Towards the use of cloud microphysical properties to simulate IASI spectra

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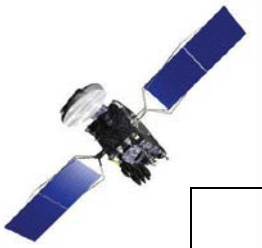
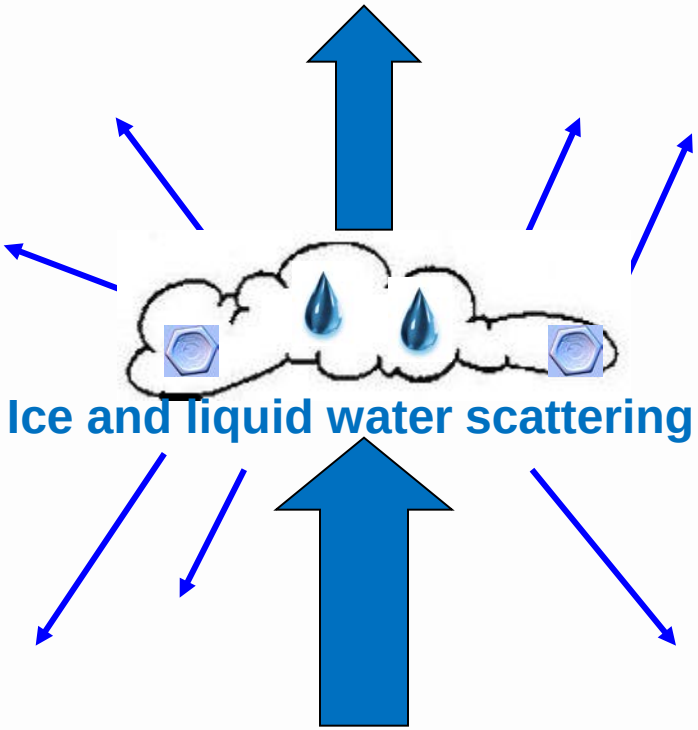
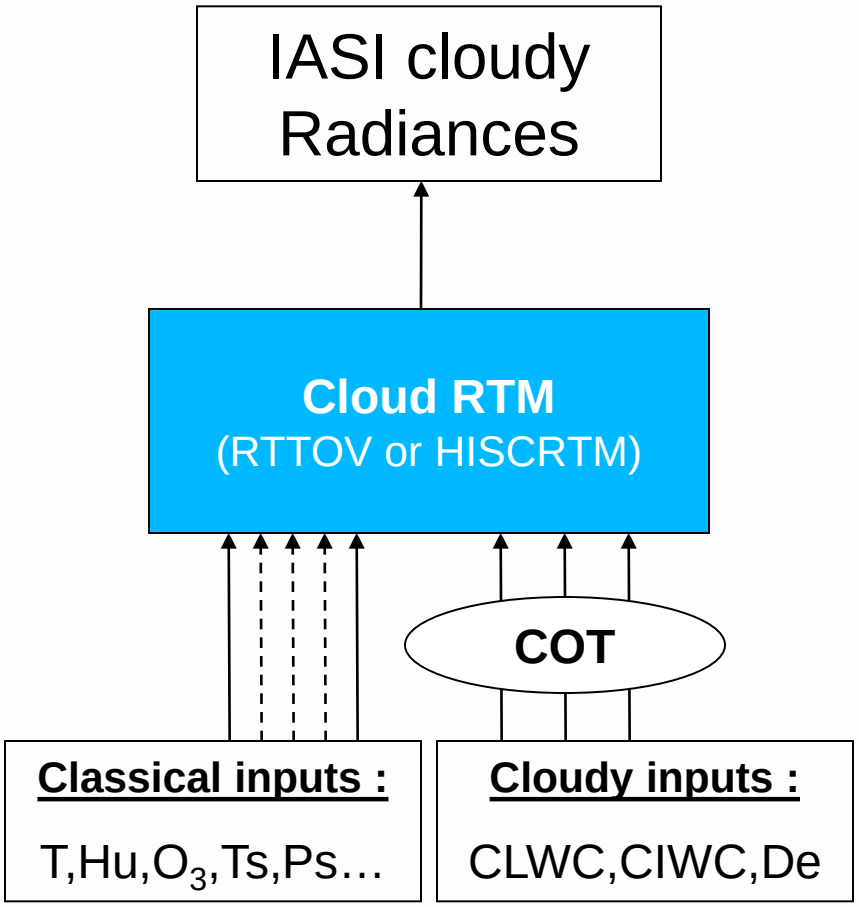


IASI cloudy Radiances

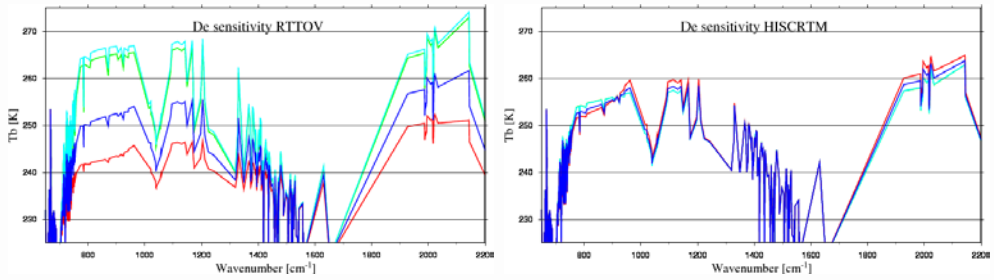


- Objectives :
  - Take into account cloud microphysical properties in radiative transfer models (RTM) to simulate IASI cloudy spectra.
  - Use cloud NWP profiles data into RTM
- Problem :
  - Due to limited description of cloud in NWP and to RTM scattering approximation, whole IASI spectra could not be well simulated
- Methodology :

