GEISA/IASI-03 DATA QUALITY EVALUATION: Trough comparisons with other public database archives

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OUTLINE

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II) **DATABASE FORMATS**

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1) Updating of H_2O in GEISA (GEISA/IASI-03)

2) Differences between GEISA (GEISA/IASI-03) and HITRAN-04

3) Differences between GEISA(GEISA/IASI-03) and MIPAS-03

IV) **EVALUATION OF THE IMPACT OF SPECTROSCOPIC ARCHIVE DIFFERENCES ON RADIATIVE TRANSFER SIMULATIONS**

V) **CONCLUDING COMMENTS**

Data bases involved in comparisons

- **GEISA** Jacquinet-Husson et al. Proc. of the 13th International TOVS Study Conference, Sainte-Adèle, Canada, 28 Oct-4 Nov. 2003

  and

- **GEISA/IASI-03** Jacquinet-Husson et al. JQSRT 95 (2005) 429-467.

- **HITRAN-04** Rothman et al. JQSRT 96 (2005) 139-204.

- **MIPAS Dedicated Spectroscopic Database**
  Flaud et al. Atm. And Ocean Optics, 16 (2003) 172-182.

Evaluation of the differences in contents and subsequent radiative transfer modelling impacts

DATABASES OVERVIEW

The GEISA-2003 system

Gestion et Etude des Informations Spectroscopiques Atmosphériques
Management and Study of Atmospheric Spectroscopic Information

Three SUB-DATABASES

- **Line transition parameters database**
  - 42 molecules (96 isotopic species)
  - 1,668,371 entries between 0 and 35,877 cm^{-1}
- **Absorption cross-sections database**
  - IR: 32 molecular species (mainly CFC's)
  - UV/Visible : 11 molecular species
- **Aerosol data archive and softwares**

ASSOCIATED MANAGEMENT SOFTWARES

(For each sub-database)

GEISA/IASI-03 database general context

GEISA/IASI-03 database: *extraction* (spectral range 599-3001 cm^{-1}) and *partial update of* GEISA-03 Spectroscopic database

- **Maintained and developed with the purpose of assessing the IASI measurements capabilities, within the ISSWG, in the frame of the CNES/EUMETSAT European Polar System (EPS) preparation, by simulating high resolution radiances and/or using experimental data.**

- **IASI mainly designed for operational meteorological soundings with a very high level of accuracy. Measurement technique based on passive IR remote sensing using an accurately calibrated Fourier Transform Spectrometer operating in the 3.7- 5.5 µm spectral range**

Continuous update

Associated interest for AIRS

IASI : Infrared Atmospheric Sounding Interferometer
AIRS : Advanced InfraRed Sounder
ISSWG : IASI Sounding Science Working Group
CNES : Centre National d'Etude Spatiales, France
EUMETSAT : EUropean organization for the exploitation of METeorological SATellites

The GEISA/IASI-2003 system

Gestion et **E**tude des **I**nformations **S**pectroscopiques **A**tmosphériques
Infrared **A**tmospheric **S**ounding **I**nterferometer

Three SUB-DATABASES

- **Individual spectral lines spectroscopic parameters database**

  14 molecules (53 isotopic species):

  H_2O, CO_2, O_3, N_2O, CO, CH_4, O_2, NO, SO_2, NO_2, HNO_3, OCS, C_2H_2, N_2

- **Absorption cross-sections database (mainly CFC's)**

  6 molecular species:

  CFC-11, CFC-12, CFC-14, CCl4, N2O5, HCFC-22

- **Microphysical and optical properties of Basic Atmospheric aerosol components database**

ASSOCIATED MANAGEMENT SOFTWARES

(For each database)

ELSEVIER

Journal of Quantitative Spectroscopy & Radiative Transfer 95 (2005) 429–467

Journal of Quantitative Spectroscopy & Radiative Transfer

www.elsevier.com/locate/jqsrt

The 2003 edition of the GEISA/IASI spectroscopic database

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16 Laboratories

MIPAS Dedicated Spectroscopic Database

- **MIPAS (Michelson Interferometer for Passive Atmospheric Sounding) experiment operating on board the ENVISAT satellite since March 2002**
- **Recording emission limb sounding spectra at 0.025 cm^{-1} (unapodized) in the spectral range 685-2410 cm^{-1}**
- ***Starting from HITRAN-96 and GEISA-97, and updated in 2001 and 2003 with specific spectroscopic studies or from spectroscopic studies prior to their publications***
- **32 molecules retained from the HITRAN list (O, NO+, HOBr, C_2H_4, CH_3OH, H_2CO, CH_3OH discarded)**
- **Molecular line parameters updated for: H_2O, CO_2, O_3,N_2O, CH_4,NO_2,HNO_3,HOCl,COF_2**
- ***Validation through ATMOS and MIPAS recorded spectra***

DATABASE FORMATS

GEISA andGEISA/IASI-03 Line Transitions Records

A-J fields — Mainly specific of GEISA management software

- **(A)** Wavenumber (cm^{-1}) of the line associated with the vibro-rotational transition.
- **(B)** Intensity of the line (cm $molecule^{-1}$ at 296K).
- **(C)** Lorentzian collision halfwidth (cm^{-1} atm^{-1} at 296K).
- **(D)** Energy of the lower transition level (cm^{-1}).
- **(E)** Transition quantum identifications for the lower and upper levels of the transition
- **(F)** Temperature dependence coefficient *n* of the halfwidth
- **(G)** Identification code for isotope.
- **(I)** Identification code for molecule.
- **(J)** Internal GEISA code for data identification.

