Assessing Spectroscopic Parameter Archives for the Second Generation Vertical Sounders Radiance Simulation: Illustration through the GEISA/IASI database

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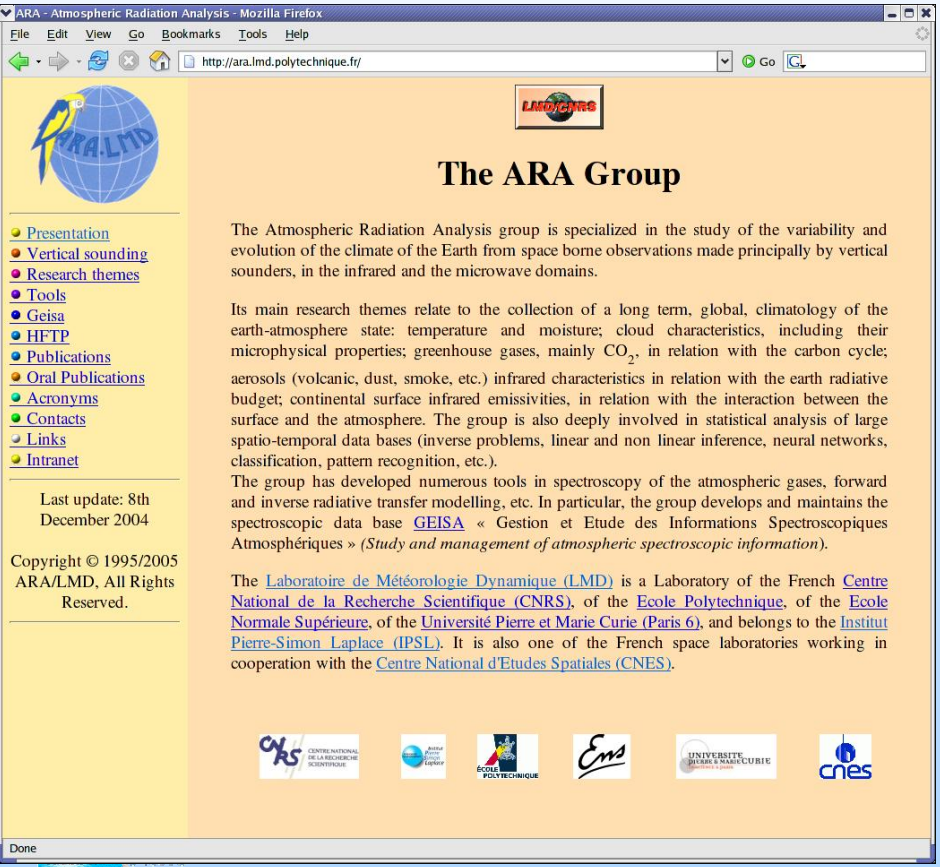

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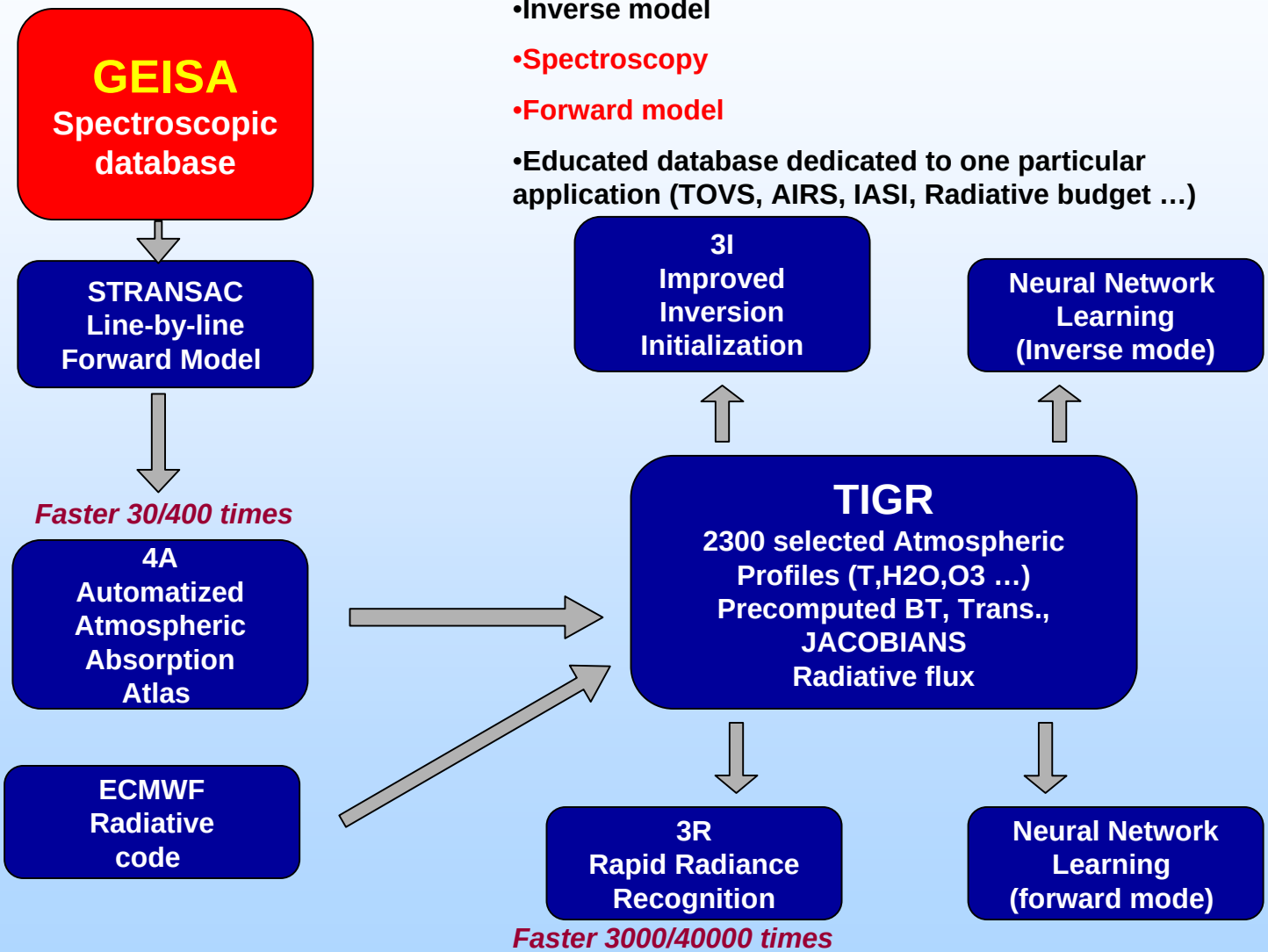
I