1. From **AQUA-Train** profiles **:**
   - evaluate cloud microphysics RTMs
   - defined a processing methodology
2. Apply previous methodology to a global **operational context**



- HISCRTM (Wei et al, 2004) :
  - Clouds defined on single levels
  - Need a Cloud Top Pressure (CTP)
  - De has an impact only on the slope between 780 cm^{-1} and 960 cm^{-1}
- RTTOV (Matricardi, 2005) :
  - Cloud profile
  - Ice De depends on parameterization Wyser, Boudala, Ou and Liou…
  - COT depends on De



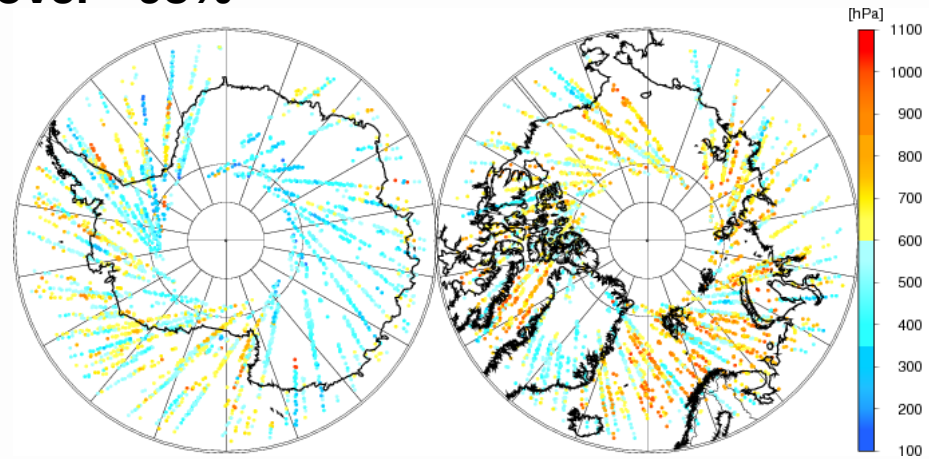
CLWC/CIWC/De : cloud liquid/ice water content/effective diameter

COT : cloud optical thickness

Concordlasi campaign : Use of co-registered cloud AQUA-Train profiles to evaluate cloud microphysic treatments in RTMs and establish a processing methodology

- **Dardar profiles :** Synergetic product from AQUA-Train CALIPSO Lidar and CLOUDSAT radar (Delanoë and Hogan, 2008) .
  - Profiles of CIWC (60 m vertical resolution)
  - Profiles of De
  - More information on ICARE website : www.icare.univ-lille1.fr

- **20896 coregistrations between DARDAR and IASI/AVHRR** from September 2010 to January 2011 over Antarctic and Arctic. **7931 coregistrations CloudCover >95%**

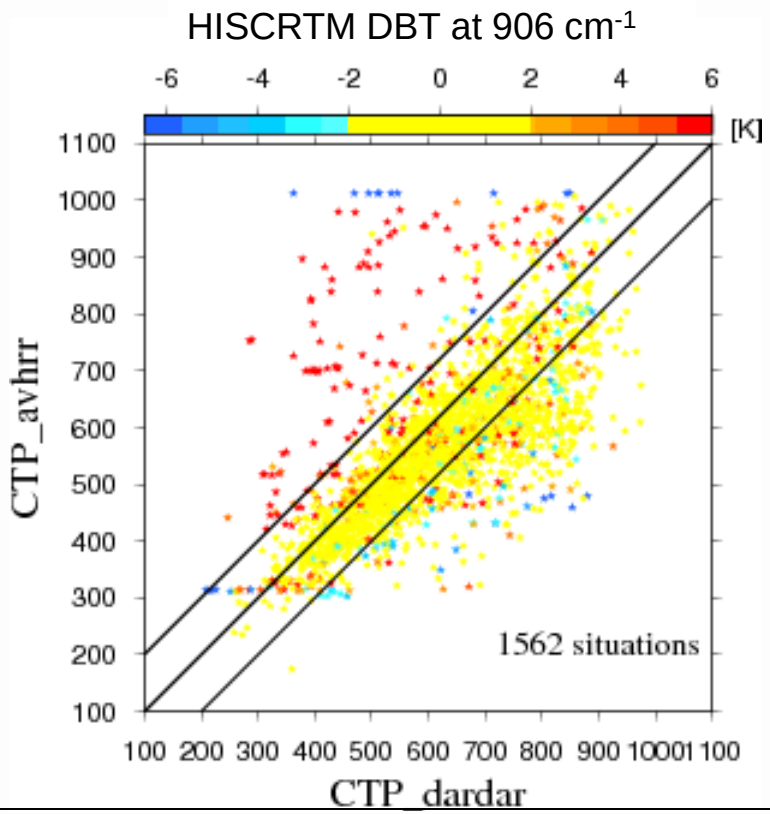


Cloud Top Pressure [hPa]

Filters : selection of situations with a **good coherence** between **IASI/AVHRR cloud information** and **DARDAR COT**