K-Q fields in the GEISA format — Mainly HITRAN-01 format inter-compatibility related

- **(K)** Molecule number as in HITRAN
- **(L)** Isotope number as in HITRAN
- **(M)** Transition probability (in $debye^2$)
- **(N)** Self broadening pressure halfwidth (HWHM) ($cm^{-1}atm^{-1}$) at 296K (for water)
- **(O)** Air pressure shift of the line transition ($cm^{-1}atm^{-1}$) at 296K
- **(P)** Accuracy indices for wavenumber, intensity and halfwidth
- **(Q)** Indices for lookup of references for wavenumber, intensity and halfwidth

GEISA-03 Line Transitions Records (following)

R-U' fields in the GEISA/IASI format **Mainly IASI specific**

(R) Temperature dependence coefficient n of the air pressure shift
(A') Estimated accuracy (cm-1) on the line position
(B') Estimated accuracy on the intensity of the line in (cm^{-1}/(molecule.cm^{-2})
(C') Estimated accuracy on the air collision halfwidth (HWHM) ($cm^{-1}atm^{-1}$)
(F') Estimated accuracy on the temperature dependence coefficient n of the air broadening HW
(O') Estimated accuracy on the air pressure shift of the line transition ($cm^{-1}atm^{-1}$) @296K
(R') Estimated accuracy on the temperature dependence coefficient n of the air pressure shift

Water specific

(N') Estimated accuracy on the self broadened (HWHM) ($cm^{-1}atm^{-1}$) @296K
(S) Temperature dependence coefficient n of the self broadening halfwidth
(S') Estimated accuracy on the temperature dependence coefficient n of the self broadening
(T) Self pressure shift of the line transition ($cm^{-1}atm^{-1}$) @296K
(T') Estimated accuracy on the self pressure shift of the line transition ($cm^{-1}atm^{-1}$) @296K
(U) Temperature dependence coefficient n of the self pressure shift
(U') Estimated accuracy on the temperature dependence coefficient n of the self pressure sh

209 Characters record

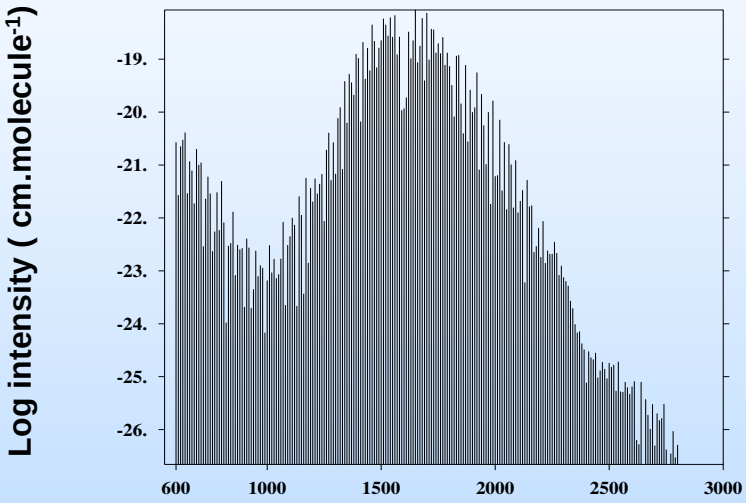
UPDATING OF SPECTROSCOPIC PARAMETERS: examples of issues

1) Updating of H_2O in GEISA and GEISA/IASI-03

H2O GEISA/IASI-0_3 updating and alternative archive

Toth's (2000, 2002)

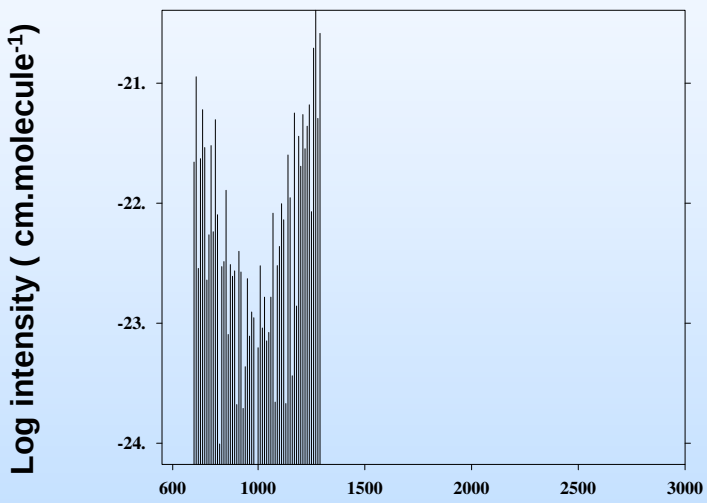
599.681 - 2819.848 cm^{-1}



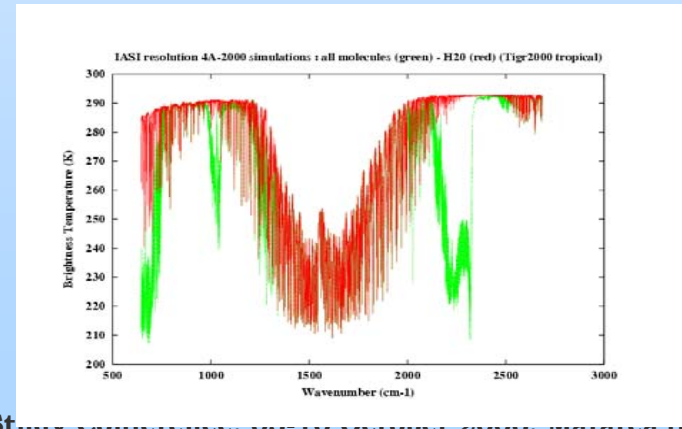
Choice for GEISA/IASI-03 update

RAL/ EUMETSAT

700.032 - 1299.980 cm^{-1}



Alternative choice for GEISA/IASI-03 update



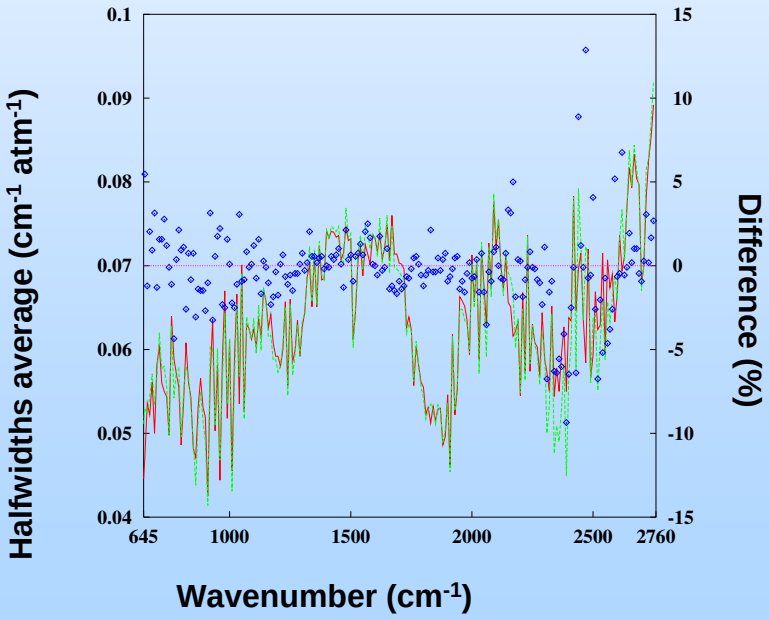
2) DIFFERENCES BETWEEN GEISA (GEISA/IASI-03) and HITRAN-04

