

# Frost Point Hygrometers and Satellite Sensors for Stratospheric Water Vapor

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# Advantages and Disadvantages FPs vs Satellite Sensors

## FPs

- +Sustainable multi-decadal accuracy
- +Very stable laboratory calibration
- +Relatively inexpensive (\$2.5K)
- +High vertical resolution (tens of m)
- Data from only a few sites (spatial)
- “Snapshot” profiles (temporal)

## Satellite Sensors

- “Lifetimes” of several years
- Require ongoing cal/val
- Very expensive (\$\$\$M)
- Low vertical resolution (>1 km)
- +Global or near-global coverage
- +Frequent profiles (36-3500/day)



# FPs vs Aura Microwave Limb Sounder

5+ year records  
1-2 Profiles/month  
45°S-52°N  
vert resolution 10s of m



## Coincidence Criteria

$\Delta t < 18$  hrs

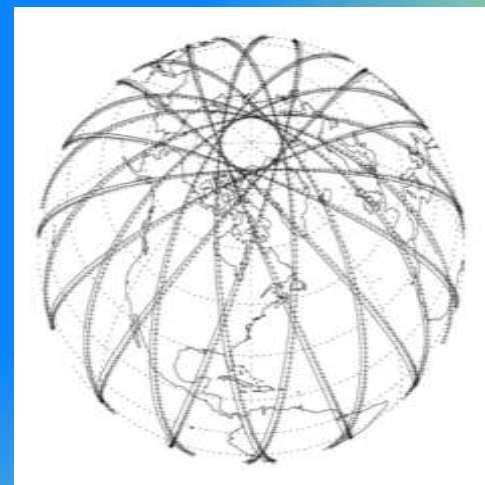
$\Delta \text{lat} < 2^\circ$

$\Delta \text{lon} < 8^\circ$

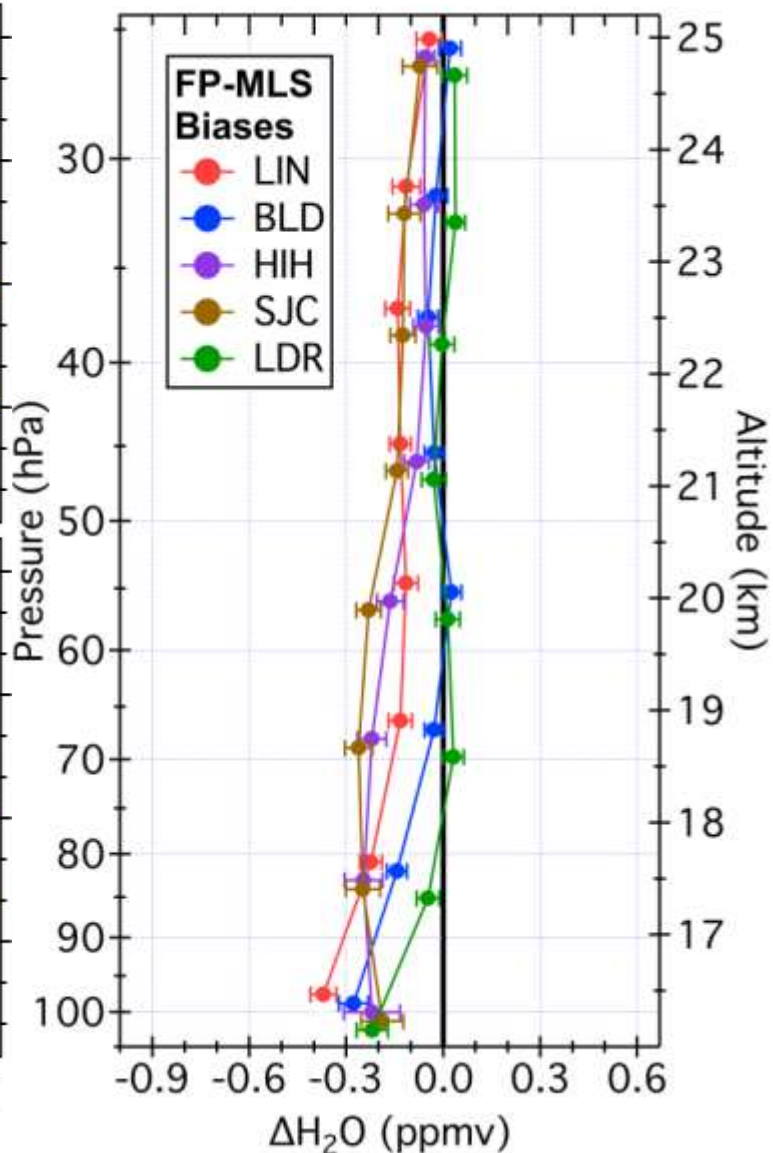
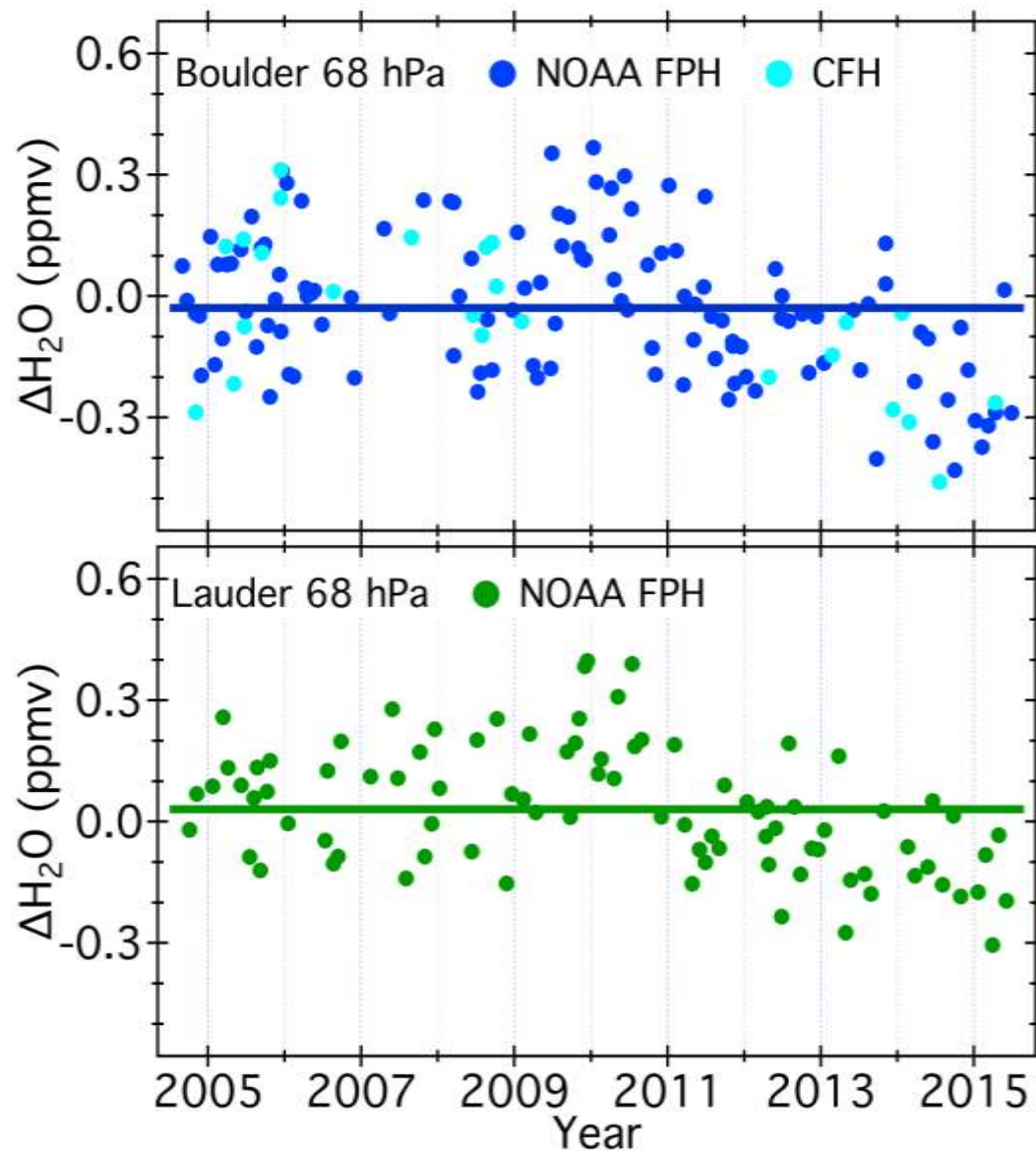
50-90  
matches yr<sup>-1</sup>