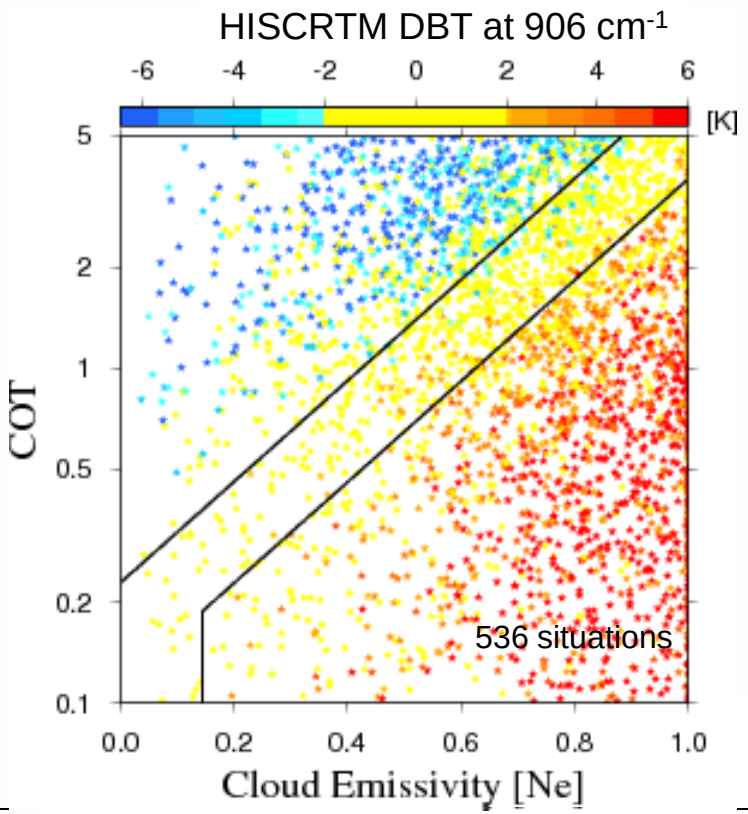
Opaque clouds (COT>5)

AVHRR CTP versus CTP (integrated COT=5) from Dardar COT



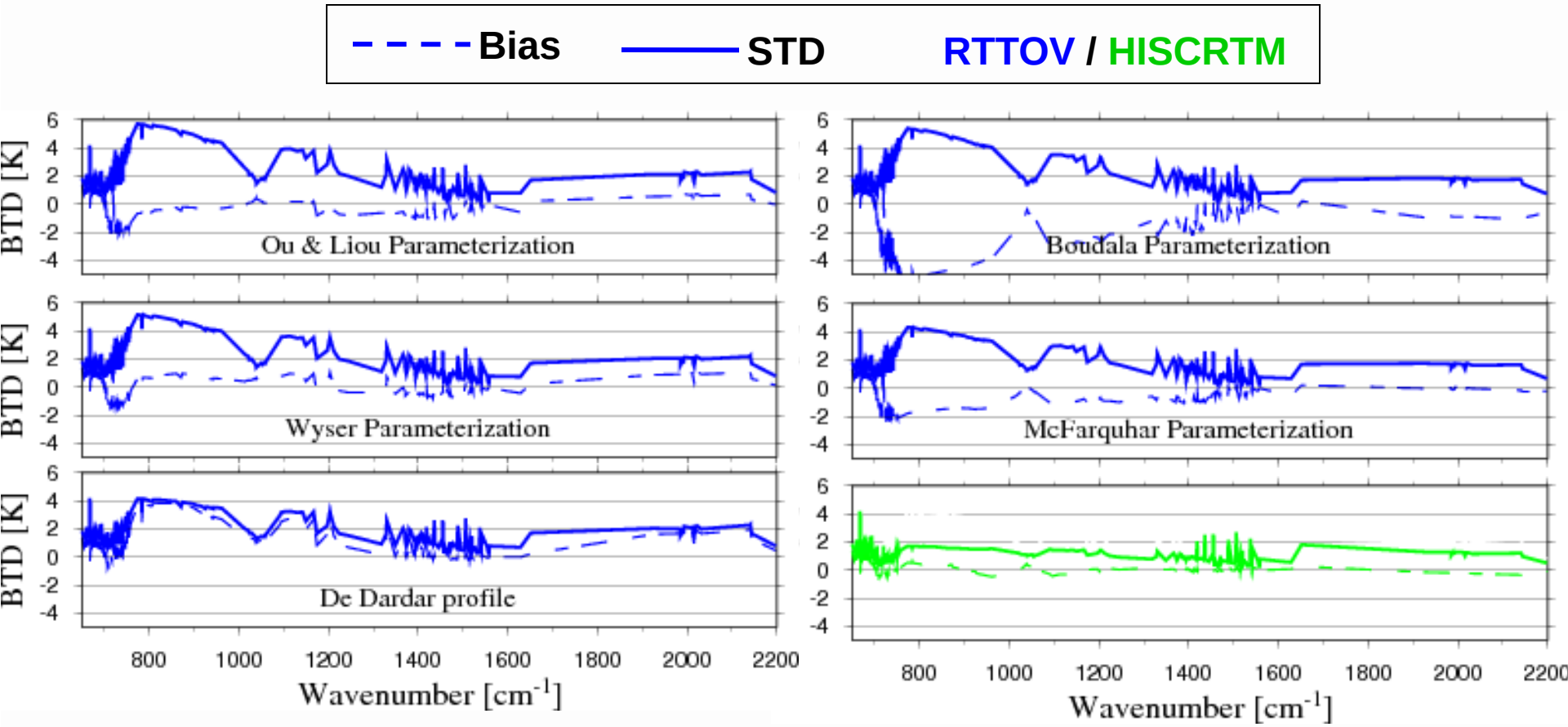
Semi-transparent clouds (COT<5)

IASI Co_2slicing Nε versus COT from Dardar COT



DBT : Difference brightness temperature

Impact of the **De parameterization in RTTOV** for semi-transparent clouds



Which parameterization ?