GEISA-03 and GEISA/IASI-03 OVERVIEW

The GEISA spectroscopic database in the ARA/LMD tools

- Inverse model
- Spectroscopy
- Forward model
- Educated database dedicated to one particular application (TOVS, AIRS, IASI, Radiative budget …)



The GEISA-2003 system

Gestion et **E**tude des **I**nformations **S**pectroscopiques **A**tmosphériques
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 database general context

- **Extraction of GEISA-03 between 599 & 3001 cm^{-1}**
  - **Individual spectral lines spectroscopic parameters sub-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**
  - **IR absorption cross-sections sub-database (mainly CFC's)**
    6 molecular species: **CFC-11, CFC-12, CFC-14, CCl_4, N_2O_5, HCFC-22**
  - **Microphysical and optical properties of Basic Atmospheric aerosol components sub-database** (similar with the GEISA-03 one)
- **Continuous update**
- **Related with:**
  - **CNES/EUMETSAT EPS mission**
  - **IASI measurement capabilities assessment**
  - **ISSWG** (**I**ASI **S**ounding **S**cience **W**orking **G**roup)

Total # entries: 702,550

Associated interest for AIRS

GEISA/IASI-03 line transition parameters sub-database content summary

2003 update

Molecule	Code	Isotopes	# Transitions
h2o	1	161-162-171-181-182	13278
co2	2	626-627-628-636-637-638-728-828-838	50840
o3	3	666-668-686-667-676	195102
n2o	4	446-447-448-456-546	18966
co	5	26- 36- 28- 27- 38- 37	3674
ch4	6	211-311-212 *(ch3d)*	121281
o2	7	66- 67- 68	435
no	8	46- 48- 56	29608
so2	9	626-646	22301
no2	10	646	71687
hno3	13	146	152586
ocs	20	622-624-632-623-822-634-722	19768
c2h2	24	221-231	2904
n2	33	44	120
Spectral range:	**599 – 3001 cm^{-1}**		**Total : 702,550**

14 molecules **53 isotopic species**

Fields of the format for line transition parameters in GEISA-03 (1)

30 format fields

A-J fields

Fortran format descriptor	F12.6	D11.4	F6.4	F10.4	A36	F4.2	I3	I3	A3
Field name	A	B	C	D	E	F	G	I	J

(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 air 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, as he following:

- TRS1 upper state vibrational identification,
- TRS2 lower state vibrational identification,
- RN1 upper state rotational identification,
- RN2 lower state rotational identification.

Blank fields (spaces) at this place match missing information.

(F) Temperature dependence coefficient *n* of the halfwidth (value set to 0.75 if *n* not available

(G) Identification code for isotope.

(I) Identification code for molecule.

(J) Internal GEISA code for data identification.

GEISA management software specific

II

GEISA-03 line transition parameters update impact illustrations: H2O, O3

GEISA-03 line transition parameters sub-database
Updated molecules and spectral intervals

Molecule	Updated spectral intervals (cm^{-1})
H_2O	500 – 2819 9603 – 11399 13184 – 25232
CO_2	436 - 2826
O_3	600 – 3391
N_2O	872 – 1243
CH_4	0 – 6184
O_2	7665 – 8064 11484 - 15928
NO	1487 - 3799
NO_2	2719 – 3074
NH3	0 - 5294
PH3	18 - 2479

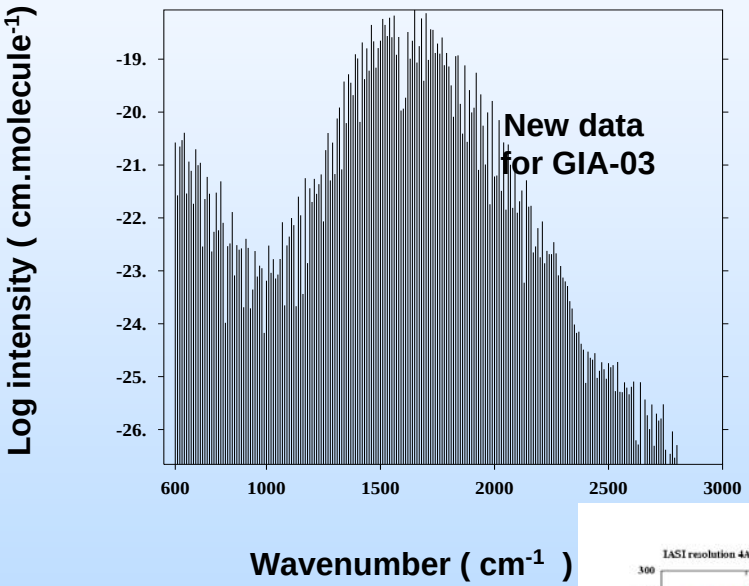
Molecule	Updated spectral intervals (cm^{-1})
OH	29808 - 35877
HBr	17 – 396 2124 - 2790
HI	13 – 320 1951 - 2403
C2H6	2975 - 2978
CH3D	0 – 6184
C_2H_2	605 - 3374
HOCl	1179 - 1320
CH3Cl	1261 - 1646
COF2	1857 - 2001
HO2	0 - 908

H_2O GEISA/IASI-03 update and alternative archive

Toth's (2000, 2002)

599.681 - 2819.848 cm^{-1}

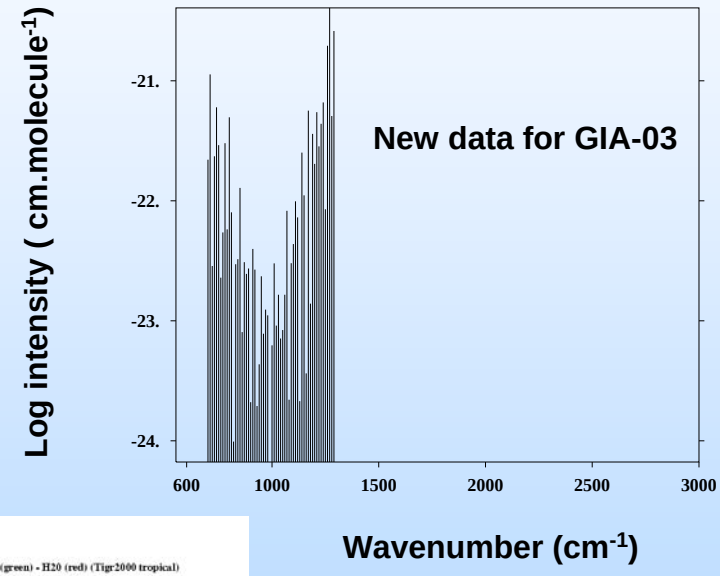
(2003 update)