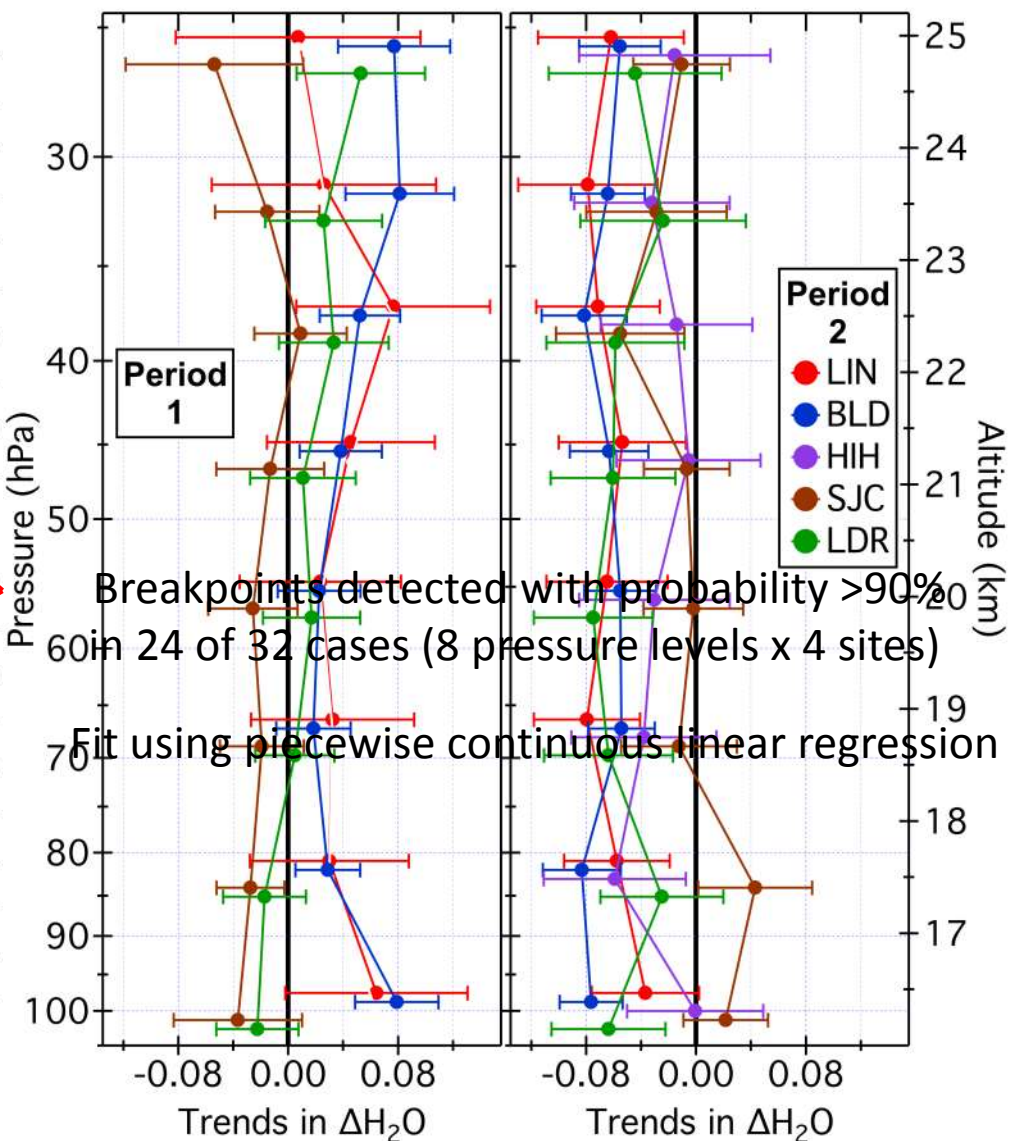
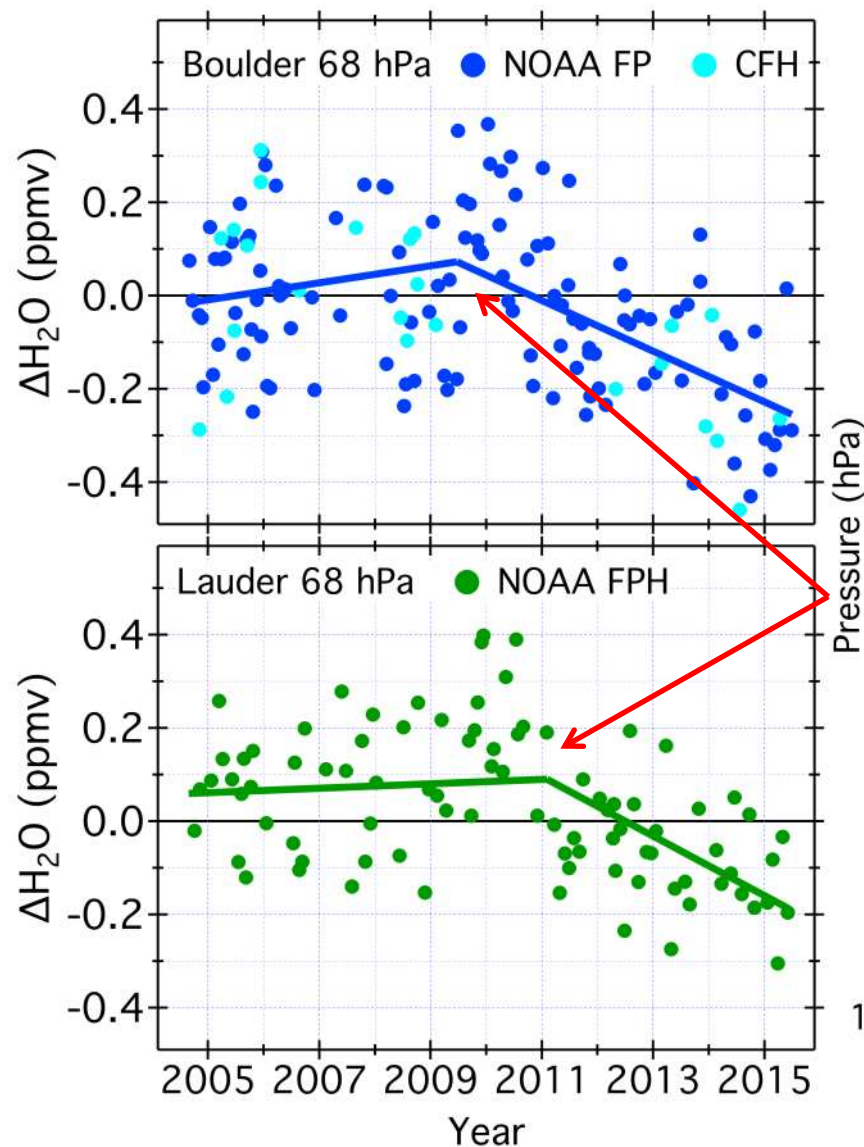