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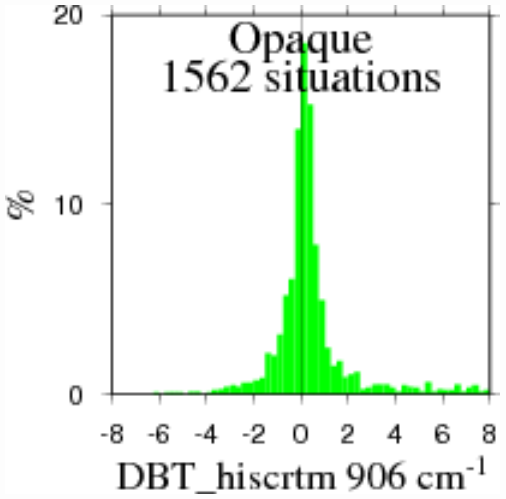
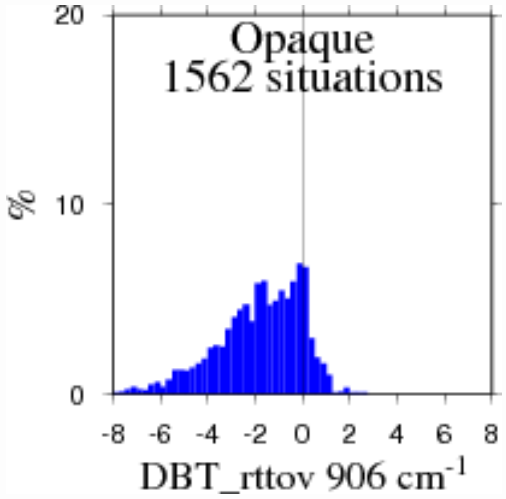
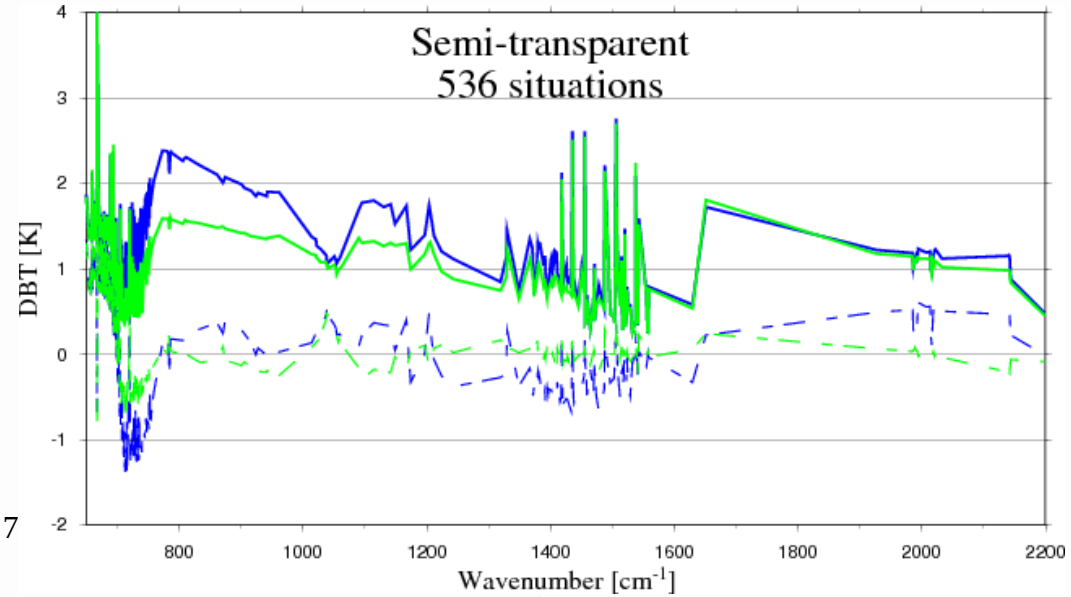




HISCRTM / RTTOV



Methodology :

- Apply **filters**
- RTTOV: De parameterization which best simulates the spectrum
- HISCRTM: De which best simulates the 780-960 cm^{-1} slope

	Op.	St.
Ou &Liou	5%	15%
Wyser	11%	17%
Boudala	3%	21%
McFarquhar	6%	19%
Dardar	75%	28%

