

## Hyperspectral IR assimilation in cloudy atmospheres: global and IPY applications

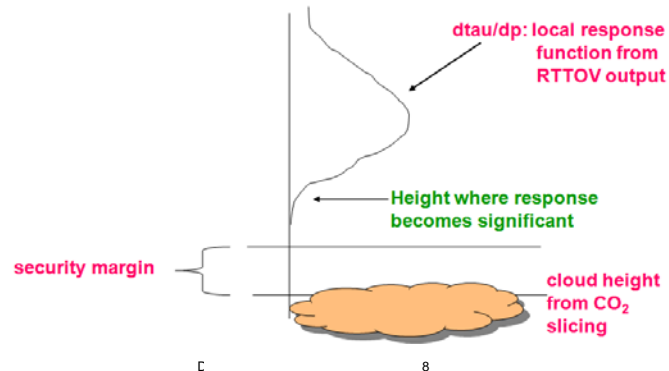
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## Background

- AIRS radiances assimilated operationally (June 2008)
  - 87 channels
  - radiances not sensitive to lower clouds assimilated
- *Therefore* need to validate cloud height/amount determination for improved quality control
- By extension interest in validating trial fields of cloud parameters and more generally cloudy radiance spectra to infer model deficiencies
- Specific problems found in Arctic/Antarctic region linked to cloud parameter determination. Validation with independent data needed (MODIS, Calipso, MISR datasets)

## Cloud height/amount from CO<sub>2</sub>-slicing technique

- CO<sub>2</sub> slicing: 12 estimates of cloud height from as many channels coupled with a reference profile peaking near the surface. Mean of valid estimates used.
- Security margin is max (50 hPa, std among valid estimates)



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## Basic idea

- Effective cloud height and amount derived from Co<sub>2</sub>- slicing technique using **observed** AIRS radiances
- Same methodology used with **calculated** cloudy AIRS radiances from 6-h and 12-h forecasts



Eliminates ambiguity of definition of cloud parameters related To observed versus calculated.



Still a need to validate the quality of retrieved parameters



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## Comparisons of cloud parameters

- **Observed** cloud top pressure and cloud fraction
- **Calculated** cloud top pressure and cloud fraction derived from cloudy AIRS radiances (6-h forecasts, closest trial between 03-09-h)

Data collected from 15 July 2008 to 15 August 2008 (128 periods)

Latitude – Longitude grid: 1.5° x 1.5°



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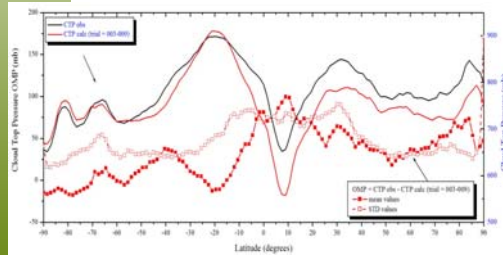
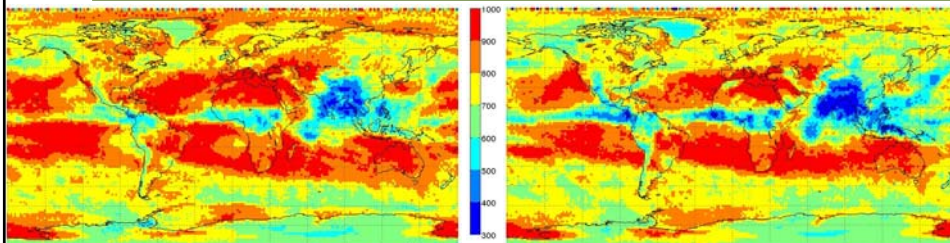
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## Global Cloud Top Pressure

Observed mean values

Calculated mean values



Good correlation between observed and calculated CTP

OMP = Observations - Calculations

OMP global mean = 31.7 mb  
OMP global STD = 48.1 mb

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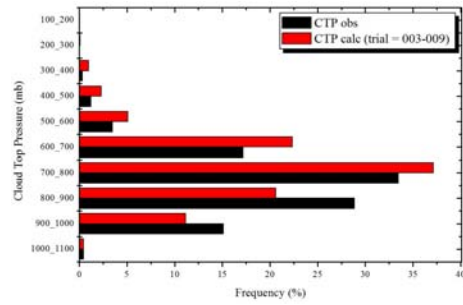
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## Global Cloud Top Pressure