Aug 2004-present  
3500 Profiles/day  
82°S-82°N  
vert resolution ~3 km











# FPs vs SCISAT ACE-FTS

5+ year records  
1-2 Profiles/month  
45°S-52°N  
vert resolution 10s of m



## Coincidence Criteria

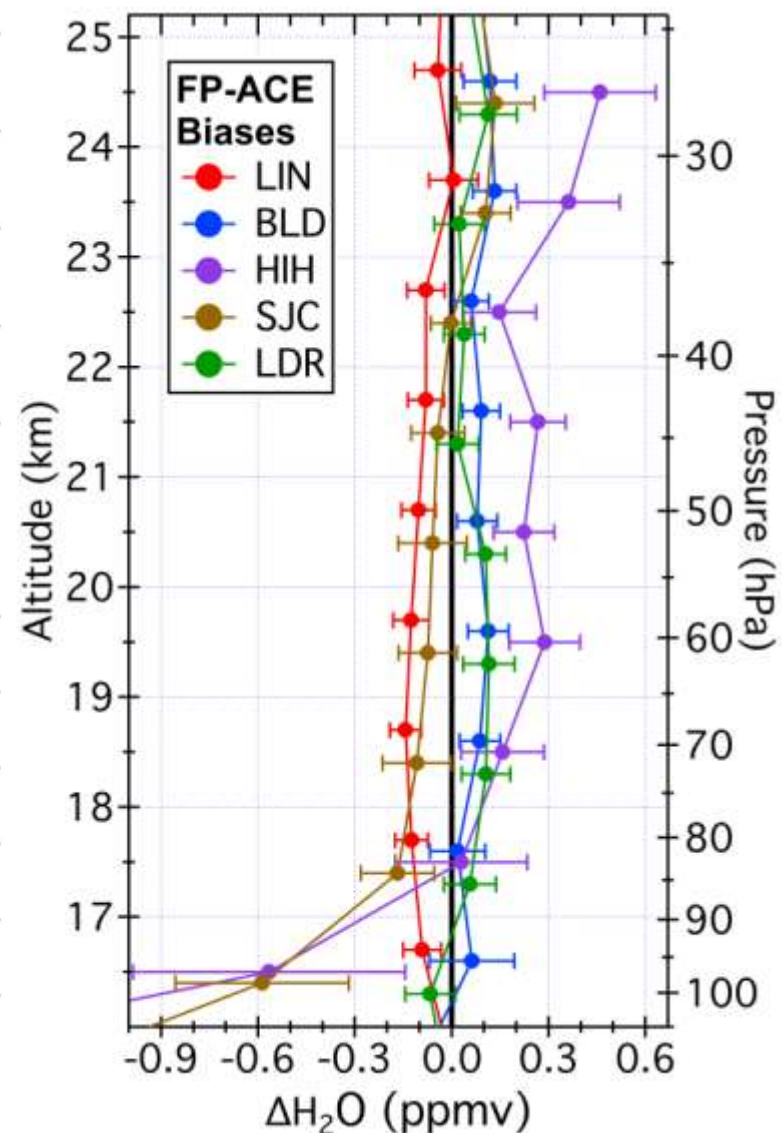
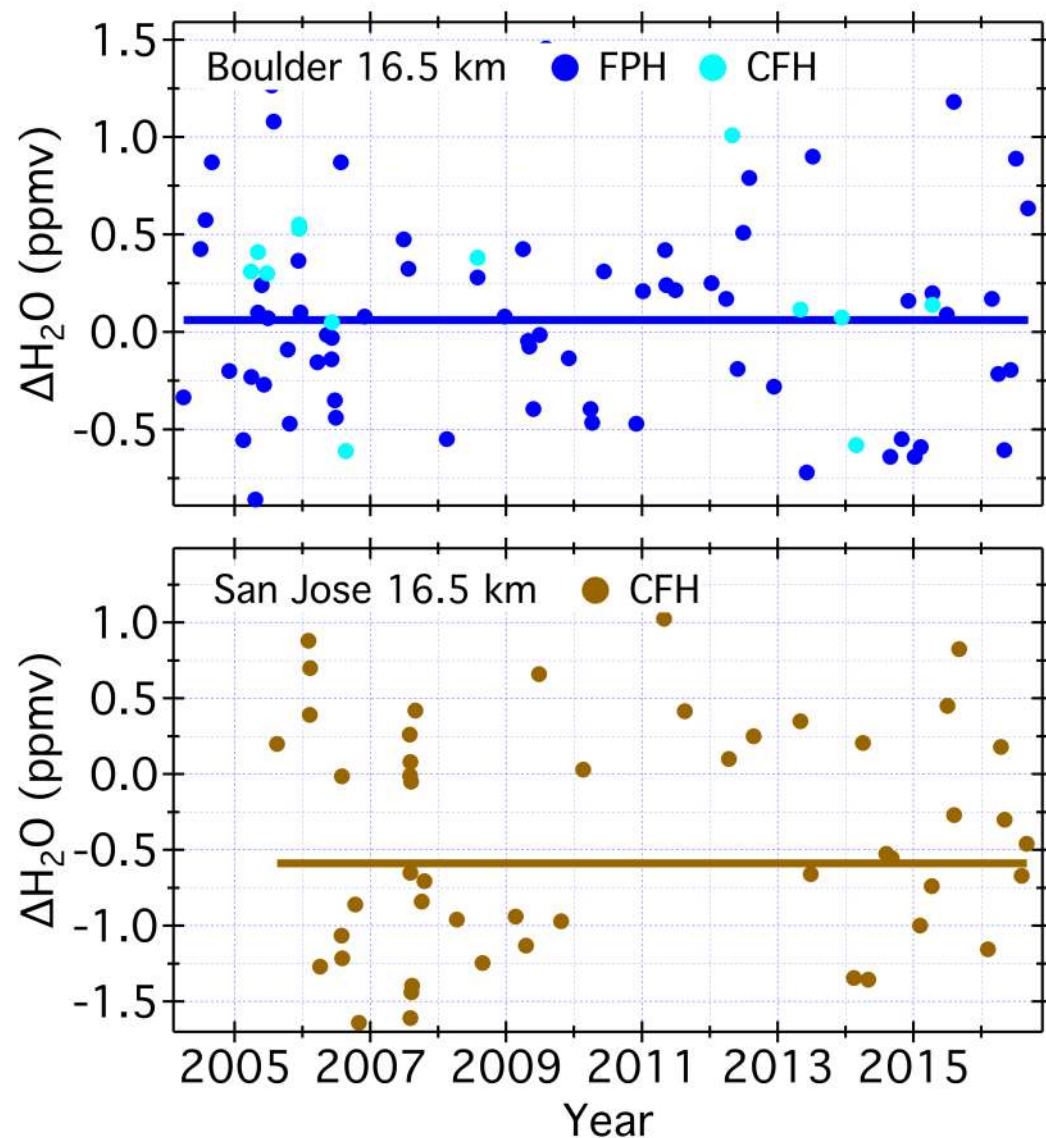
$\Delta t < 7$  days  
 $\Delta \text{lat} < 15^\circ$  5-9  
 $\Delta \text{lon} < 30^\circ$  matches yr<sup>-1</sup>

