



The GEISA Database 2009 Edition: A Tool for Hyperspectral Earth Tropospheric Satellite Observations Studies

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Spectroscopic remote sensing is an indispensable tool of modern meteorology and for the investigation of climate change, providing an improved understanding of the different phenomena driving the atmospheric system and the prediction of its future evolution. In particular, spectrally highly resolved radiances measured by powerful observational techniques such as satellite-based sensors enable global monitoring of the atmosphere, providing a wealth of information about its actual state. The launch of high spectral resolution vertical infrared sounders like AIRS (<http://www-airs.jpl.nasa.gov/>) on board EOS (<http://eospsa.gsfc.nasa.gov/>)-Aqua (<http://aqua.nasa.gov/>) since May 2002, or IASI (<http://smc.cnes.fr/IASI/index.htm>) on board the European polar satellite MetOp-A (<http://www.eumetsat.int/Home/Main/Satellites/Metop/index.htm?l=en>; <http://www.esa.int/export/esaLP/LPmetop.html>) since October 2006, have opened promising perspectives for remote sensing applications as the improvement of temperature and water vapor profile retrieval, cloud and surface characteristics retrieval, or retrievals of greenhouse gases (CO₂ and CH₄ for example) and of various chemical species. The January 2009 launch of the GOSAT satellite (http://www.gosat.nies.go.jp/index_e.html) is another noteworthy event (measurement of the column amounts and profiles of the concentration of CO₂ and CH₄ over the globe).

For the remote sensing of planetary atmospheres from satellite spectra measurements, an essential prerequisite is the availability of a high accuracy forward radiative transfer modeling. Related to the strong impact of the quality of the reference spectroscopic information on the research in direct and inverse planetary radiative transfer, there is an acute and constant demand for validated, operational and interactive public spectroscopic databases. In this context, the ARA group at LMD (<http://ara.abct.lmd.polytechnique.fr>) develops and maintains, for over three decades, GEISA (1) (Gestion et Etude des Informations Spectroscopiques Atmosphériques: Management and Study of Atmospheric Spectroscopic Information), a computer accessible database system. GEISA comprises three independent sub-databases devoted respectively to: line parameters (50 molecules involved, including 111 isotopes, for a total of 3,807,997 entries, in the spectral range from 10-6 to 35,877.031 cm⁻¹), infrared and ultraviolet absorption cross-sections, microphysical and optical properties of atmospheric aerosols. It is used on-line by more than 300 laboratories working in the domains of atmospheric physics, astronomy and astrophysics, and planetology.

Since the launch of MetOp-A, GEISA is the reference basis for the validation of the level-1 IASI data, using the 4A radiative transfer model (2) (4A/LMD; 4A/OP co-developed by LMD and Noveltis- <http://www.noveltis.fr/>, with the support of CNES).

The contents of each of the three sections of the GEISA 2009 edition (3) will be presented. Recommendations on the quality of spectroscopic line parameters required (from the conclusions of experts involved in Atmospheric Science) will be specified in the context of comparisons between observed or simulated Earth atmosphere spectra. GEISA is freely accessible from the CNRS/CNES/IPSL expertise center website Ether (<http://ether.ipsl.jussieu.fr/>).

Refs:

- (1) Jacquinet-Husson N., N.A. Scott, A. Chédin, L. Crépeau, R. Armante, V. Capelle, J. Orphal, A. Coustenis, C. Boone, N. Poulet-Crovisier, et al. THE GEISA SPECTROSCOPIC DATABASE: Current and future archive for Earth and planetary atmosphere studies. *JQSRT* 2008, 109, 1043-1059.
- (2) Scott N.A. and A. Chédin, 1981: A fast line-by-line method for atmospheric absorption computations: The Automated Atmospheric Absorption Atlas. *J Appl Meteor*, 20, 556-564.
- (3) Jacquinet-Husson N., L. Crépeau, R. Armante, C. Boutammine, A. Chédin, N.A. Scott, C. Crevoisier, V. Capelle, et al. The 2009 edition of the GEISA spectroscopic database. *JQSRT*, submitted for publication, september 2010.