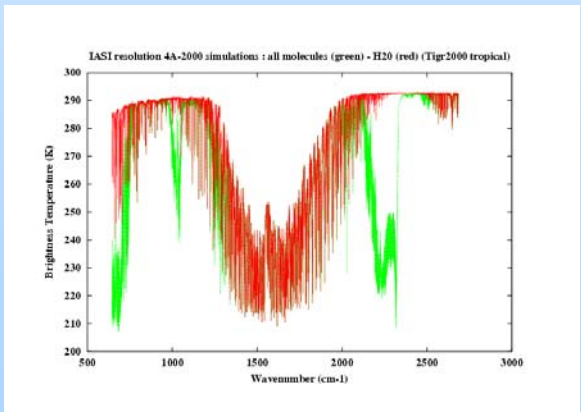
RAL/ EUMETSAT

700.032 - 1299.980 cm^{-1}

(Alternative archive)

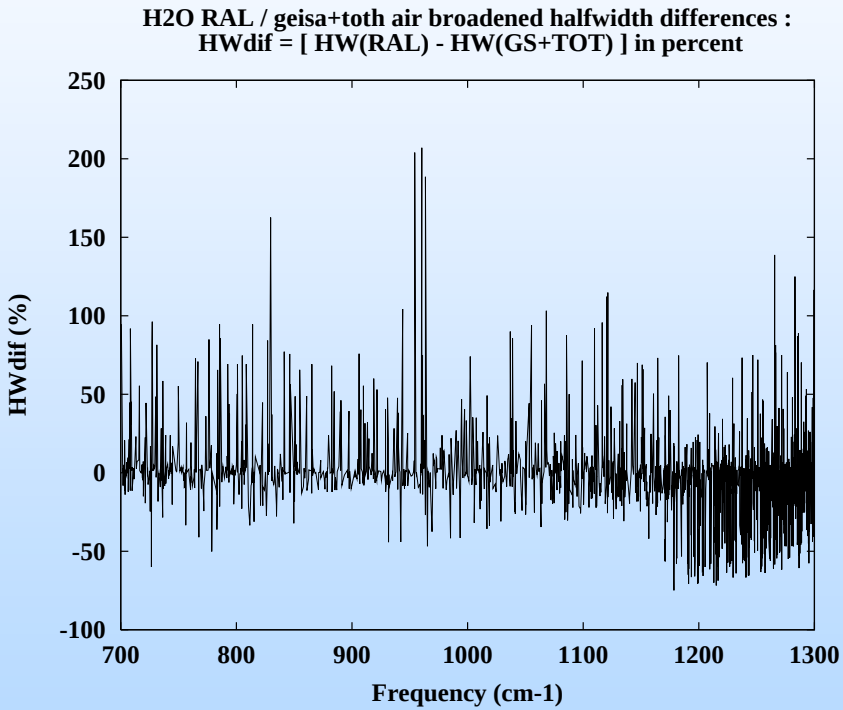


(GIA: *GEISA/IASI)*

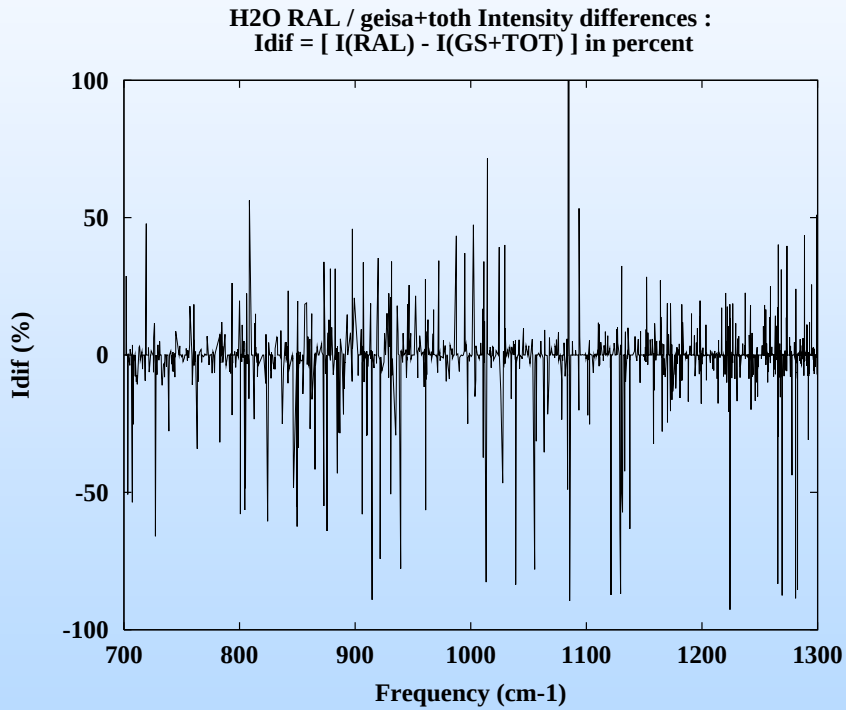


H2O update in GEISA/IASI-03: TOTH VS RAL (1)

Halfwidths (%)

