Deriving Atmospheric Motion Vectors From AIRS Moisture Retrieval Data

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Tracking humidity features from AIRS retrievals

Project Overview

1) Determine to what extent AIRS-derived AMVs can provide useful wind information. Advantages:
   a) Provide a 3-dimensional winds dataset
   b) Removes issues with AMV height determination
   c) Clear sky (and above cloud) wind information
   d) No water vapor imager channel after MODIS (polar orbiter)

2) Blend the AIRS moisture retrieval AMVs with MODIS AMVs to create 3-D polar wind fields.

3) Perform NWP experiments with the blended product to determine the overall impact on numerical forecasts, and the relative contributions of each data type (MODIS vs. AIRS).
Polar Winds Coverage
MODIS vs. AIRS
AIRS Retrieval Images at 500, 700, 850 hPa

Specific humidity SFOV AIRS retrievals
Remapped composites at 16 km resolution
Sensors Degrading?

01 Jan 2005

AIRS moisture 300 hPa over polar region; clouds in cyan

08 Jan 2011
Sensors Degrading?

Line average

AIRS moisture 300 hPa over polar region; clouds in cyan
Spatial distribution of AIRS retrieval winds for one day. North Pole region.

All derived winds from 5 January 2011. Color coded by level:

- 700 - 600 hPa (red)
- 550 - 450 hPa (green)
- 400 - 300 hPa (blue)
- 150 hPa ozone (gray)
Assimilation

1) Two weeks: 01 – 14 January 2011
2) Northern Hemisphere
3) 29 levels: 12 ozone and 17 moisture levels (away from tropopause)
   - Ozone: 103 - 201 hPa
   - Moisture: 359 – 661 hPa
4) 2010 version of GSI
5) All winds; no quality control
All derived winds from 6 January 2011 at 1200 UTC.

Colors denote distance from pole: blue (far) to red (close). Gray is the analysis.

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Vertical distribution of AIRS retrieval winds used. North Pole region.

All derived winds from 6 January 2011 at 1200 UTC.

Colors denote distance from pole: blue (far) to red (close). Gray is the analysis.
Status

• New challenges:
  • Lower resolution (16 km) vs. 4 km for AVHRR
  • Noise in SFOV retrievals (low pass and median filters)

• Use this AIRS retrieval tracking method for IASI (Metop) and CrIS (Suomi NPP, JPSS)

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