is difficult: it is essential to identify key reactions to mimic the composition of Titan ionosphere. Studies of sensitivity are the methods to do so. We need to integrate reaction rates... and their measurement uncertainties.

### Files

Presentation Berlin 2006	PPT
Titan Chemistry Nov2007	PPT



**IDIS N7 Atmosphere Node**

**IDIS Science Case**


# **Titan Ion-Neutral chemistry**

**Leader : Pascal Pernet, LCP, Orsay, France**


**Co-leaders: Odile Dutuit LPG, Grenoble, France**

**Sébastien Lebonnois LMD, IPSL, France**

**Node coordinators: Alain Sarkissian SA, IPSL, France**

  
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## Science Case 2.1 : Databases

## ■ GAPHYOR

- **Content:** Bibliographical database on the Properties of Atoms, Molecules, Gases and Plasmas, including Chemical Reactions

- **Creator(s):** LPGP, Univ. Paris-Sud, Orsay, France

- **Comments:**

- **References:**

- **Medium:** Database interface

- **Simplified form:**

Enter formula with all elements counts (ex: C1H4 for CH<sub>4</sub>) and charge ("+", "-" or nothing)

Formula:  Charge:

## ■ AMBDAS: Atomic and Molecular Bibliographical Database

- **Content:** Atomic and Molecular Bibliographical Database

- **Creator(s):** International Atomic Energy Agency, Nuclear Data Section/Atomic and Molecular Data Unit, Vienna, Austria

- **Comments:**

- **References:**

- **Medium:** Database interface

## ■ OSU chemical database

- **Content:**

- **Creator(s):** Eric Herbst (Columbus University, Ohio, USA), updates by Valentine Wakelam (LAB, Univ. Bordeaux I, France) and Eric Herbst

- **Comments:** Uncertainties are being introduced

- **References:** Lee, Bettend & Herbst (1996, A&AS 119, 111); Smith, Herbst & Chang (2005, MNRAS 350, 323)

- **Medium:** ".csv" file

## ■ UDFA: UMIST Database for Astrochemistry

- **Content:**


- **Creator(s):** T. Millar (Queen's University Belfast, UK) since 1995

- **Comments:** No uncertainties


- **References:** Millar, Farquhar & Willacy (1997, A&AS 121, 139); Le Teuff, Millar & Markwick (2000, A&A 146, 157)

- **Medium:** Database interface / ".csv" file

## ■ Electron Impact Cross Sections (NIST)

  
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**N7 : Integrated and Distributed Information Service (IDIS)**



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## Science Case 2.1 : Bibliography

### Bibliography related to SC 2.1

■ **Bibliography related to SC 2.1**

#### Bibliography of Experts

<ul style="list-style-type: none"> <li>■ Pascal Pernot (LCP)</li> <li>■ Christian Alcaraz (LCP)</li> <li>■ Roland Thissen (LPG)</li> <li>■ Odile Dutuit (LPG)</li> <li>■ Jean Lilensten (LPG)</li> <li>■ Michel Dobrijevic (LAB)</li> <li>■ Nathalie Carrasco (IPSL)</li> <li>■ Sébastien Lebonnois (IPSL)</li> <li>■ André Canosa (PALMS)</li> <li>■ Sébastien Le Picard (IPR)</li> <li>■ Daniela Ascanzi (Univ. Trento)</li> <li>■ Paolo Tosi (Univ. Trento)</li> </ul>	<ul style="list-style-type: none"> <li>■ Zdenek Herman (Heyrovsky Institute)</li> <li>■ Marek Baraszkiewicz (SRC)</li> <li>■ Ingo Müller-Wodarg (Imperial College)</li> <li>■ Marina Galand (Imperial College)</li> <li>■ Wolf Geppert (Stockholm Univ.)</li> <li>■ Detlef Schröder (AVCR)</li> <li>■ Jana Rolova (AVCR)</li> <li>■ Véronique Vuitton (Univ. Tucson)</li> <li>■ Roger Yelle (Univ. Tucson)</li> <li>■ Jan Zabka (Heyrovsky Institute)</li> </ul>
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## At SA

<http://bdap.ipsl.jussieu.fr> : Portal for data and tools related to planetary atmospheres at IPSL.



Mise à jour le 16-09-2005

## ACCES DONNEES EXPERT

- Configurations



Aide



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## Informations sur les expériences et les services à valeur ajoutée

### Données spatiales

MARS

### Sorties de modèles

CLIMAT MARTIEN

CLIMAT VENUS

ATMOSPHERE DE TITAN

### Données d'expériences en laboratoires

SPECTROMETRIE















# At LISA

<http://www.lisa.univ-paris12.fr/GPCOS/SCOOPweb/lesmoleculesdeSCOOP.htm>



## Titan's spectroscopic database

Molecules		Spectral domain	
		Mid-UV	IR
<b>Hydrocarbons</b>			
$C_2H_2$	<i>Acetylene</i>		
$CH_3C_2H$	<i>Methylacetylene</i>		
$CH_2CCH_2$	<i>Allene</i>		
$CH_2CHCCH$	<i>Vynilacetylene</i>		
<b>Polyynes</b>			
$C_4H_2$	<i>Diacétylène</i>		
$C_6H_2$	<i>Triacétylène</i>		