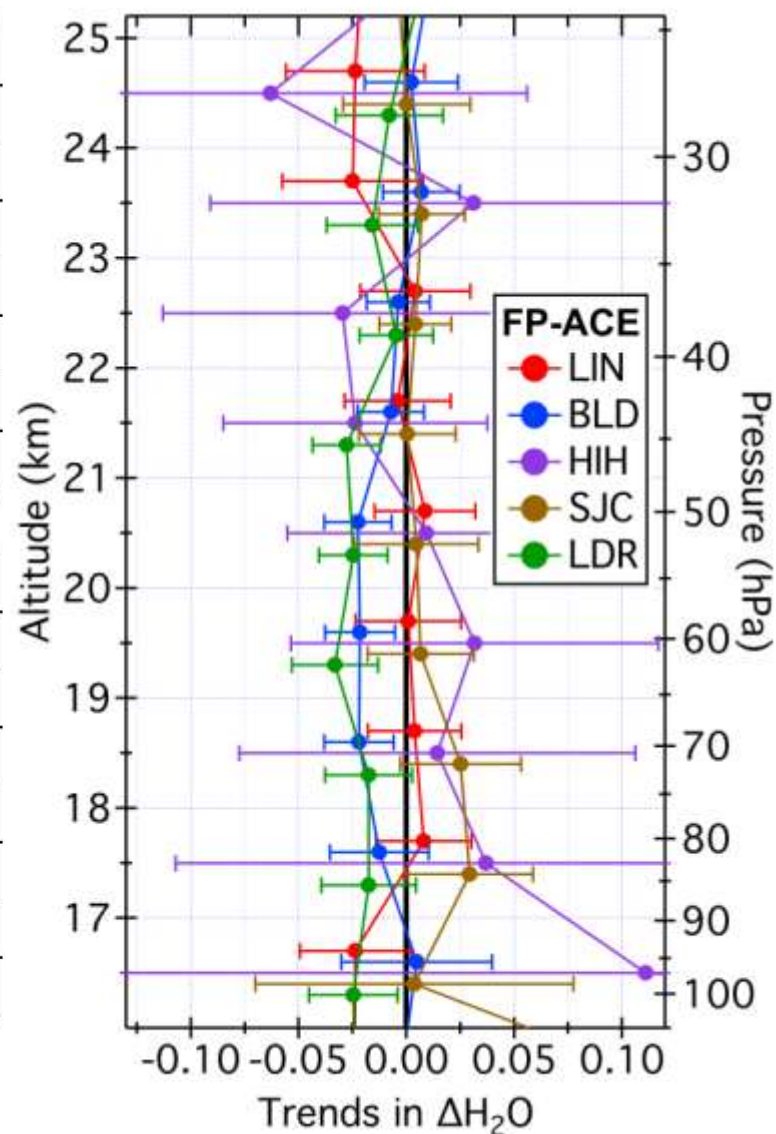
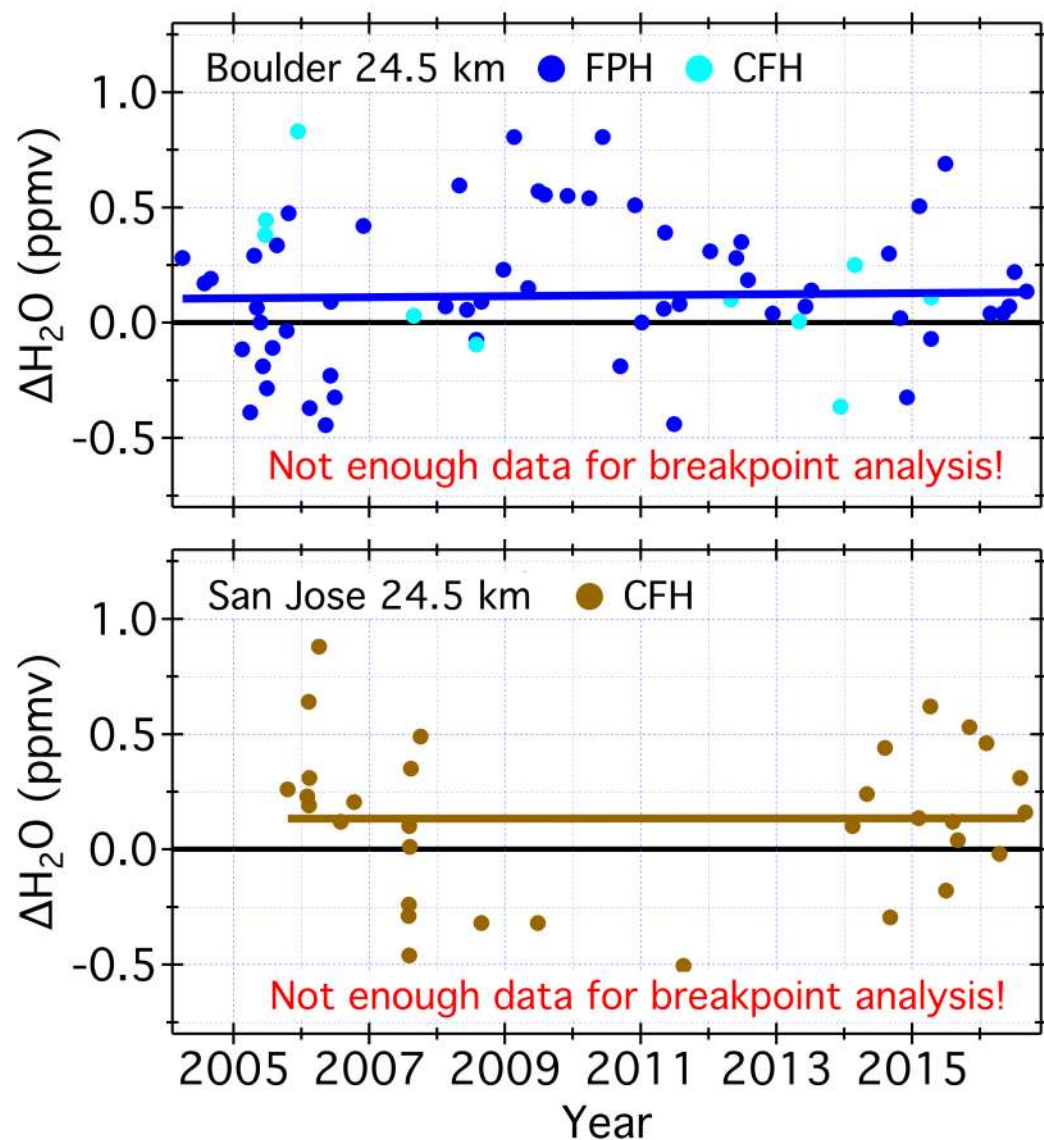
Feb 2004-present  
12 Profiles/day  
85°S-87°N\*  
vert resolution ~3 km