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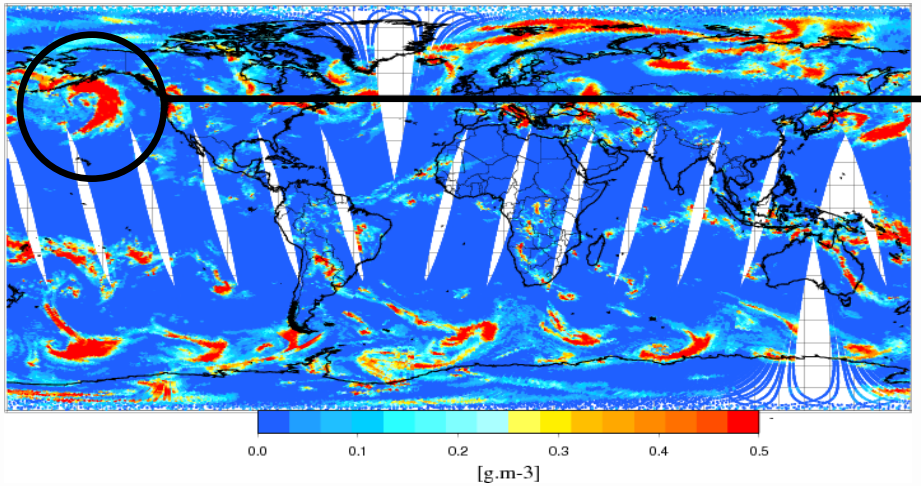
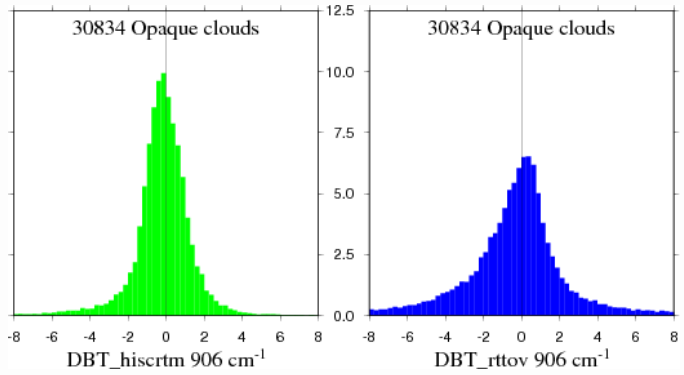
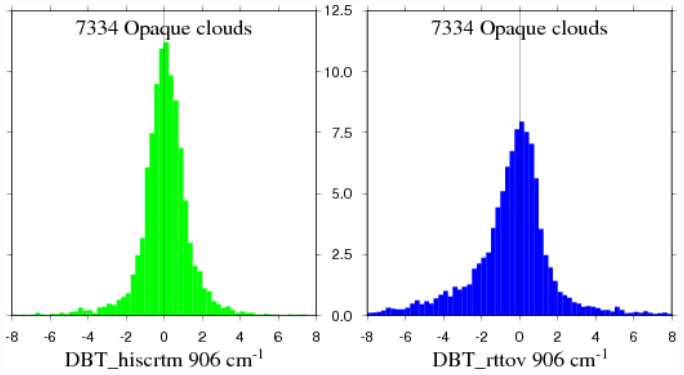
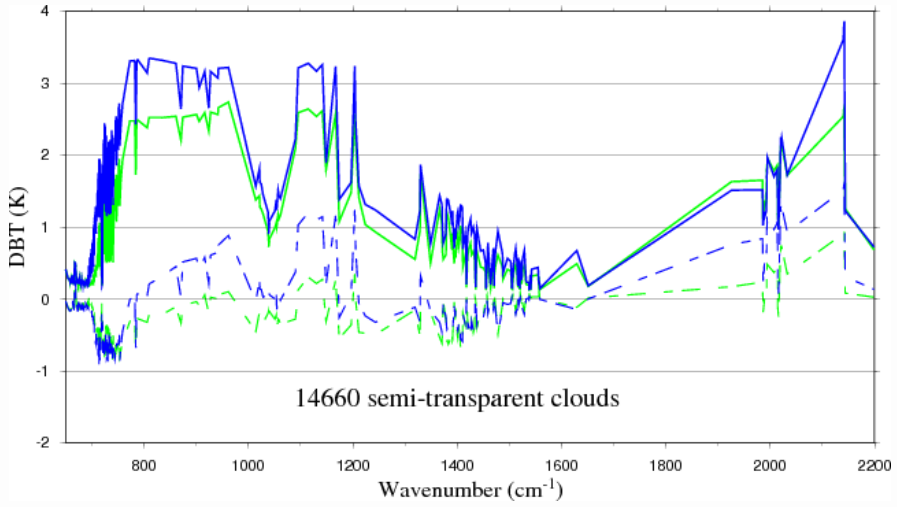
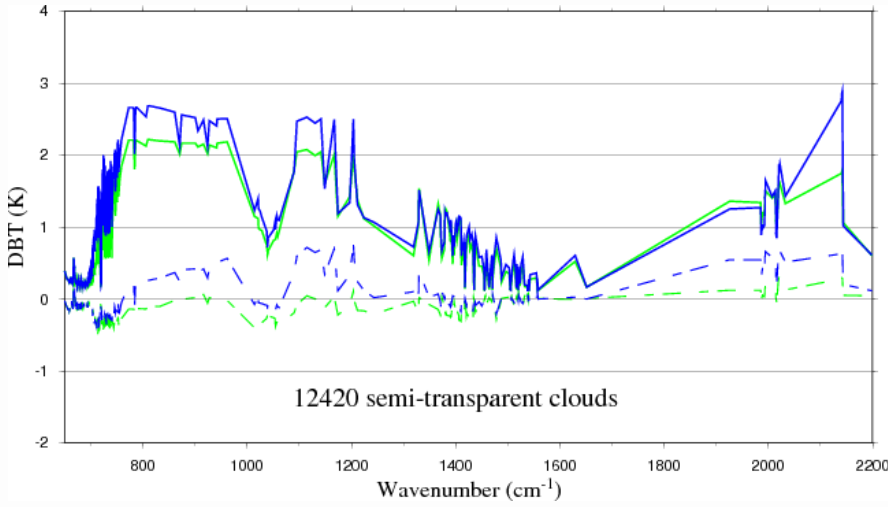
Objective : Apply previous methodology to an operational context with the cloud data from ECMWF 6h-12h forecast