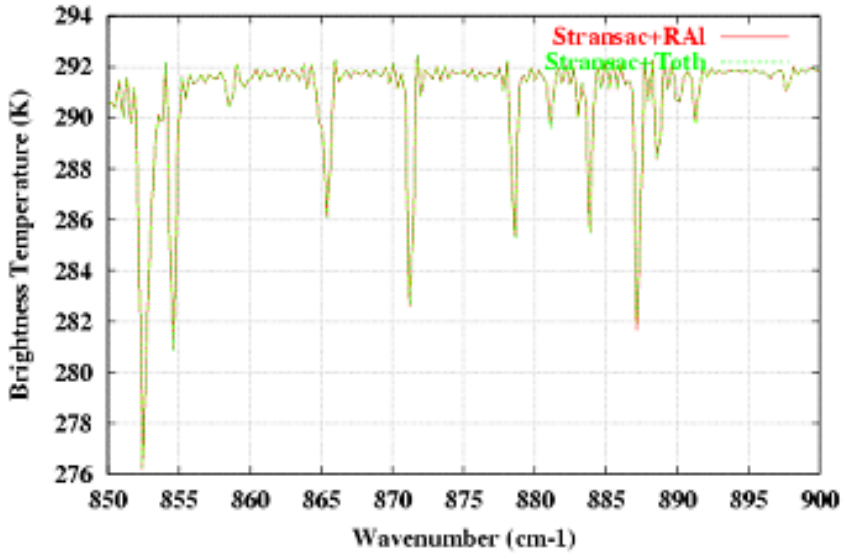


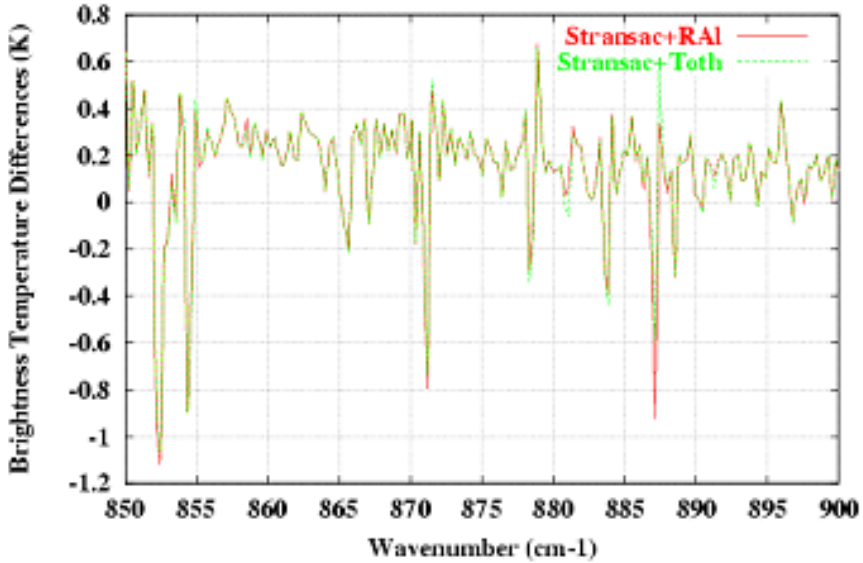
Intensity (%)



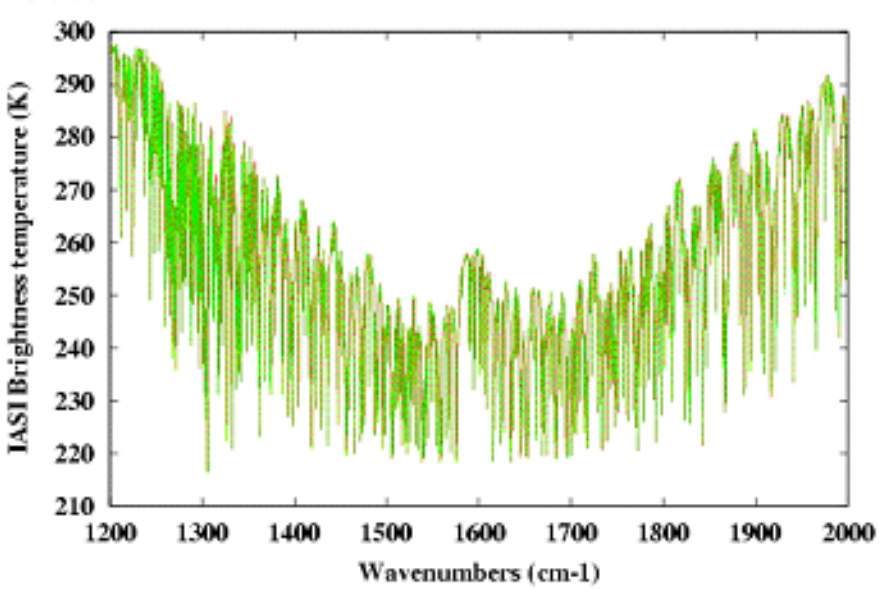
IASI Stransac-2000 simulations with RAL or TOTH's H2O spectroscopy (2)