\*Polar (>60°) = 62%

\*30°S-30°N = 10%





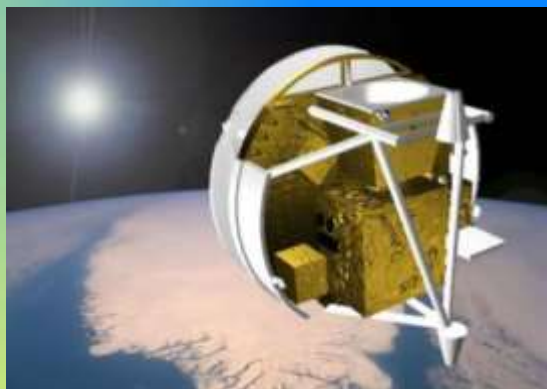




# ACE-FTS vs MLS

Feb 2004-present  
12 Profiles/day  
85°S-87°N\*  
vert resolution ~3 km

\*Polar (>60°) = 62%  
\*30°S-30°N = 10%

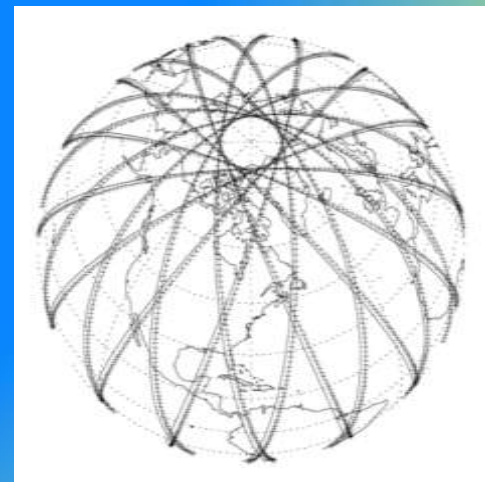


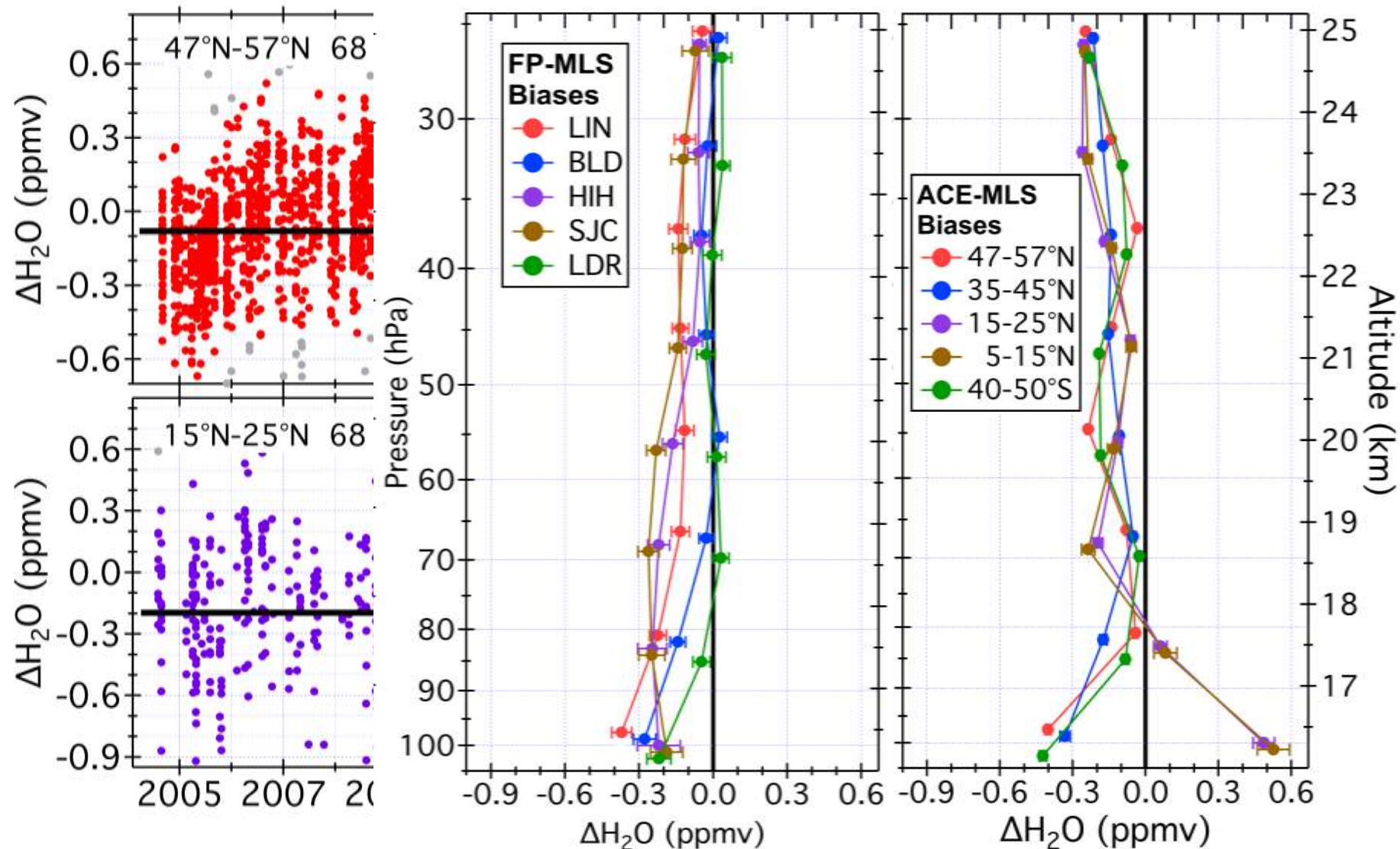
## Coincidence Criteria

$\Delta t < 18$  hours  
 $\Delta \text{lat} < 2^\circ$       50-250  
 $\Delta \text{lon} < 8^\circ$       matches yr<sup>-1</sup>

