

# Dust AOD and altitude retrieved from 7 years of infrared sounders observations (AIRS, IASI) Comparison with other aerosol datasets (MODIS, CALIOP, PARASOL)

S. Peyridieu<sup>1</sup>, A. Chédin<sup>1</sup>, D. Tanré<sup>2</sup>, V. Capelle<sup>1</sup>, C. Pierangelo<sup>3</sup>, N. Lamquin<sup>1</sup>, R. Armante<sup>1</sup>

1. LMD, CNRS/IPSL, Palaiseau (France) <http://ara.lmd.polytechnique.fr> 2. LOA, CNRS/Univ. Lille (France) 3. CNES, Toulouse (France)

sophie.peyridieu@lmd.polytechnique.fr

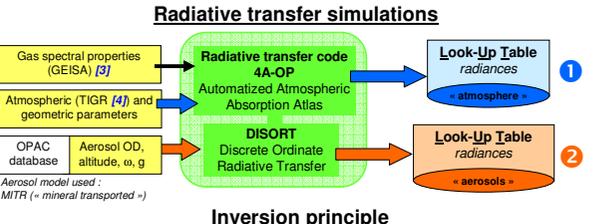


## Introduction

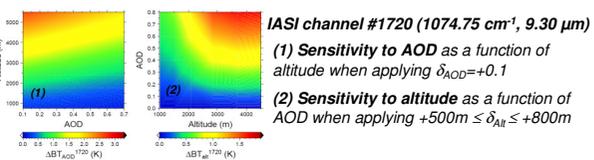
Observation from space, being global and quasi-continuous, is a first importance tool for aerosol studies. Remote sensing in the infrared domain is needed for the evaluation of the **total radiative forcing** of aerosols. Infrared sounders provide a way to retrieve other aerosol characteristics, including their **mean altitude** [1,2].

We present results obtained from AIRS and IASI sounders, and comparisons with other aerosol datasets including MODIS & PARASOL (AOD) and CALIOP (Altitude).

## Method



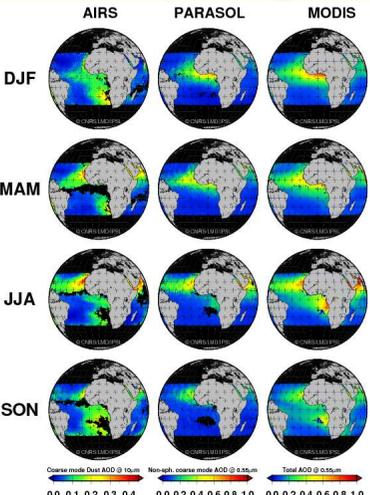
- Determination of an atmospheric situation** the closest to the situation observed (AIRS or IASI) using channels mostly sensitive to temperature and water vapor,
- Simultaneous retrieval of aerosol properties (AOD, altitude)** from BTs of channels mostly sensitive to aerosols. The proximity recognition in the LUT is made only for atmospheric situations found in step 1.



**References**  
 [1] Peyridieu et al., *Atmos. Chem. Phys.*, 10, 1953-1967, 2010  
 [2] Pierangelo et al., *Atmos. Chem. Phys.*, 4, 1813-1822, 2004  
 [3] Jacquinet-Husson et al., *J. Quant. Spec. Rad. Trans.*, 109, 2008  
 [4] Chédin et al., *J. Appl. Meteor.*, 24, 128-144, 1985  
 [5] Pierangelo et al., *Geophys. Res. Lett.*, 32, L20813, 2005  
 [6] Capelle et al., *in prep*, 2010

## Results obtained from AIRS

Aerosol properties have been retrieved over the tropics (30°S-30°N) from AIRS observations covering the period January 2003 – December 2009. The size of AIRS FOVs is 13.5 km at nadir. Our product is reported on a 1°x1° grid for each month. The method is designed to retrieve simultaneously the **dust coarse mode infrared optical depth and mean altitude** [1,2].



### Aerosol optical depth (AOD)

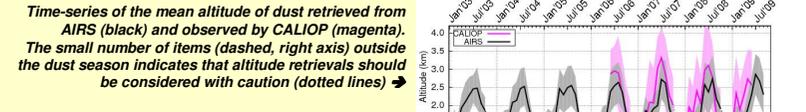
Comparisons with other aerosol sensors (total AOD from MODIS/Aqua, non-spherical coarse mode AOD from PARASOL) show a good agreement, especially during the **dust season (JJA)**. Time series for different regions of the Atlantic or the Arabian sea confirm the agreement [1].  
**AIRS vs. MODIS** product comparison is used to analyze the relative contributions of the **coarse vs. fine modes** to the AOD.  
**AIRS vs. PARASOL** product comparison illustrates the role of **non-spherical vs. spherical particles** in the coarse mode.

7-year AOD seasonal climatology obtained from AIRS (left), compared to PARASOL (center) and MODIS (right) products.

### Mean altitude of the aerosol layer

In the infrared, the altitude retrieved is the altitude at which half of the AOD is above and half of the AOD is below.

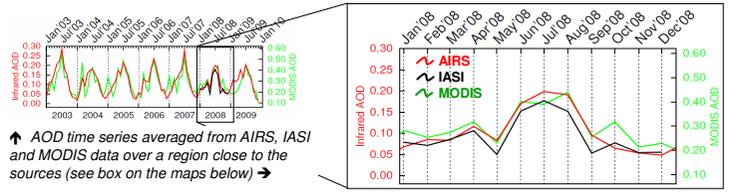
**CALIOP Level-2 (v2.01) aerosol layer product** has been used to validate AIRS infrared mean altitude. In this comparison, for a region close to the sources, dust aerosol **single-layer cases** have been considered (64% of all cases).



The agreement between the two instruments is satisfactory. However one should keep in mind the extreme difference in spatial resolution between the two instruments.

## Results from IASI/Metop

The method developed for AIRS has been designed for infrared sounders in general. In a preliminary phase, IASI channels equivalent to AIRS channels have been selected and results have been obtained from **one full year (2008) of IASI data**.



AOD time series averaged from AIRS, IASI and MODIS data over a region close to the sources (see box on the maps below) →



Maps of the mean altitude retrieved from AIRS (top) and IASI (bottom) July 2008 observations (shown only when corresponding AOD ≥ 0.10).

Preliminary results from 2008 IASI observations are encouraging. A satisfactory agreement is found with AIRS results.

### Retrieval of the dust coarse mode effective radius

We are currently retrieving the effective radius of the dust coarse mode from IASI observations (following the method developed for AIRS in [5]).



Once AOD and altitude are determined,  $R_{eff}$  can be deduced from a simple  $BT=f(R_{eff})$  relationship

## Conclusion and future work

We show that aerosol properties – such as **aerosol optical depth and mean altitude** – are retrieved from infrared sounders observations (7 years of AIRS, 1 year of IASI at present) and show a good agreement with other aerosol products. The inversion of aerosol properties from IASI is in progress as the data is made available.  
 Current and future work include :  
 - comparison with MODIS, PARASOL, CALIOP (v3), ground-based observations  
 - retrieval of the dust coarse mode effective radius [5]  
 - study of the sensitivity to other aerosol models  
 - retrieval of aerosol properties over land, using a database of spectral surface temperature and emissivity retrieved from IASI [6].