Separating recent emissions from background CO and V6 validation

Juying Warner, Zigang Wei, Fabien Carminati
- Dept. of Atmospheric and Oceanic Science, Univ. of Maryland College Park

Recent Publications:


Funded by:


• NASA Jet Propulsion Laboratory - COEUS #19770, $100K, 10/01/2013-9/30/2014, Continued Efforts for AIRS CO Using OE Method.
Collocated AIRS Pixels with MODIS Cloud Masks

- For retrieval quality assurance.
- To develop a clear sky dataset for AIRS single FOV ret.
AIRS V5 CO trends under clear and cloud cleared skies - daytime

- Globally cloud clearing cause very little differences in trends;
- It does causes positive bias over land and negative bias over ocean;
- CO shows decreasing trends, more in the NH than in the SH indication of economic slowdown.
AIRS V5 CO trends under clear and cloud-cleared skies - nighttime

- Similar conclusions to the daytime cases, but smaller CO difference between clear and cloud-cleared skies.
DOFS comparison: clear vs cloud-cleared

CO VMRs comparison: clear vs cloud-cleared

- CO VMRs and DOFS show higher values under clear sky cases.
Separating CO fresh emissions from background – PDF distribution and two Gaussian Fits

Normalized PDFs

CO VMRs (ppbv)
AIRS V5 and NOAA IASI at 500 hPa CO trends for recent emission (right Gaussian: red-AIRS and yellow-IASI) and background (left Gaussian: blue-AIRS and cyan-IASI)

Length of record matter to trend studies.
Recent emission from AIRS correlated with standard emission inventories.

CO Emissions: AIRS 500 hPa vs GFED3\MACCity

- **NH**
  - CO (ppbv)
  - Airs CO (ppbv)
  - GFED3\MACCity CO (x10^{-11} kg.m^{-2}.s^{-1})
  - Time (Year)

- **SH**
  - CO (ppbv)
  - Airs CO (ppbv)
  - GFED3\MACCity CO (x10^{-11} kg.m^{-2}.s^{-1})
  - Time (Year)

**CO Emission in NH**

- $r = 0.726$

**CO Emission in SH**

- $r = 0.915$
Implications of separating fresh emissions from the background

North_America: Background for 20060304

Raw Data (UT: 18:59:34~19:05:27)
AIRS V6 CO Validation
increase high values in NH & decrease low values in SH

AIRS V5 vs V6 daily CO (506 hPa)

V6 NH trend $-1.11\% \text{yr}^{-1} / -1.24(0.10)\text{ppbv.yr}^{-1}$
V5 NH trend $-1.06\% \text{yr}^{-1} / -1.16(0.09)\text{ppbv.yr}^{-1}$
V6 SH trend $-0.51\% \text{yr}^{-1} / -0.36(0.10)\text{ppbv.yr}^{-1}$
V5 SH trend $-0.46\% \text{yr}^{-1} / -0.34(0.09)\text{ppbv.yr}^{-1}$
AIRS V6 CO - primary upgrades: Hemispheric uniform first guesses & upstream improvements

• AIRS V5 CO uses 1 global FG leads to low bias in the NH and high bias in the SH.
• V6 made significant improvements.
AIRS CO V5 and V6 validated against HIPPO-HIAPER Pole to Pole Observations

1. Jan. 8 - 30, 09
2. Oct. 31 – Nov. 22, 09
3. Mar. 24 – Apr. 16, 10
5. Aug. 9 – Sept. 9, 11
Ave Differences INTEX-A/B & ARCTAS