CAMEX (HIS) 29/09/94

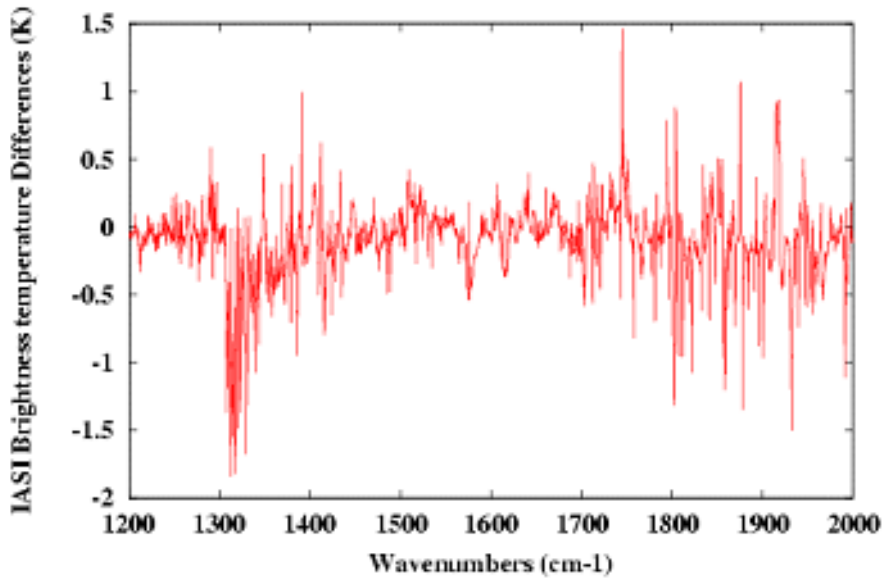




IASI Stransac-2000 simulations with RAL or TOTH's H2O spectroscopy



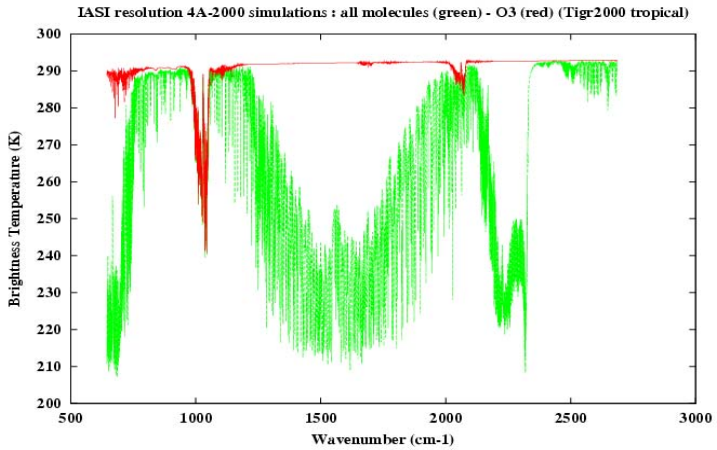
Mc Clatchey Tropical



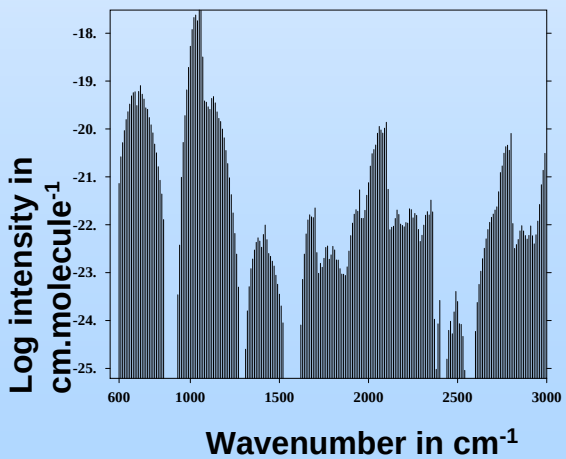
Stransac + Toth _____

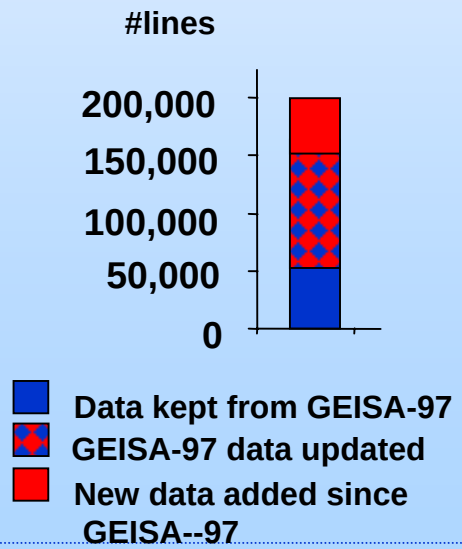
Stransac + RaL _____

O_3 GEISA/IASI-03 Update

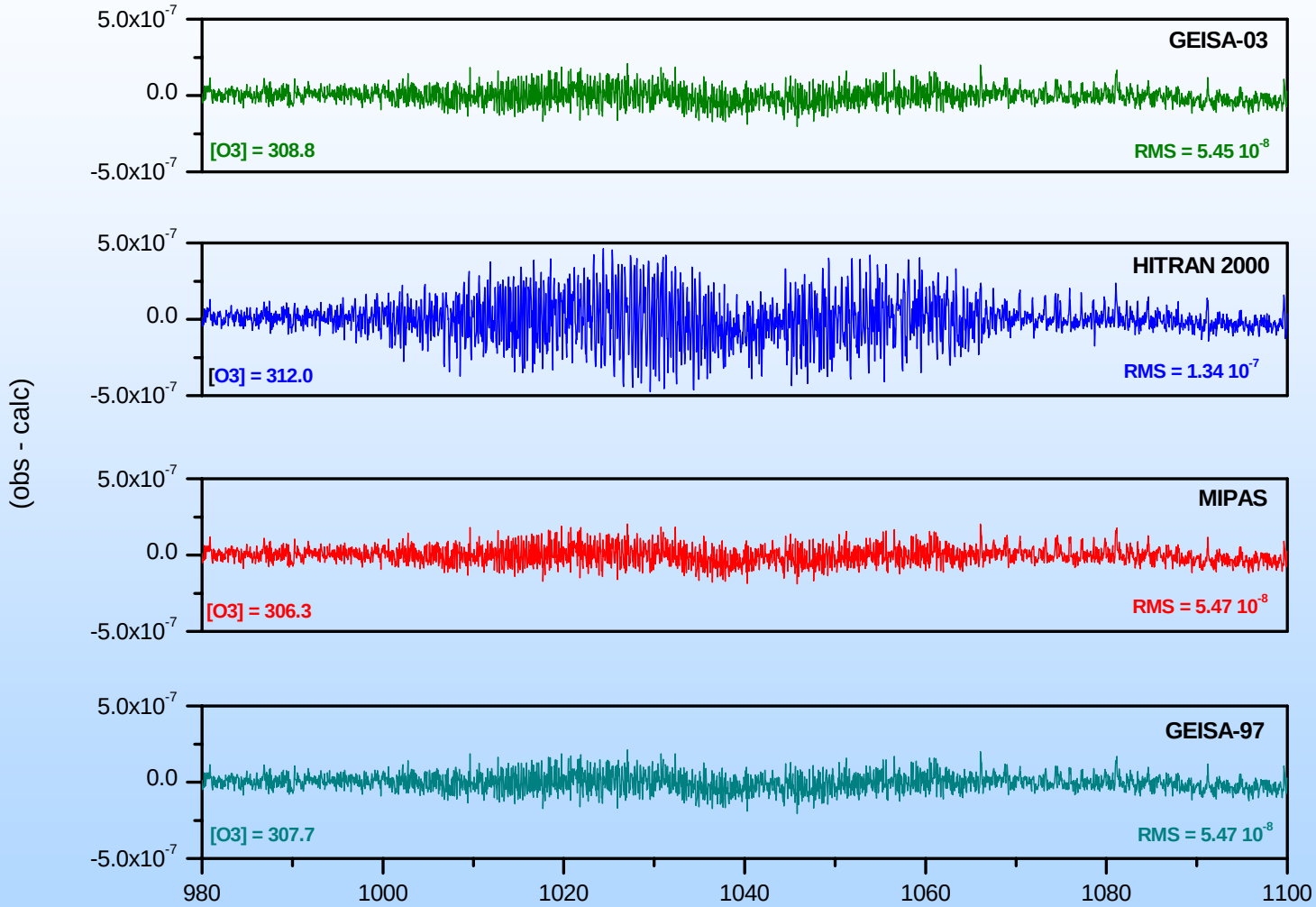


Updated spectral interval : 600.179 - 3000.971 cm^{-1}





Spectroscopy impact on IMG O_3 Total column retrieval



Courtesy P.F. Coheur (ULB)