Matches in five  
10° zonal bands:  
FP site lat  $\pm 5^\circ$

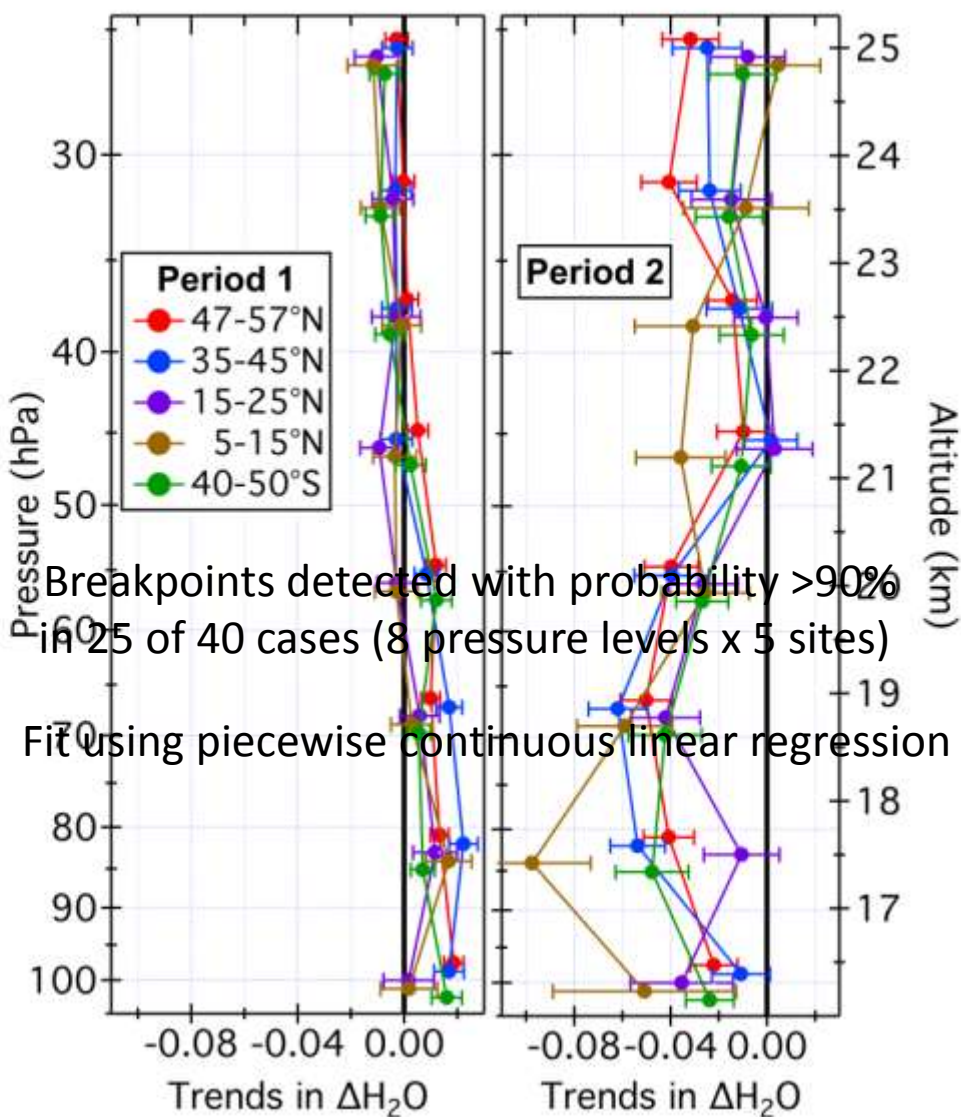
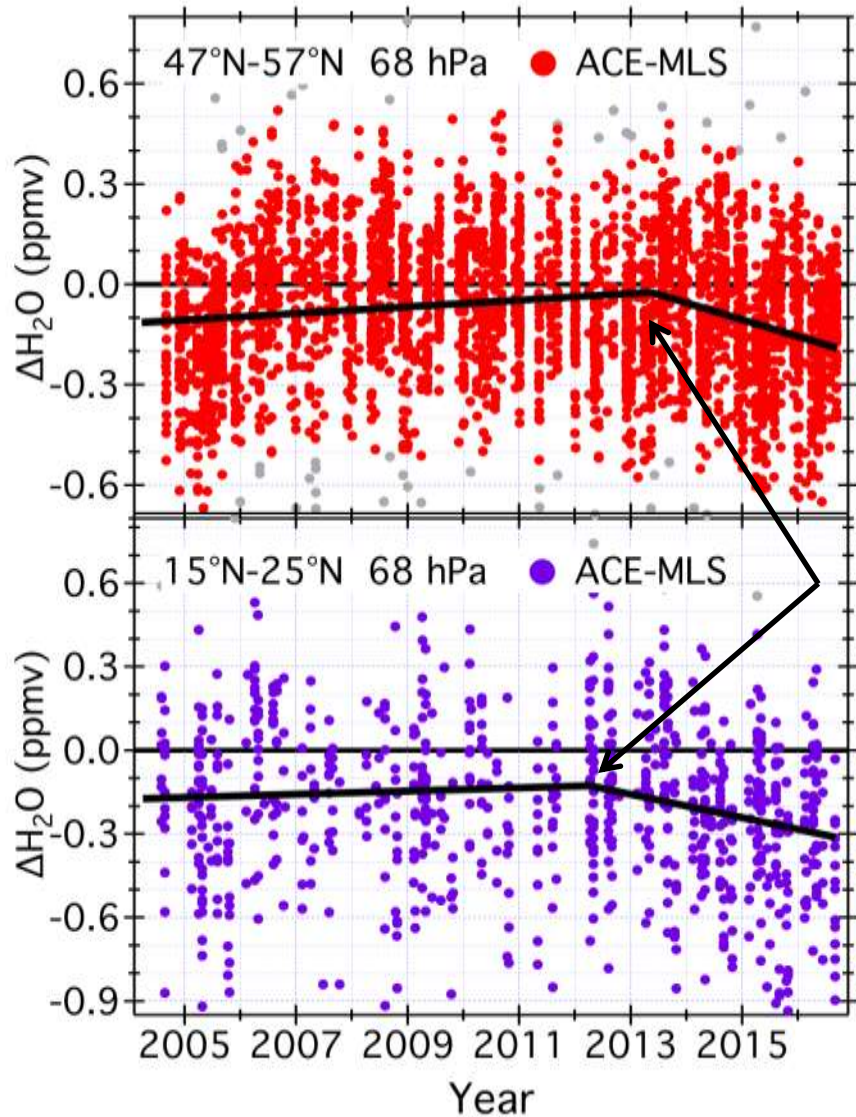
Aug 2004-present  
3500 Profiles/day  
82°S-82°N  
vert resolution ~3 km