H_2O Intensity Differences

GEISA/IASI 03 *(Toth's data)* and HITRAN 04 comparisons for air-broadened half-widths (HW) and intensities (I)

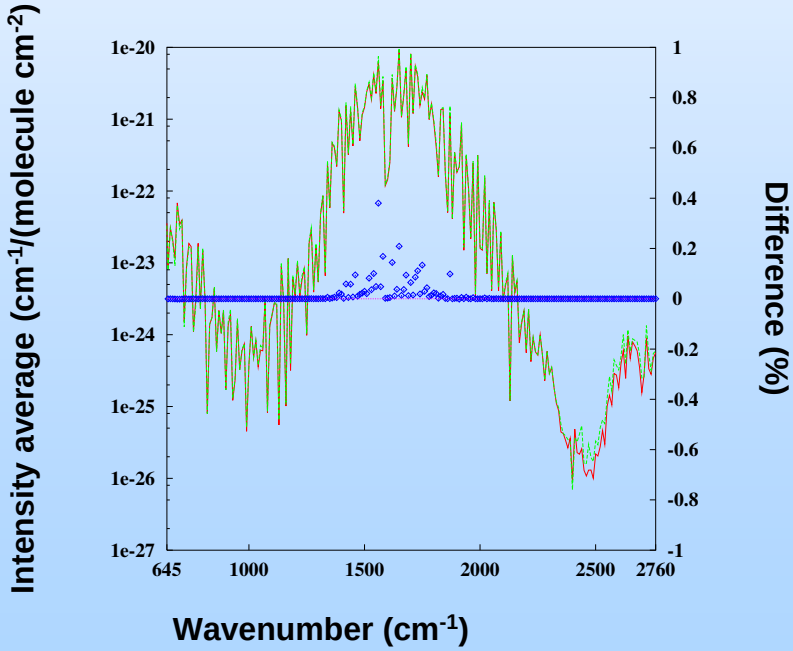
% 10 cm^{-1} HW Average difference

$$(HW_{H04} - HW_{G03}) / (HW_{H04\,max} + HW_{G03\,max})*2*100$$



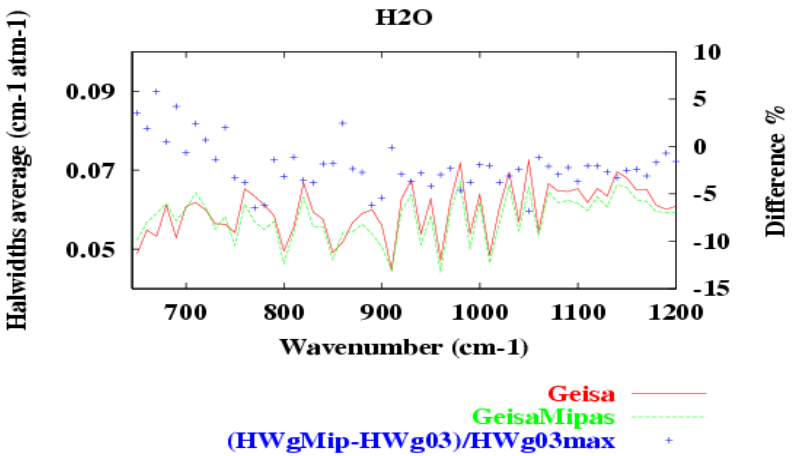
% 10 cm^{-1} Intensity Average difference

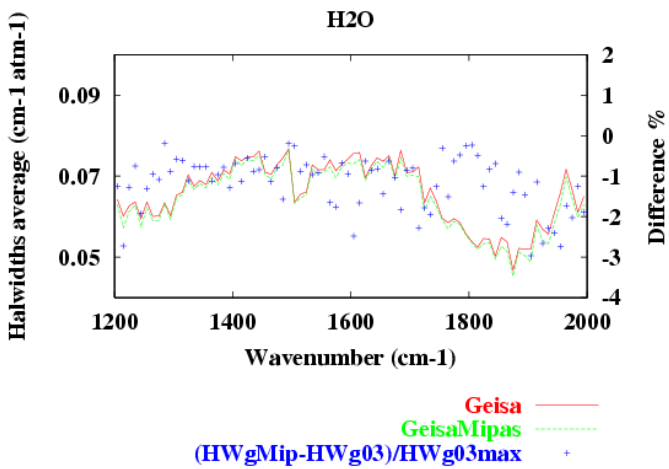
$$(I_{H04} - I_{G03}) / (I_{H04\,max} + I_{G03\,max})*2*100$$