- Six days : 01/02/2012 - 06/02 /2012
- Resolution : spatial < 0.25° temporal < 1h30mn
- Processing of only overcast IASI pixels (from AVHRR cloud mask)

CIWC from NWP (ECMWF)



Cloud mask from IASI-AVHRR clusters

	SEA	LAND
Opaque		
Semi-transparent		

RTTOV / HISCRTM

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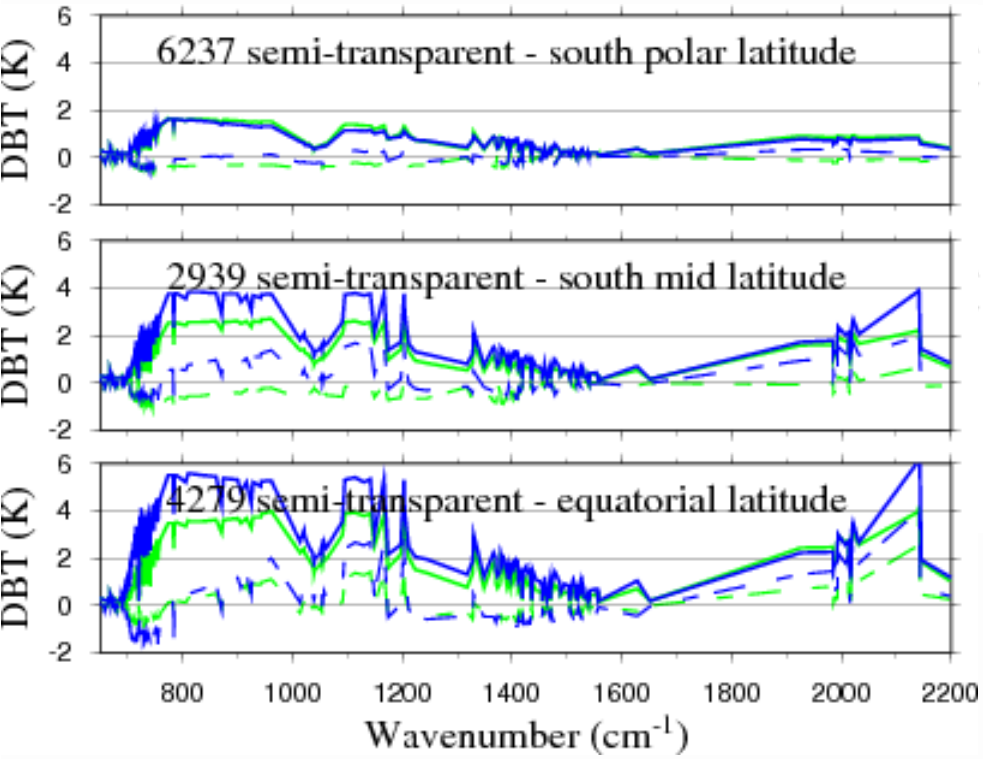

