Comparisons of VCSEL and AIRS/AMSU-A on water vapor and temperature in HIPPO#1

Minghui Diao, Mark A. Zondlo
Loayeh Jumbah, Justin Sheffield, Eric Wood
Dept. of Civil and Environmental Engineering,
Princeton University
Center for Mid-Infrared Technologies for Health and the Environment (MIRTHE).

Southwest Sciences, Inc.;
HIPPO Global Team;
RAF Technical and Ground Crews;

Photo by Minghui Diao

NASA Earth System Science Fellowship;
Funding of NSF – 0840732.

2011-March-18
**Introduction**

Motivation – Why do we compare *in situ* measurement with AIRS/AMSU-A data?
1. Routine assessment to ensure validity and confirm improvements
2. HIPPO - A unique dataset to assess AIRS observation
3. AIRS has large temporal and spatial coverage

**Difficulties:**
1. Different spatial/temporal resolutions
2. Algorithm to choose “closest” points

**HIPPO#1 Water vapor distribution**

 HIPPO#1 RF2 AIRS granules  
Version 5, level-2 standard products

+/- 1.5 days +/- 0.5 degrees
Time series comparison of HIPPO#1 RF2

Algorithm 1

H2O quality control
Delete:
- Qual_H2O=2
- H2OMMRStdErr > 0.5 (Olsen et al, 2007).
- P > PBest

Algorithm 1
Best 1 point
1. ± 22.5 km bin
2. Sort by time
3. Keep searching ± 22.5*i km, i = 1,2,3

Algorithm 2
Average window
- ± 45 km
- ± 3 hrs
HIPPO#1 RF1 to RF7

Algorithm 1

npnts= 23818;
$r^2 = 0.929505$;
a = 0.39 ± 0.0056
b = 0.82 ± 0.0021

Algorithm 2

npnts= 7520;
$r^2 = 0.97$;
a = -0.29 ± 0.0071
b = 1.02 ± 0.0032
Algorithm 1 - Pressure level

dH2O = 50 ~ 75 %
Algorithm 1 - Land fraction

![Graph showing the relationship between land fraction and the difference in water content (dH2O). The graph plots the number of points against the land fraction and the difference in water content. There are two sets of data points: red circles representing H2O difference and green triangles representing the number of points. The graph indicates a trend where higher land fraction corresponds to larger dH2O (%).]
Algorithm 1 - Latitude

Similar dH2O (%) in NH and SH hemispheres.
Influences of $d$Time and $d$Distance
- Grids of H2O difference

Bin by 22.5km * 1800 s

Bin by 100km * 1e4 s
Temperature comparison

1. Data: reference aircraft temperature (ATX)

2. T Quality Control
   Delete:
   P>PGood
   (Susskind,2007)

3. Algorithm 1
Grids of temperature difference

Bin by 22.5km * 1800 s

Bin by 100km * 1e4 s
Conclusion

1. Choice of criteria influences the comparison
   - Average window criteria better than 1 point selection

2. Pressure, Land fraction, latitude dependence
   - Pressure: 50~75% (should improve if use average window)
   - Land fraction: generally higher land fraction, larger dH2O (%)
   - Latitude: similar dH2O between 0~60 N and 0~60S

3. Temporal and spatial influence on H2O comparison
   H2O has both strong dependence on space and time
   Temperature has stronger dependence on distance than time

Future work

Compare more algorithms;
Define “optimal” algorithms for H2O and temperature, respectively.

Thank you!
Questions?