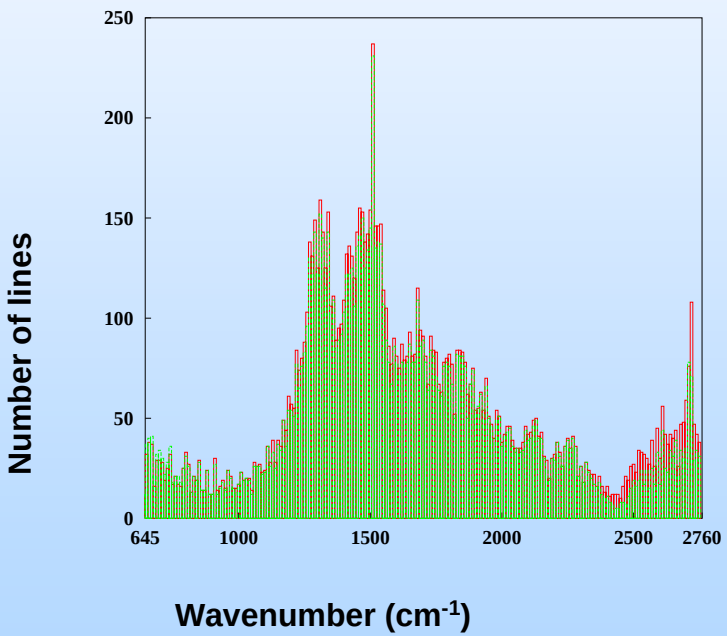
GEISA/IASI-03 and HITRAN-04 Archive Differences:impact illustration

HITRAN-04 *JQSRT, in press*

GEISA/IASI-03 *JQSRT, Vol. 95,**4**, 1 November 2005*

GEISA/IASI-03 and HITRAN-04 H_2O archives in the IASI spectral range (1)

GEISA/IASI 03 and HITRAN 04

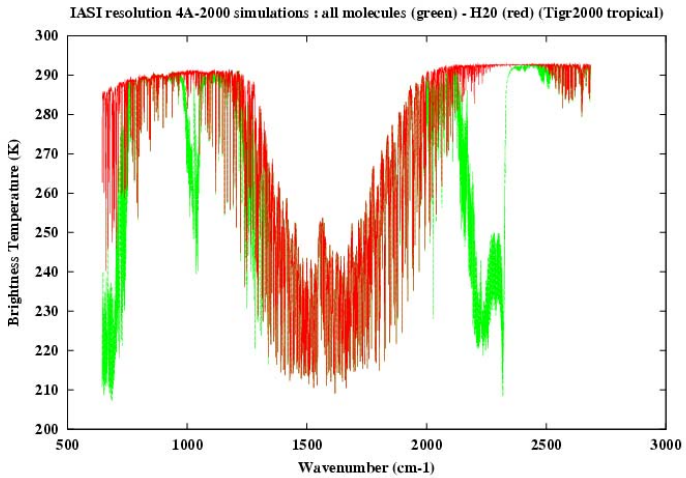


HITRAN-04

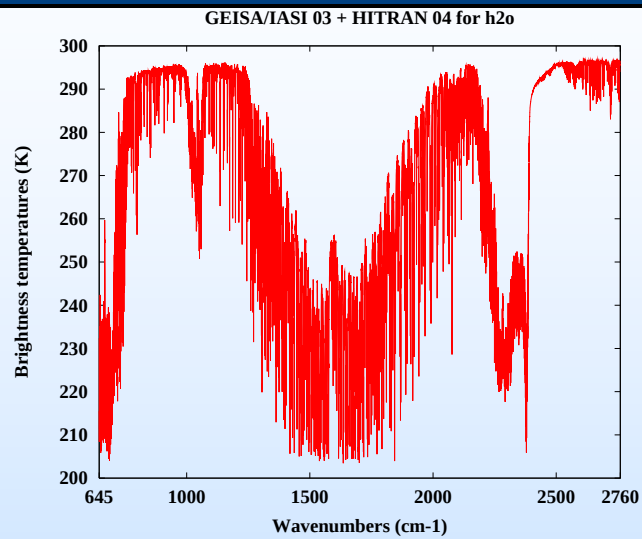
Toth:
"Linelist of water vapor parameters from 500 to 8000 cm^{-1}:
includes new measurements and analysis of air-broadening parameters". JQSRT (in press).

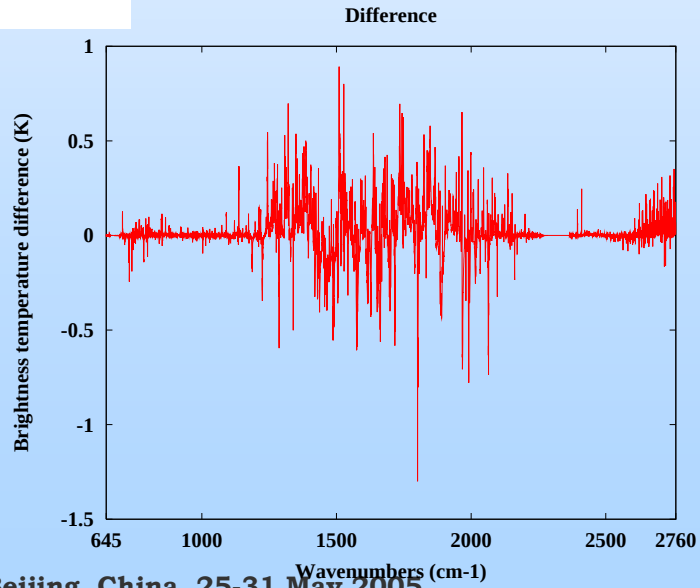
Jacquemart et al:
"Semi-empirical calculation of air-broadened half-widths and air pressure-induced frequency shifts of water-vapor absorption lines". JQSRT (in press).