The model has more high altitude clouds



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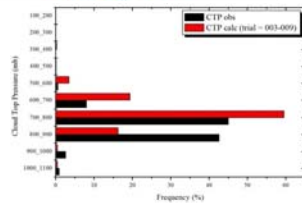
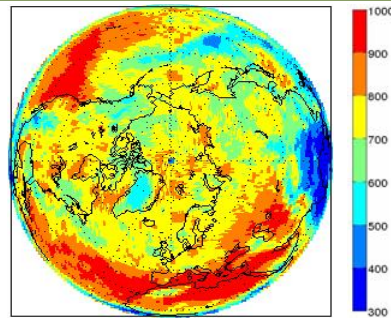
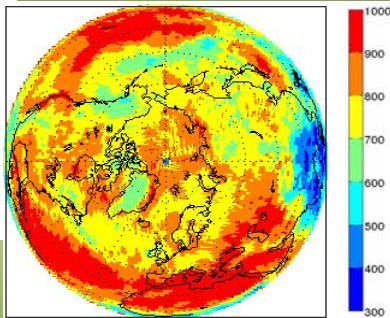
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## Arctic Cloud Top Pressure

Observed mean values

Calculated mean values



OMP = Observations - Calculations  
(statistics between 90° N and 60° N)  
OMP arctic mean = 50.0 mb  
OMP arctic STD = 41.7 mb

The model has more high altitude clouds



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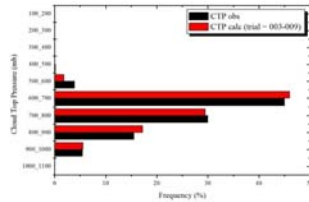
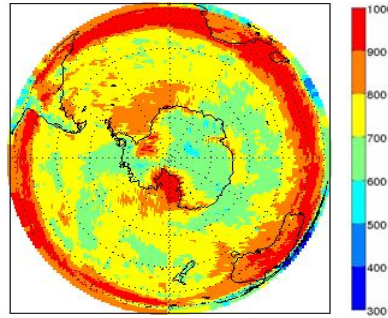
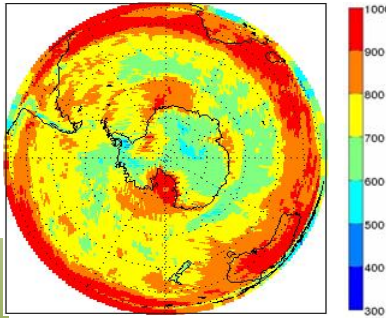
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## Antarctic Cloud Top Pressure

Observed mean values

Calculated mean values



OMP = Observations - Calculations  
 (statistics between 90° S and 60° S)  
 OMP arctic mean = -6.4 mb  
 OMP arctic STD = 33.2 mb  
 Relative good agreement between observed  
 and calculated CTP distribution, but ...  
 This is linked to high occurrence of clear cases

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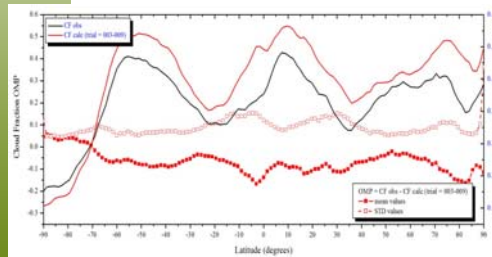
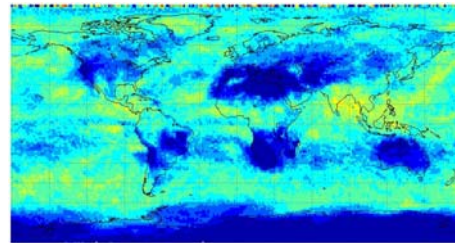
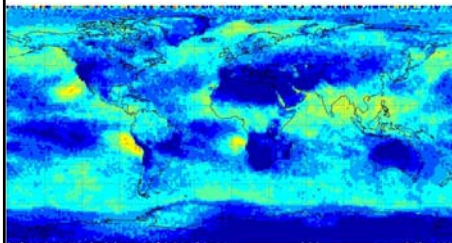
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## Global Cloud Fraction