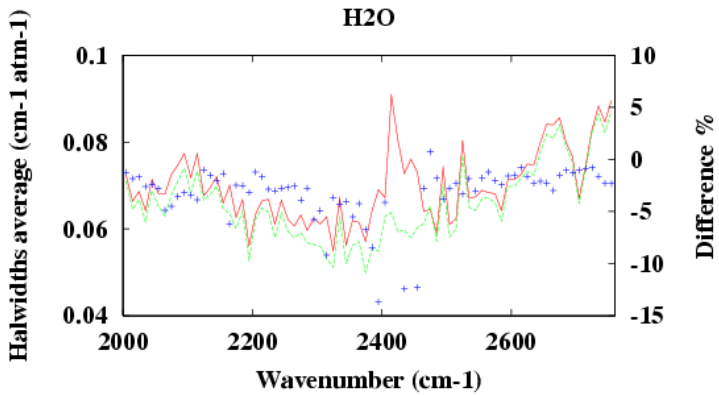


3) DIFFERENCES BETWEEN GEISA (GEISA/IASI-03) and MIPAS-03

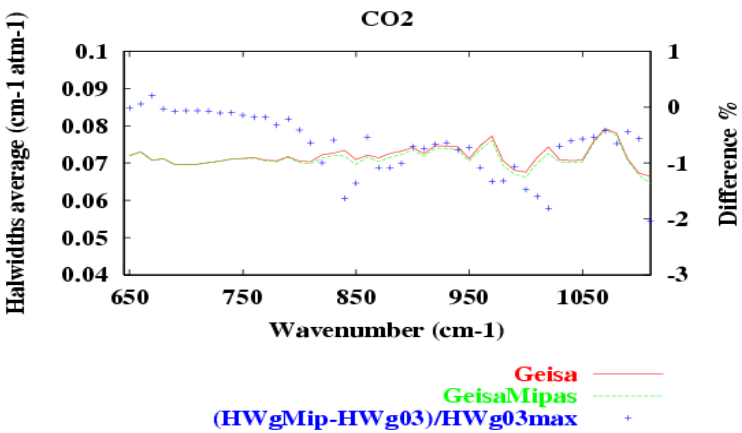
H_2O Collision Half-Width Differences

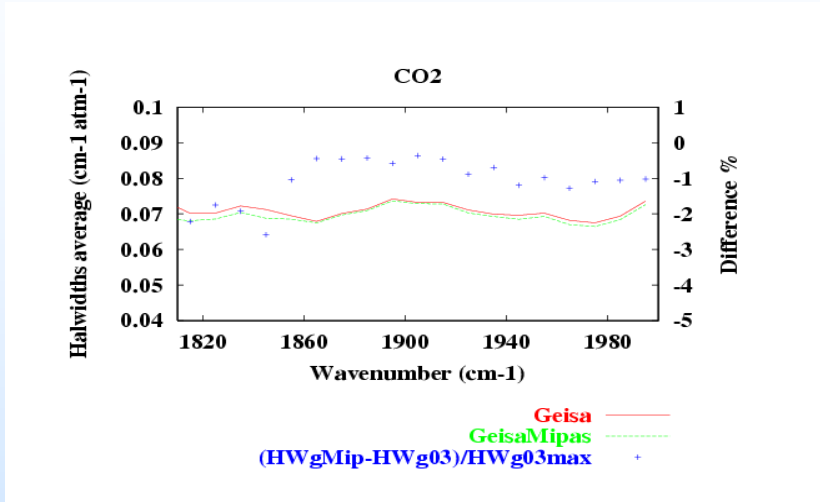


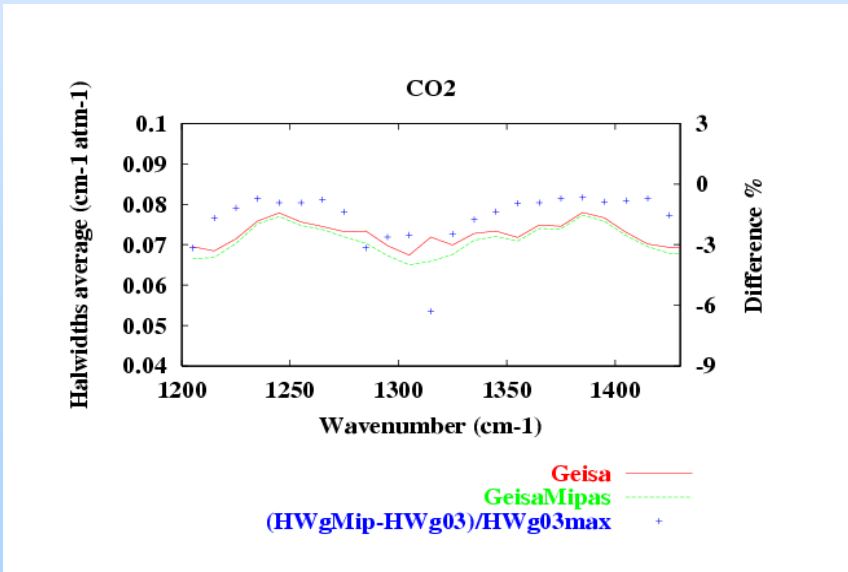




CO_2 Collision Half-Width Differences







Evaluation of the Impact of Spectroscopic Archive Differences on Radiative Transfer Simulations

Spectroscopic data involved in comparisons

- **GEISA/IASI-03** 599 - 3,001 cm^{-1}

  14 molecules: H_2O, CO_2, O_3, N_2O, CO, CH_4, O_2, NO, SO_2, NO_2, HNO_3, OCS, C_2H_2, N_2

- **MIPAS database** 597 – 2,503 cm^{-1}

  Version pf3.1

- **HITRAN-04** extractions in GEISA/IASI and MIPAS databases common spectral intervals

6 Molecular species selected for comparisons, i.e.:
H_2O, CO_2, O_3, N_2O, CO, CH_4

IASI Radiative Transfer Modelling Overall Approach

- **Five atmospheric profiles**; mean of each of 5 air mass class the **T**hermodynamic **I**nitial **G**uess **R**etrieval (**TIGR**) data set, in its latest version, a climatological library of about 2300 representative atmospheric situations selected by statistical methods from 80,000 radiosonde reports *[Chédin et al., 1985; Achard, 1991; Chevallier et al., 1998].*

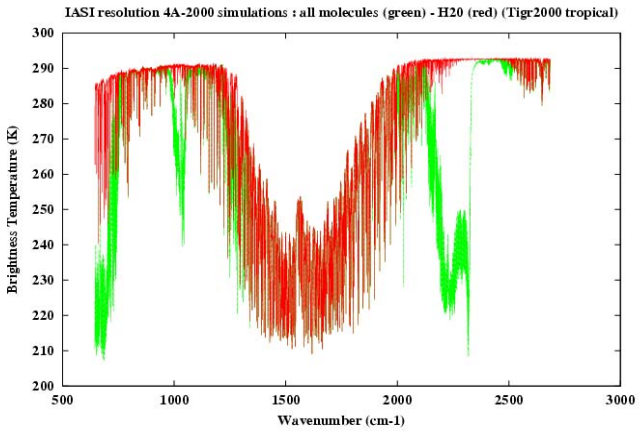
- **Mc Clatchey profiles**

- **Three IASI spectral Bands**: 645-1210 cm^{-1}; 1210-2000 cm^{-1}; 2000-2760 cm^{-1}