GEISA/IASI-03 and HITRAN-04 H_2O STRANSAC-2000 IASI simulation



Tropical TIGR-2000 atmosphere





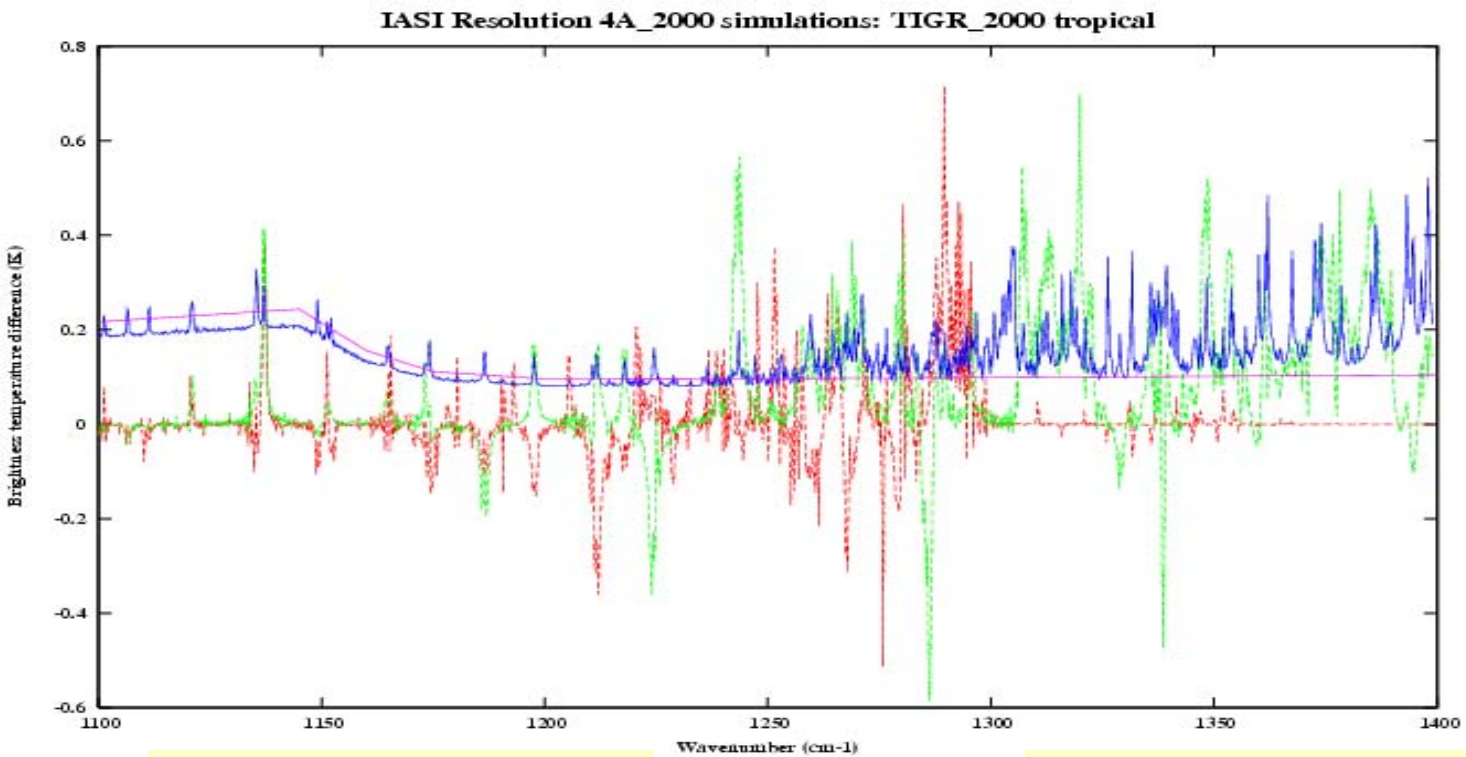
H_2O and CH_4 spectroscopy impact for IASI remote sensing

Evaluation of the impact of spectroscopic archive differences (HITRAN-04 and GEISA/IASI-03) on IASI direct radiative transfer simulations

- Two atmospheric TIGR profiles (mean of each of the 2 TIGR selected air-mass classes, i.e.: tropical and mid-latitude-2)
- 4A-2000
- Mean thermodynamic parameters for each air-mass