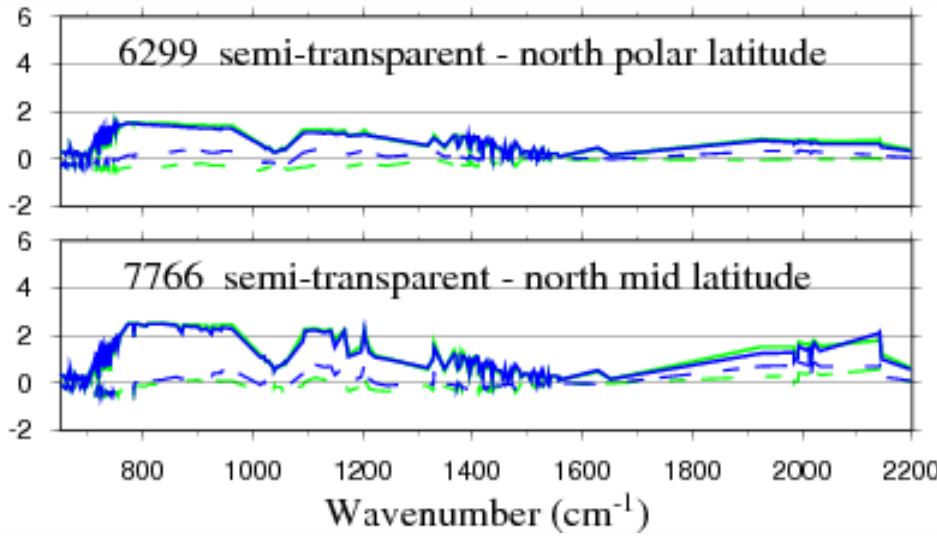

RTTOV / HISCRTM

Better results in the high latitudes

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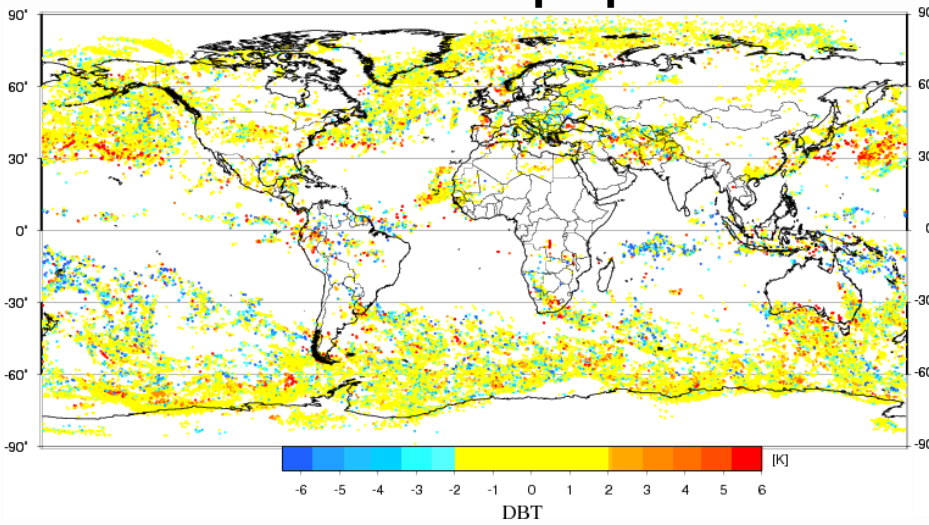
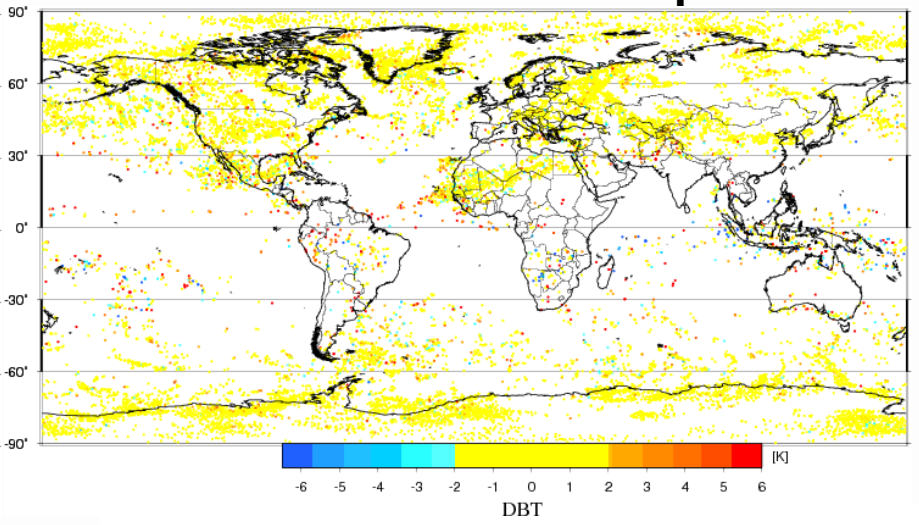
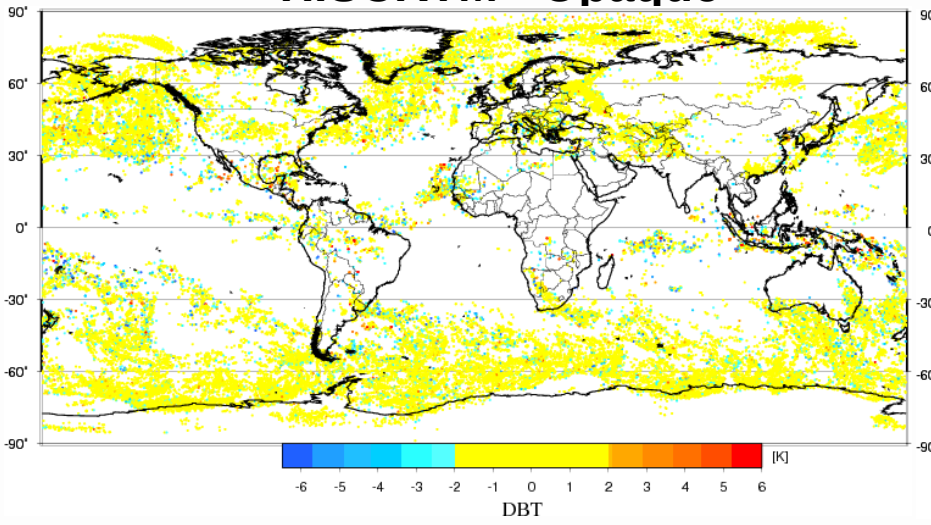
RTTOV - Opaque