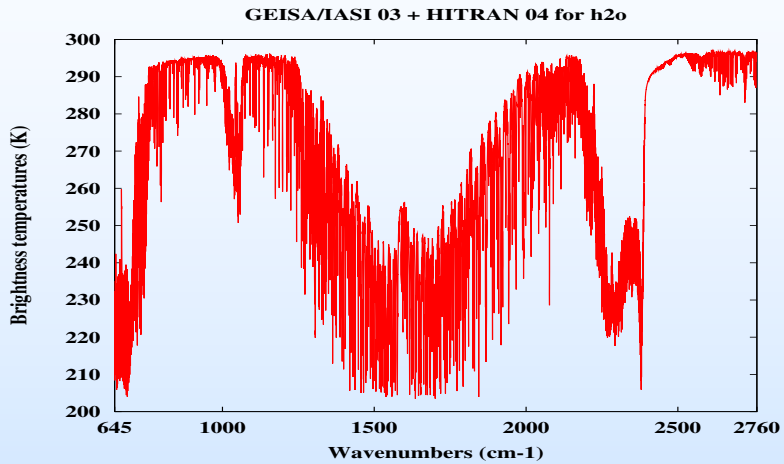
- **4A** (Automatized Atmospheric Absorption Atlas); fast and accurate line-by-line radiative transfer model *[N.A. Scott and A. Chédin, 1981; Tournier et al. 1995; Chéruy et al. 1995]* or **STRANSAC** line-by-line and layer-by-layer model, in their **latest 2000 version** *[N.A. Scott, 1974]*

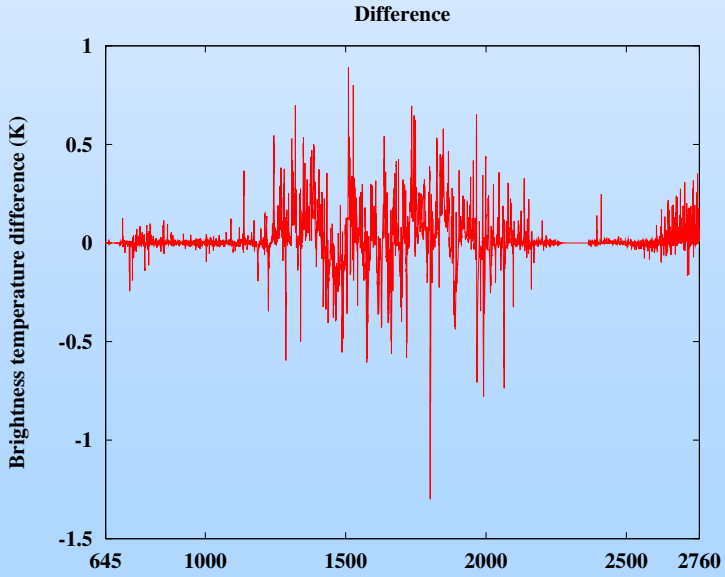
- **Mean thermodynamic Parameters** for each **TIGR** air-mass