IASI 4A-2000 Simulation
TIGR-2000 Tropical

1110-1400 cm^{-1} spectral region

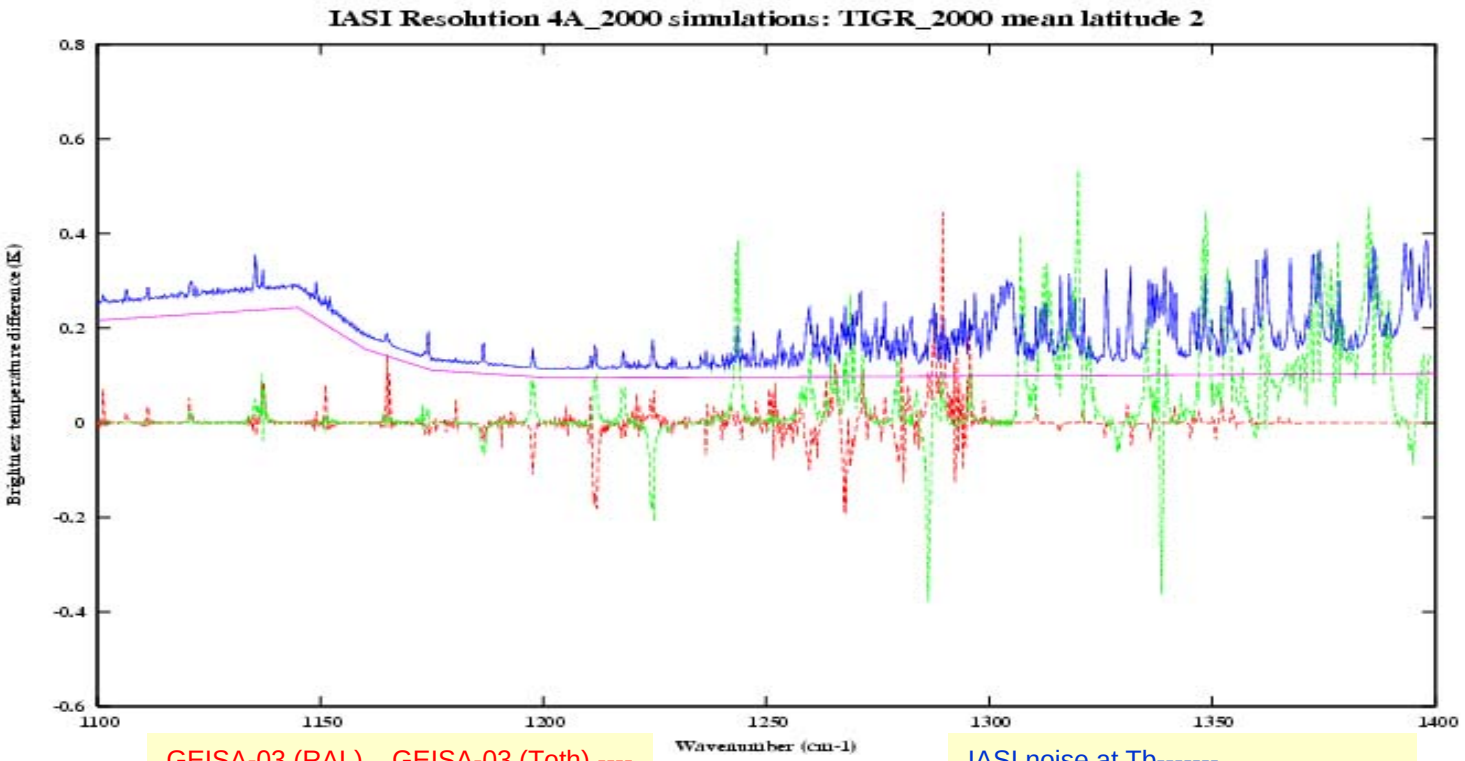


GEISA-03 (RAL) – GEISA-03 (Toth) ----
HITRAN-04 – GEISA-03 ----

IASI noise at Tb-------
Standard IASI noise at T=280 K -----

IASI 4A-2000 Simulation
TIGR-2000 Mean Latitude 2

1110-1400 cm^{-1} spectral region

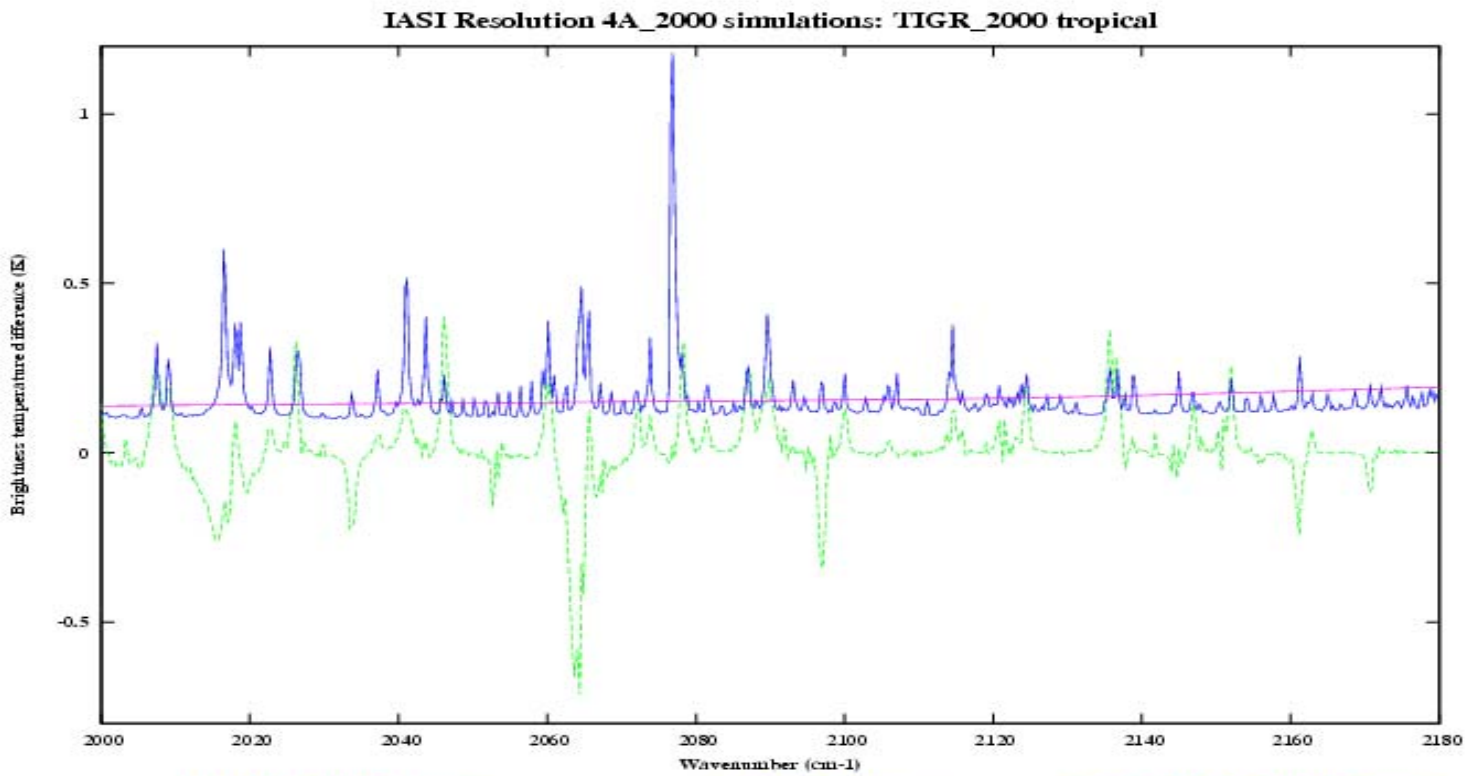


GEISA-03 (RAL) – GEISA-03 (Toth) ----
HITRAN-04 – GEISA-03 ----

IASI noise at Tb-------
Standard IASI noise at T=280 K -----

IASI 4A-2000 Simulation
TIGR-2000 Tropical

2000 - 2180 cm^{-1} spectral region



GEISA-03 (RAL) – GEISA-03 (Toth) ---- HITRAN-04 – GEISA-03 ---- standard IASI noise at T=280 K

IV
GEISA-03 distribution and access

ftp :

- **new GEISA-03 data for lines**, **cross sections** and **aerosols :**

  → different formats available including the HITRAN-00 and HITRAN-04 formats for the line sub-databases

- **associated management tools**

Web:

- **complete new technical documentation on the web site**

http://ara.lmd.polytechnique.fr

GEISA and GEISA/IASI Operational Use (3)
First access
http://ara.lmd.polytechnique.fr/registration

ACKNOWLEDGMENTS

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