Site Progress Report: Boulder, Colorado

Dale Hurst
Junhong Wang

Earth System Research Laboratory
Global Monitoring Division

EOL NCAR Earth Observing Laboratory
### Table Mountain
- Full BSRN instrumentation

### Boulder
- GPS column water
- Microwave profiler $WV, T, H_2O(L)$
- FTIR column water

### Marshall
- Weekly balloon launches InterMet RS-1, GPS, ECC
- Twice monthly add NOAA FPH
- Weekly add RS-92 to payload
- GPS column water
- Microwave profiler $WV, T, H_2O(L)$

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### Map

- **Table Mtn**: Table Mountain
- **Boulder**: Boulder
- **Marshall**: Marshall

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2nd GRUAN Implementation-Coordination Meeting, Payerne, Switzerland, 2-4 March 2010
Marshall Balloon Launch Site

Progress Since March 2009

• Weekly Launches now always include GPS
  InterMet RS-1 has built-in GPS receiver

• Surface Met now recorded before every flight
  Real-time T, P, RH, wind data from nearby (100 m) NCAR WWE sensors

• Statistical Analysis of Historic FPH Data Uncertainties
  Examination of mixing ratio variability in 0.25-km altitude bins and differences between ascent and descent profiles (stratosphere)
  Greatly helps with estimates of modern FPH measurement uncertainties
Boulder Site Wish List

Add Vaisala RS-92 to every payload launched

Operation of Radiometrics microwave profiler at Marshall
   Next best: operation of profiler at company site in Boulder during balloon flights

Operation of FTIR at NCAR in Boulder during balloon flights
   Column - and with some work – 3 vertical layers (coarse resolution)

UCAR/COSMIC to retrieve column WV from GPS @ Marshall
   Already have retrievals from NOAA @ Boulder

Installation of our own Met Sensors at Marshall Launch Site
   NCAR WWE sensors are 100m away and are not under our control
   Concerns about calibration and the long-term stability of calibration
<table>
<thead>
<tr>
<th>System</th>
<th>Sensor</th>
<th>Institute</th>
<th>Variables</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOAA H$_2$O balloon payload</td>
<td>FPH, CFH, InterMet-1</td>
<td>NOAA/ESRL/GMD</td>
<td>P, T, 2 FPTs, RH, wind,</td>
<td>Can also use Vaisala RS80</td>
</tr>
<tr>
<td>NCAR GAUS + Vaisala RR01</td>
<td>Vaisala RS92, RR01</td>
<td>NCAR/EOL/ISF</td>
<td>P, T, RH, FPT</td>
<td>RR01 for FPT -30°C to -90°C</td>
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<tr>
<td>SWS balloon-borne TDL</td>
<td>TDL</td>
<td>Southwest Sciences, Inc.</td>
<td>Q</td>
<td>Prototype</td>
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<tr>
<td>HIAPER (Gulfstream-V)</td>
<td>TDL, VCSEL, chilled-mirror DPHs</td>
<td>NCAR/EOL/RAF</td>
<td>2 Qs, P, T, DPT</td>
<td>Most likely not available until 2011</td>
</tr>
<tr>
<td>Ground-based GPS receivers</td>
<td>GPS receivers</td>
<td>UCAR/COSMIC</td>
<td>PW</td>
<td>Also at NOAA in Boulder</td>
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<tr>
<td>Radiometrics MWR profiler</td>
<td>MWR profiler</td>
<td>Radiometrics</td>
<td>T, RH, LWC</td>
<td>At Radiometrics or possibly at Marshall</td>
</tr>
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</table>
Desired Science Objectives:

**Evaluate balloon-borne humidity sensors (side-by-side)**
Including NEW Vaisala RR01 humidity sensor

**Explore water vapor and temperature differences between Marshall and Boulder, representativeness of Marshall**
Intercompare: GPS at Marshall and Boulder, FTIR at Boulder sonde and satellite data
sonde and ground-based remote sensors

**Evaluate continuous ground-based water vapor profiling**
Radiometrics microwave radiometer – at Boulder or Marshall?

**Utilize HIAPER in situ WV measurements in the local area (2011)**
Compare with sondes, representativeness of Marshall
Sustainable accuracy of FPH measurements

WV mixing ratio is a function of FPT and $P_{\text{air}}$ only

**No WV calibration standards or scale required!**

Accuracy of WV mixing ratio depends on:
- Calibration of mirror thermistor (NIST traceable)
- Calibration of ambient pressure sensor (ground check)

The accuracy of FPH WV measurements should be sustainable for long periods of time
The Boulder water vapor record is about to reach the 30-year mark

First data flight: April 14, 1980