HITRAN and GEISA H_2O DIFFERENCE IMPACT



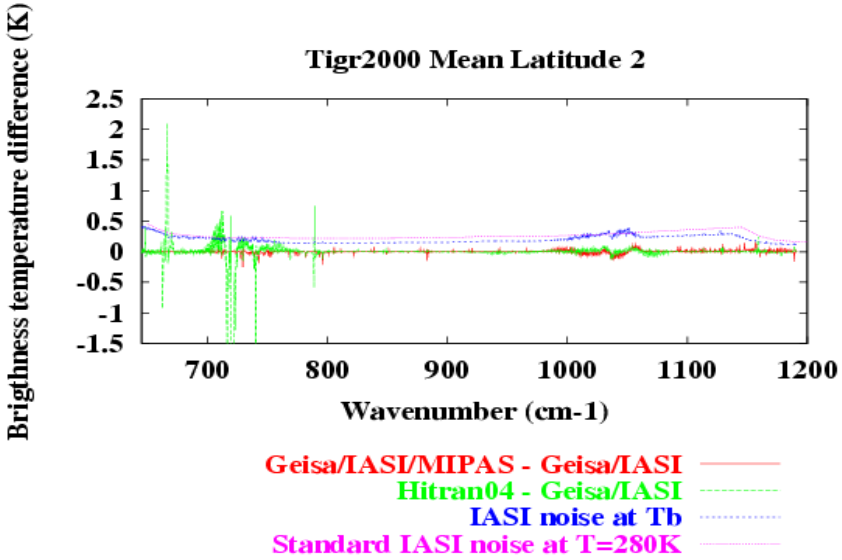
STRANSAC-2000 IASI Simulation

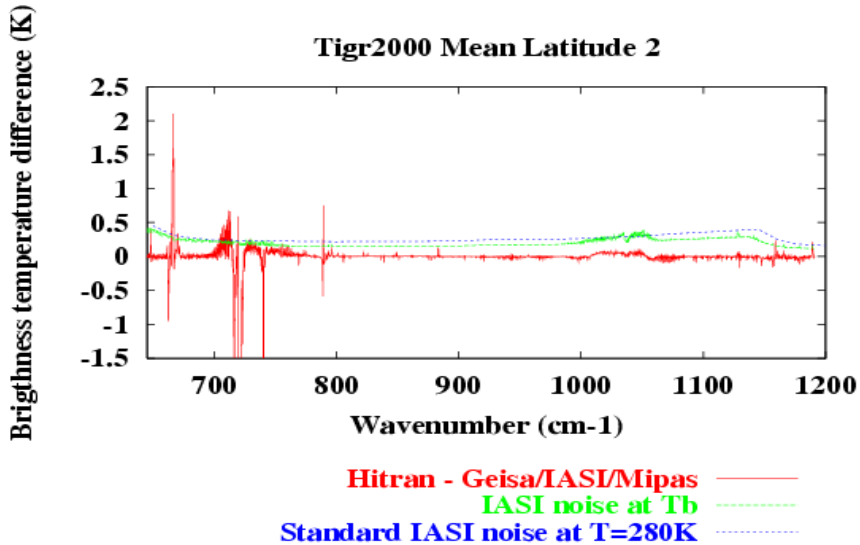




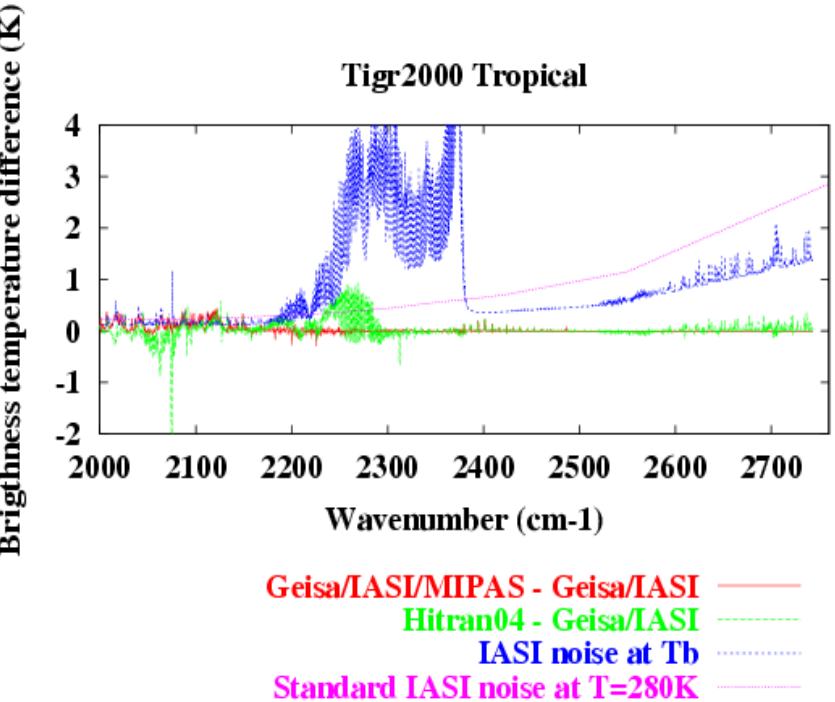
Tropical TIGR-2000 atmosphere

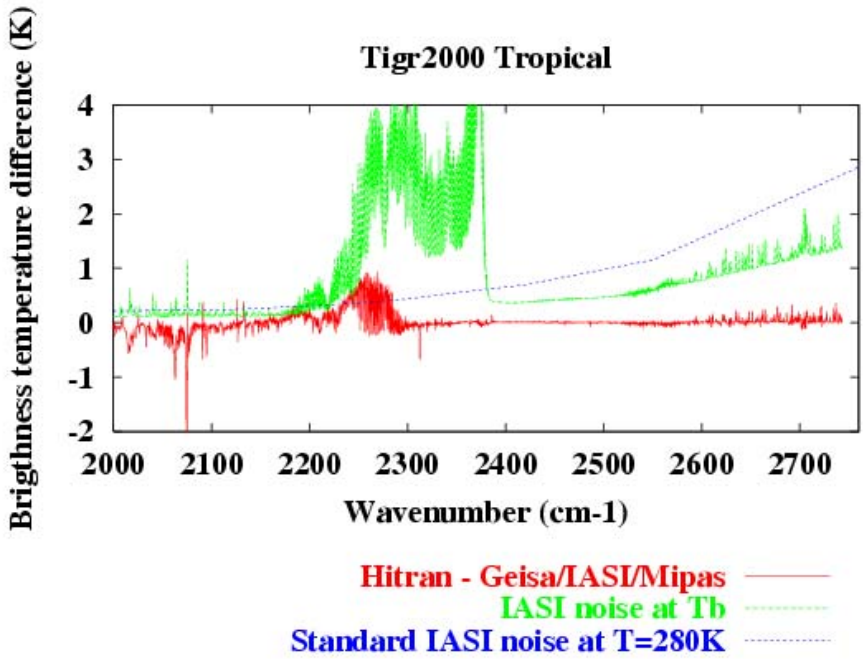
IASI 4A-2000 Band-1 Simulation
TIGR-2000 Mean latitude 2





IASI 4A-2000 Band-3 Simulation
TIGR-2000 Tropical





CONCLUDING COMMENTS

STATUS OF MOLECULES FOR IASI RADIATIVE TRANSFER MODELLING

From ISSWG-14 (March 24-26 2001) Conclusions

WHERE ARE WE NOW ?

MOLECULE	LINE POSITION	LINE INTENSITIES	LINE BROADENING	LINE MIXING	CONTINUUM	CROSS-SECTIONS
H2O	1	1	1		1	
CO2	Y	Y	2	Y		
O3	3	1	1			
CH4	2	2	1	1		
CO	Y	Y	Y			
N2O	?	?	2	2		
HNO3	3	2	3			
O2 & N2 collision induced spectrum					Y	
CFC's, HCFC's, N2O5						Y