# ACE-MLS Trends

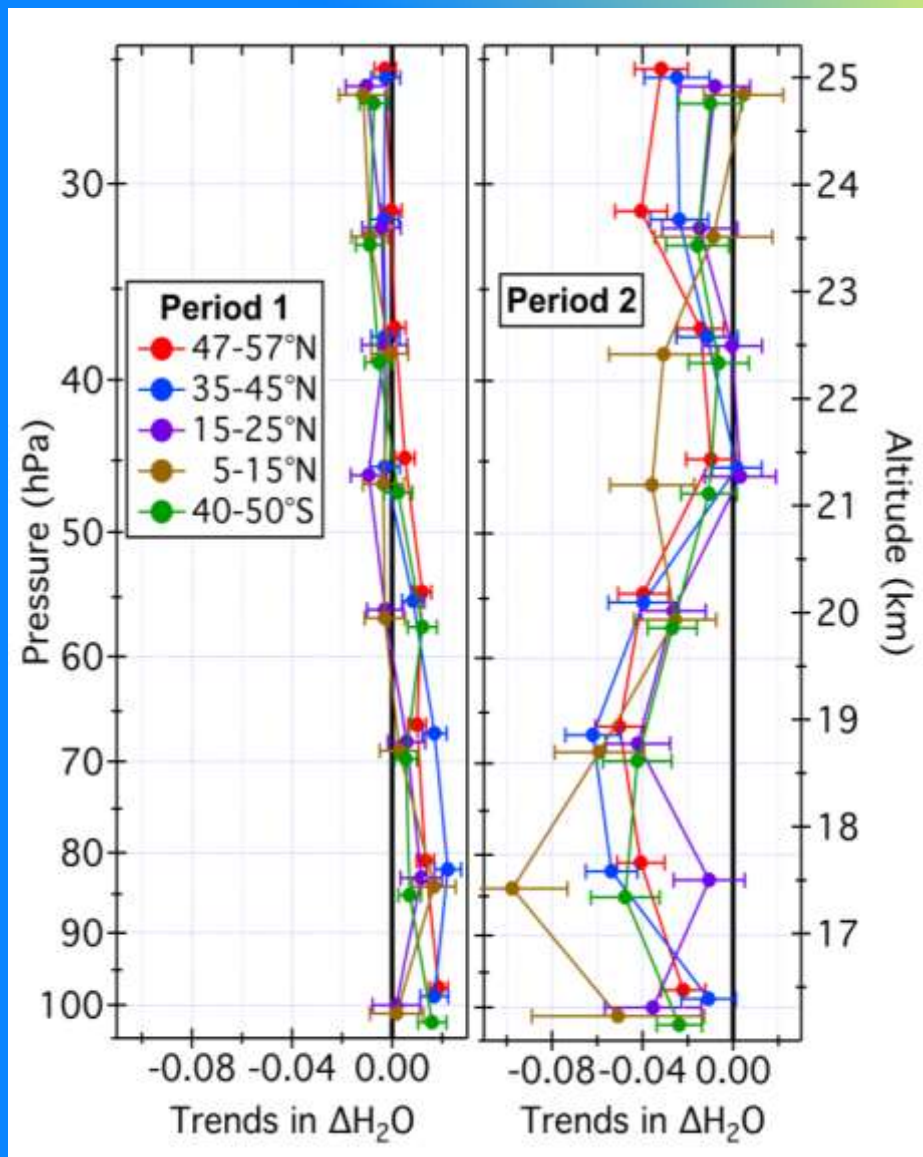
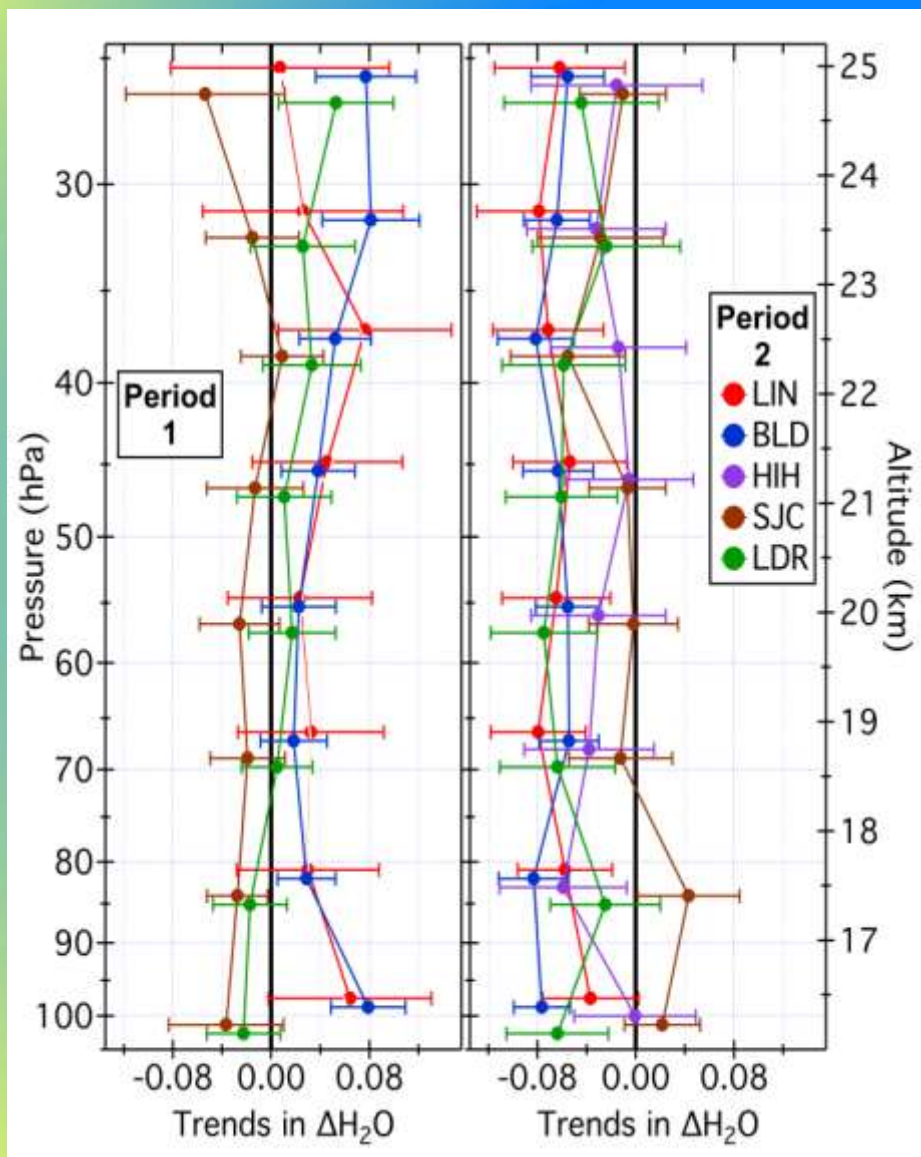




# $\Delta H_2O$ Trends Comparison

## FP-MLS Trends

## ACE-MLS Trends





Balloon launches from Boulder and Lauder - starting July 2017

- Coordinated with overpasses of SAGE III/ISS
- NOAA FPH, ECC ozonesonde, aerosol sonde
- Anticipated 3-year duration of monthly validation launches







Photo by Patrick Cullis, CIRES