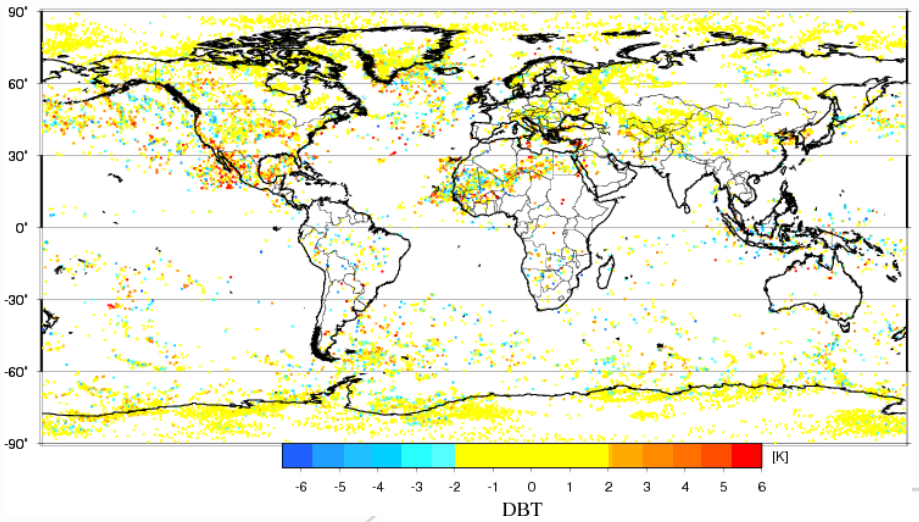
RTTOV – Semi-transparent



HISCRTM - Opaque



HISCRTM – Semi-transparent



Results on 6 days

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- Two studies were conducted :
  1. Use of co-registered cloud AQUA-Train profiles to evaluate cloud microphysics treatments in RTMs and establish a processing methodology
  2. Apply previous methodology to global NWP context

- RTMs including cloud microphysics correctly simulate IASI observations when the cloud profiles are accurate enough
- Establishment of two efficient filters independent from RTMs
- Similar results for the two studies
- **RESIDUALS<3K** whatever the type of cloud (Opaque or Semi-Transparent)

- Large impact of ‘unknown’ De on the simulated spectrum: need of De in the control variables of a retrieval process (ex : 1dVar system)
- Tropics: applied filters are less efficient

Thank you for your attention

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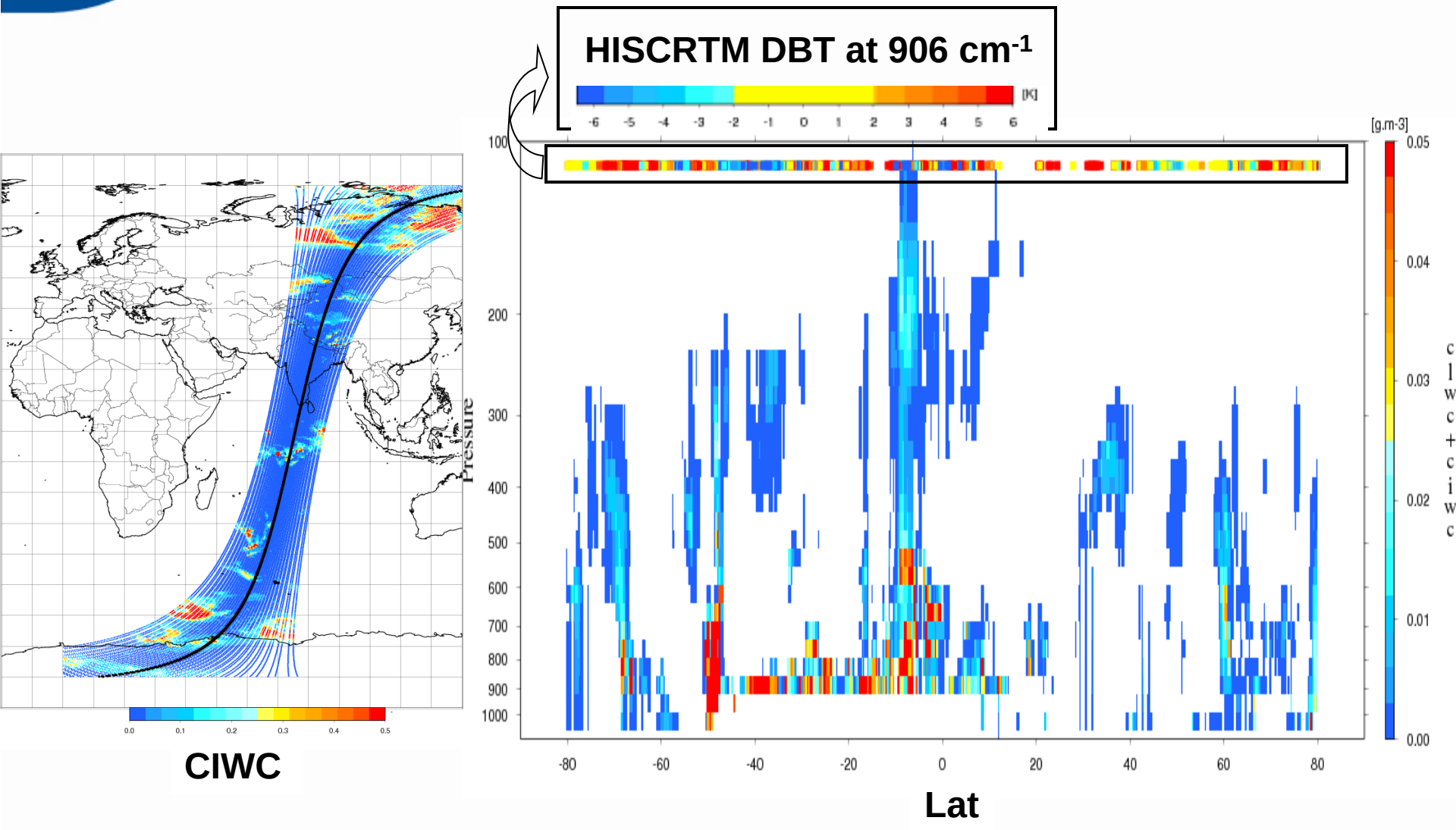

High DBT in presence of multi layer clouds

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