1: Parameters that need to be improved; 2 rd priority; 3 rd priority

Y no problem clearly identified; ? The databases have to be checked

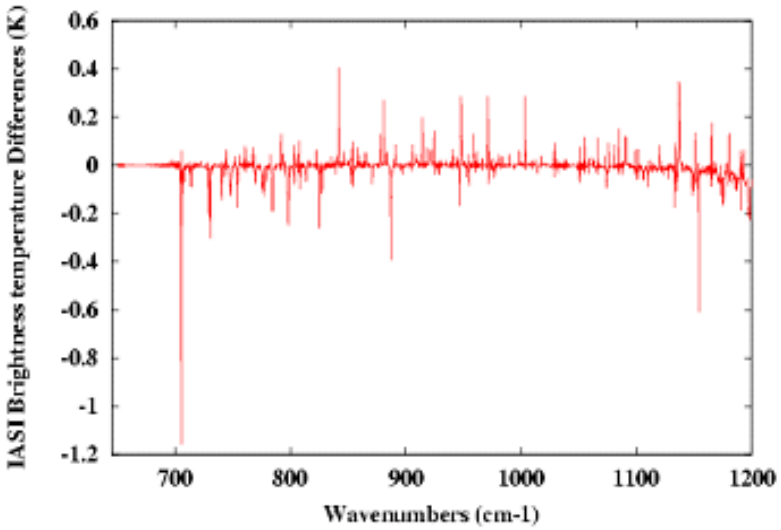
Remaining spectroscopy related problems

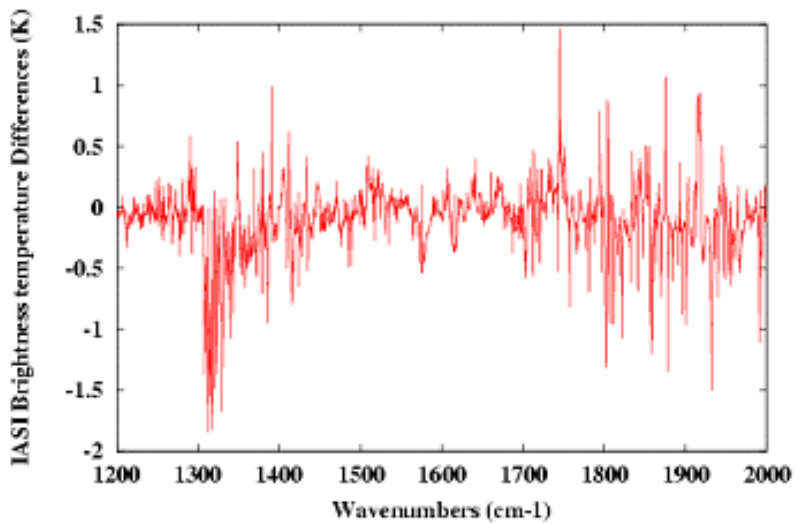
Some conclusions of validation exercises, using e.g. : the 4A-00/LMD Model, in the case of IASI radiative transfer modelling

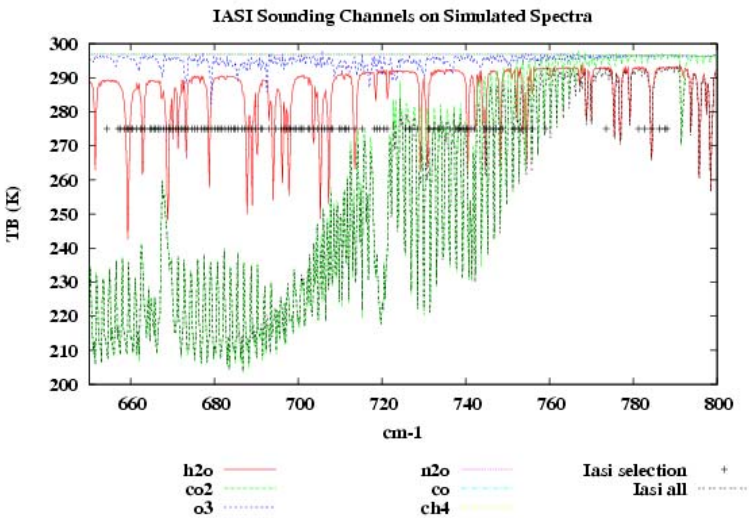
1. **The water vapour spectroscopic parameters: still need to be validated;**
2. **The water vapour continuum: more tuning to be done when more validation data (especially with high water vapor content) become available;**
3. **The freons bands at 850 and 920 cm^{-1}: refine the temperature dependence;**
4. **O_3 in the 9.6 micron region: the spectroscopic parameters still need to be validated;**
5. **Some CO2 – Q branches: further improvement/tuning of the line mixing**

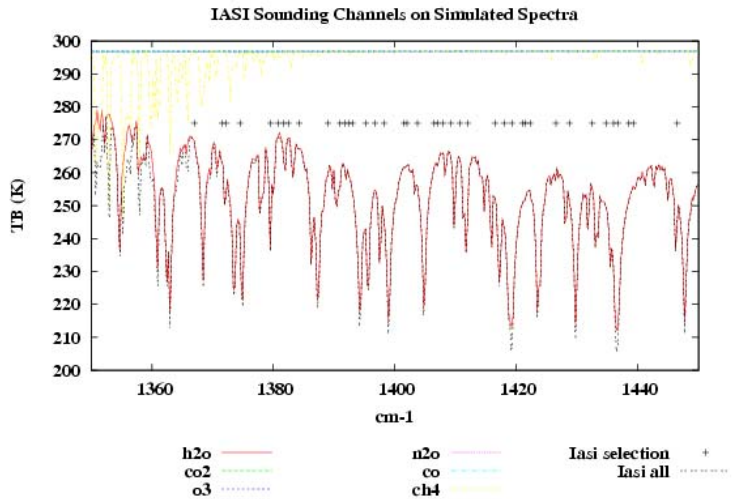
Spectroscopy issues and IASI sounding Channels Selection (H_2O exemple)