# At LMD

Mars: <http://johnson.lmd.jussieu.fr:8080/las/servlets/dataset>

The screenshot shows the Mars Climate DataBase web interface. At the top, there's a header with a Mars image and the title "Mars Climate DataBase". Below the title is a search bar with the text "Search:" and a "Go" button. On the left side, there's a navigation menu with links: "single data set", "compare two", "Datasets", "Variables", "Constraints", "Output", "Output Options", "Previous Outputs", "Define variable", "Documentation", "LAS Homepage", and "LAS UI Version 6.2.1". The main content area is titled "Datasets" and contains the text "Select a dataset to continue or click on ⓘ (where available) for related informations." with a "Help" button. Below this, there's a section for "Related documentation:" with links to "About dust and solar scenarios", "Informations on solar longitude Ls", and "About vertical coordinates". The "Select dataset:" section lists eight options: 1 - Martian Year 24 dust and average solar flux scenario (ADVISED), 2 - Martian Year 24 dust and minimum solar flux scenario, 3 - Martian Year 24 dust and maximum solar flux scenario, 4 - Dust storm and average solar flux scenario, 5 - Dust storm and minimum solar flux scenario, 6 - Dust storm and maximum solar flux scenario, 7 - Warm scenario (dusty, with maximum solar flux), and 8 - Cold scenario (clear, with minimum solar flux). At the bottom, there's a footer with logos for LMD/CNRS, Open University, University of Oxford, CMC, ESA, and a Mars rover icon.

**Mars Climate DataBase**

Search:  Go

[single data set](#) [compare two](#)

**Datasets**

Variables

Constraints

Output

Output Options

Previous Outputs

Define variable

Documentation

LAS Homepage  
LAS UI Version 6.2.1

Select a dataset to continue or click on ⓘ (where available) for related informations. [Help](#)

**Related documentation:** ⓘ [About dust and solar scenarios](#)  
ⓘ [Informations on solar longitude Ls](#)  
ⓘ [About vertical coordinates](#)

Select dataset:

- [1 - Martian Year 24 dust and average solar flux scenario \(ADVISED\)](#)
- [2 - Martian Year 24 dust and minimum solar flux scenario](#)
- [3 - Martian Year 24 dust and maximum solar flux scenario](#)
- [4 - Dust storm and average solar flux scenario](#)
- [5 - Dust storm and minimum solar flux scenario](#)
- [6 - Dust storm and maximum solar flux scenario](#)
- [7 - Warm scenario \(dusty, with maximum solar flux\)](#)
- [8 - Cold scenario \(clear, with minimum solar flux\)](#)

LMD/CNRS Open University University of Oxford CMC ESA

# At LMD

Titan : <http://web.lmd.jussieu.fr/titanDbase/>

## GCM TITAN DATABASE

Institut Pierre-Simon Laplace

- Laboratoire de Meteorologie Dynamique, Jussieu, Paris, France
- Service d'Aeronomie, Verrieres-le-Buisson, France

Project developed by:

Pascal RANNOU [pra@aero.jussieu.fr](mailto:pra@aero.jussieu.fr)

Frédéric HOURDIN [hourdin@lmd.jussieu.fr](mailto:hourdin@lmd.jussieu.fr)

Sébastien LEBONNOIS [Sebastien.Lebonnois@lmd.jussieu.fr](mailto:Sebastien.Lebonnois@lmd.jussieu.fr)

David LUZ [luz@despace.obspm.fr](mailto:luz@despace.obspm.fr)

We have developed in the last decade a two dimensional version of the LMD Titan General Circulation Model. This model accounts for multiple coupling occurring on Titan between dynamics, haze, chemistry and radiative transfer. It was successful at explaining many observed features related to atmosphere state (wind, temperature), haze structure and chemical species distributions. An important step in our knowledge about Titan has now been taken with the Cassini mission and Huygens descent on Titan. In this context, we want to make the results of our model available for the scientific community which is involved in the study of Titan. Such a tool should also be useful for interpreting ground based telescope observations.

Our results are presented here as an atmospheric database, in an ASCII file database.wrk (around 28 Mo).

To use it, two methods are proposed:

- Use the Fortran routines ready to read the database
- Get and install the Graphical User Interface (GUI) package

But first, you may want to get and read the User's Guide.

These files are available below. Up-to-date versions are:

- User's Guide: online january 17, 2006.
- database: 1.5, online end november 2007
- GUI: 1.0, online end december 2005

### USER'S GUIDE

In pdf format: [users\\_guide.pdf](#)

In postscript format: [users\\_guide.ps](#)

### DOWNLOAD THE DATABASE



http://vo-web.obspm.fr/  
 at VO-Paris Data Centre  
 (OBSPM) Virtual Observatory activities of IPSL  
 Definition of standards, Data Model, Interoperability and VO tools for planetology