Observed mean values

Calculated mean values



Good correlation between observed  
 and calculated CF

OMP = Observations - Calculations

OMP global mean = - 0.07  
 OMP global STD = 0.09

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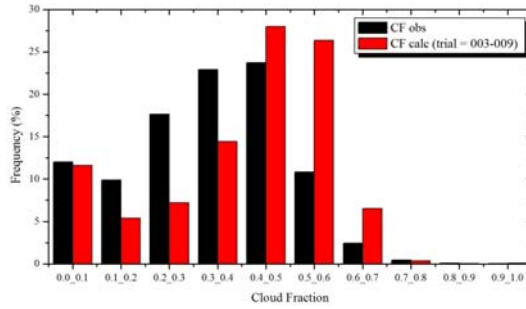


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## Global Cloud Fraction



Weak distribution of clear cases



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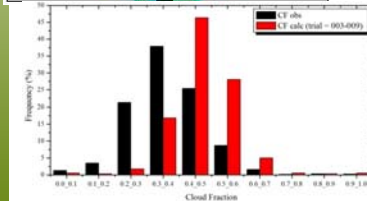
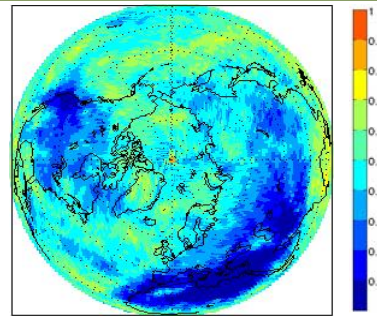
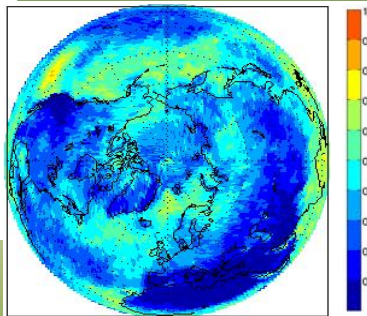
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## Arctic Cloud Fraction

Observed mean values

Calculated mean values



OMP = Observations - Calculations  
 (statistics between 90° N and 60° N)  
 OMP arctic mean = - 0.10  
 OMP arctic STD = 0.10

The model has more clear cases



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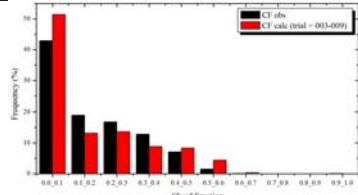
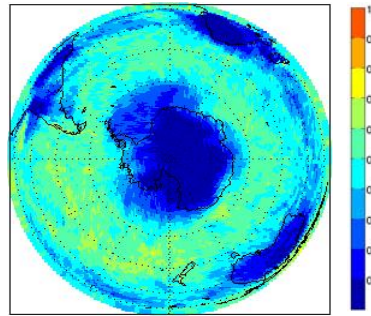
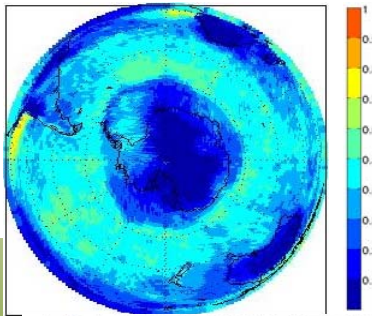
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## Antarctic Cloud Fraction

Observed mean values

Calculated mean values



OMP = Observations - Calculations  
(statistics between 90° S and 60° S)  
OMP arctic mean = - 0.01  
OMP arctic STD = 0.07

Both observation and model present clear cases over Antarctica

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## Perspectives

- Develop validation statistics for cloudy radiance spectra
- Validation of AIRS-derived cloud parameters with independent data, in particular for polar winter cases
- Assimilation tests with revised quality control
- Collaboration to IPY research on ice cloud parameterization (Chosson- Vaillancourt)
- Extend application to IASI

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