IASI Stransac-2000 simulations with RAL or TOTH spectroscopy

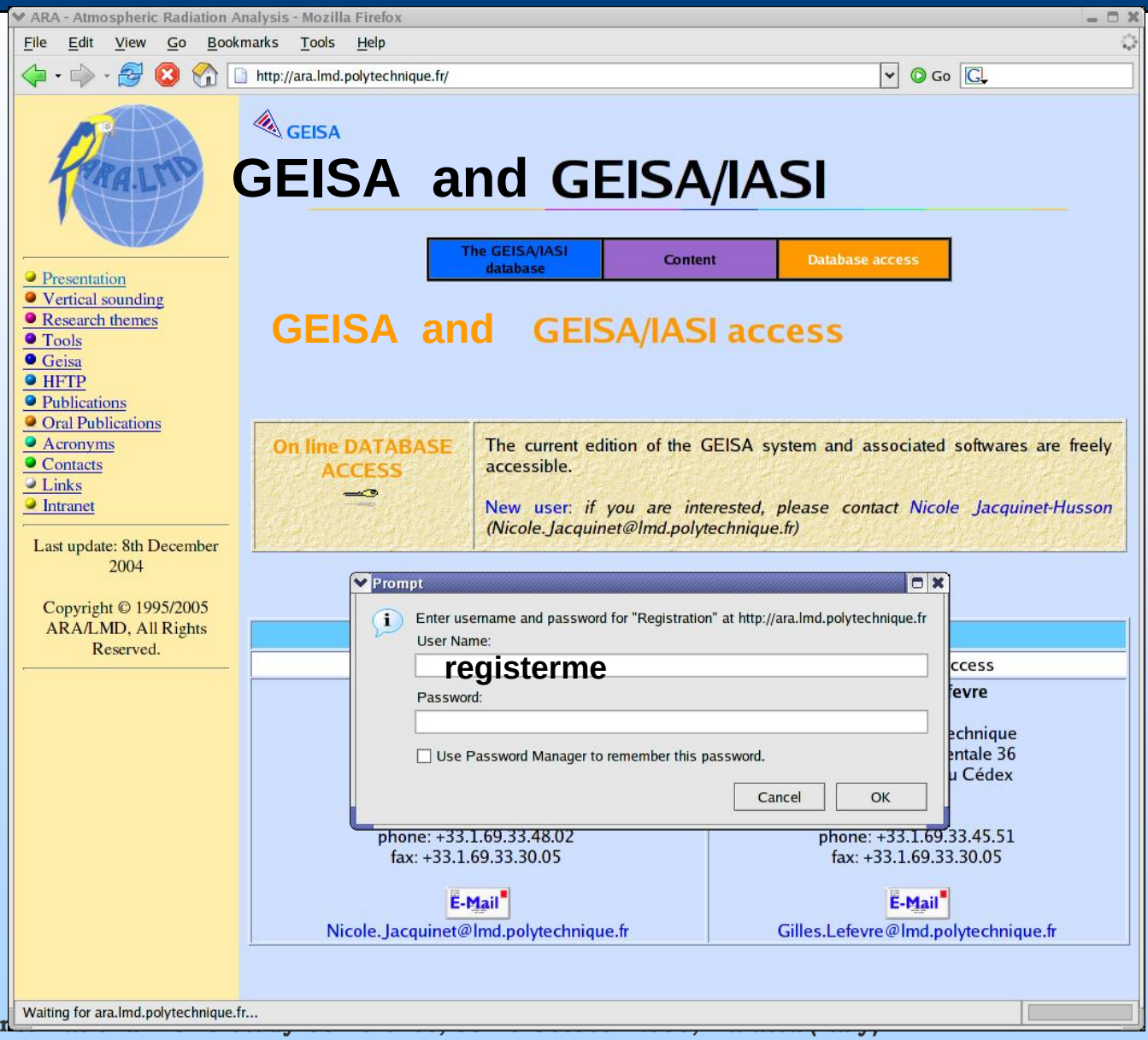








GEISA/IASI Present Operational Use



Ether: Accueil - Mozilla

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Ether

Centre de Produits et de Services de Chimie de l'Atmosphère

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Présentation du site

Accueil

« L'harmonieux Ether dans ses vagues d'azur enveloppe les monts d'un fluide plus pur » Lamartine

Bienvenue sur le site Ether

- Ce site est développé et maintenu par le **Pôle de Compétence Thématique Ether**.

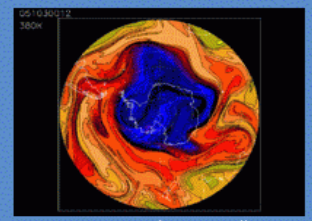
- Il met à disposition des informations sur les activités scientifiques françaises liées à l'étude de la **chimie de l'atmosphère**. Il s'intègre dans le Centre de Produits et de Services **Ether** (CPS). A travers ce site, **le CPS** met à disposition :

  - des **données de mesure** en provenance des laboratoires français, et de nombreux centres internationaux,
  - des **prévisions** comme la Vorticité Potentielle,
  - des **résultats de modèles**,
  - des **procédures** téléchargeables,
  - des **browses**, et des **logiciels** de traitement pouvant être activés.

- Les données sont publiques ou privées suivant les règles internationales d'utilisation. Les jeux de données publiques ayant un faible volume (moins de 50 Mb) peuvent être téléchargés (voir demande de login pour les autres données).

- Certains logiciels sont à accès contrôlé pour des questions de ressource machine (voir demande de login).

L'image du mois



Carte Vorticité Potentielle :
Campagne STRATEOLE-VORCORE

Flash Infos

25-10-05 20:05
Atelier de modélisation de l'atmosphère 2006
Appel à communications [suite]

25-10-05 19:46
la campagne CARBOEUROPE
cf. Dossier [suite]

29-09-05 12:34
Appel à projet Ether
Deadline : 15 décembre 2005 [suite]

Programmes en cours

- ACCENT
- GIRAFE

Autres activités

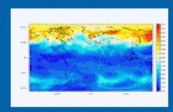
- STRATEOLE-VORCORE
- SUBTROP

Proposer de nouvelles activités dans Ether

Appel_a_projet_Ether.doc

Accès aux produits et informations associées

Choix par Expérience

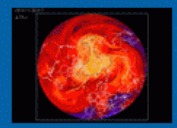


Modèles et Assimilations

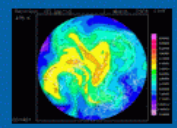
Logiciels

Base de données spectroscopiques

Productions journalières



PV-Mimosa



O3-Reprobus

Utilisateur Ether : DEMANDE LOGIN | ESPACE UTILISATEUR | CONTRÔLE COMMANDES | DROITS UTILISATEURS

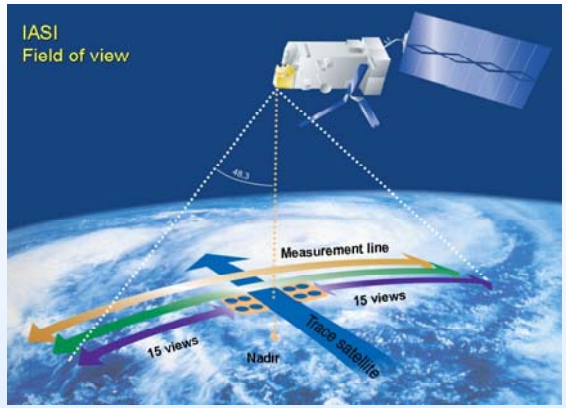
Contacter le responsable scientifique

Contacter le webmaster

A lire avant l'utilisation de ce site

Géré par

IASI INSTRUMENT STATUS



Launch October 2006

IASI Level 1 Cal/Val activities

- **GEISA/IASI used as the reference spectroscopic database**
- **It is expected that validation can be achieved using a Line by line RTM (4A will be used for validation at 3 wavenumbers in each 3 bands)**

ACKNOWLEDGMENTS

to

CNES and EUMETSAT

for their Encouragements and Supports