Boulder

Routine GRUAN Activities

GPS IPWV
- J. Wang (NCAR), S. Gutman (NOAA),
  J. Braun (NCAR)

Balloon Soundings
- Ozone + Imet (weekly)
- FPH + Ozone + Imet (monthly)
- Add RS92 to every balloon payload
  - D. Hurst, E. Hall, A. Jordan, B. Johnson
    (all NOAA)

FTIR
- Column H₂O, O₃, other trace gases
- Vertical profiles of H₂O and O₃
  - J. Hannigan (NCAR)
GNSS - GNSS IPWV Comparison

IPWV 2010
- Marshall
- NOAA Bldg
- NCAR FL

Year

IPWV (mm)

2010.0  2010.2  2010.4  2010.6  2010.8  2011.0

ΔIPWV (mm)

-1.0  -0.5  0.0  0.5  1.0

5%  25%  50%  75%  95%

Marshall - NOAA Bldg
NOAA Bldg - NCAR FL
Marshall - NCAR FL

95%  5%

75%  25%

50%  avg
FPH - GNSS IPWV Comparison

Boulder IPWV
- Marshall
- NOAA
- FPH

ΔIPWV (mm)

Marshall  -  FPH
NOAA Bldg  -  FPH
NCAR FL  -  FPH

N=23
N=13
N=11
A priori (green) is WACCM monthly mean

• 11 Coincident measurement days - late 2009 to present

• Continue to build a record with a large range of column water
Boulder *Non-Routine* GRUAN Activities

3000 g balloon
NOAA FPH / Imet
CFH / Imet
SWS TDL
RS92 (NCAR GAUS)

1500 g balloon
RR01
RS92 (DigiCora)

08 April, 2010
Marshall Field Site
Boulder Water Vapor Trends

- Net increase of $1.0 \pm 0.2$ ppmv ($27 \pm 6\%$) from 1980-2010
- CH$_4$ growth can account for at most $25 \pm 5\%$ of this net increase
- Sharp 0.5 ppmv decrease after 2000 attributed to anomalously cold tropical tropopause and increased tropical upwelling \([Randel\ et\ al.,\ 2006]\)
- The 10% decrease counteracted 25% of global surface temperature increase expected from well-mixed greenhouse gases during 2000-2009 \([Solomon\ et\ al.,\ 2010]\)
Boulder Water Vapor Trends

from Karen Rosenlof, NOAA
Boulder Water Vapor Trends

Water vapor at 46 hPa over Boulder, CO

Boulder Frost Point
HALOE V20
MLS V3

will appear in BAMS “State of the Climate 2010”