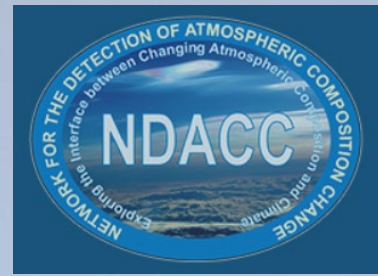


# WV Sondes Update

*Dale Hurst, Sondes Working Group Representative*



<u>Station</u>	<u>New Files</u>	<u>Data Files in Pubic Archive (as of 10 Sep 2021)</u>
Beltsville, MD, USA	0	
Boulder, CO, USA	+25	02/1991 – 08/2021 (450 files)* 92 additional files 1980–1990 available
Hilo, HI, USA	+10	12/2010 – 07/2021 (118 files)
Lauder, New Zealand	+11	08/2004 – 08/2021 (187 files)
Lindenberg, Germany	+15	09/2006 – 07/2021 (264 files)
Ny-Ålesund, Svalbard	+5	12/2002 – 02/2004; 10/2013 – 08/2020 (50 files)
San José, Costa Rica	+11	07/2005 – 06/2021 (229 files)
Sodankylä, Finland	+1	01/2005 – 04/2005; 03/2017 – 08/2020 (17 files)
<b>Total (new additions)</b>	<b>+78</b>	
<b>Total (whole archive)</b>	<b>1315</b>	

*The number of WV Sonde data files submitted each year continues to grow!*

# WV Sondes Update

**Of all non-NDACC sites launching frost point hygrometers, only Beltsville has moved forward with a consistent measurement program (since 2018)**

**Beltsville became the 8<sup>th</sup> WV Sonde Site in March 2021**

- *No data or 2020/2021 site report submitted (to date)*

## **Other recent developments:**

Ryan Stauffer replaced Rennie Selkirk as PI for ozone and WV soundings at San José, Costa Rica

Hong Kong has begun a program of routine FP soundings for GRUAN

NIWA (New Zealand) will investigate starting a FP sounding program this summer at Ross Island, Antarctica



# WV Sondes Update

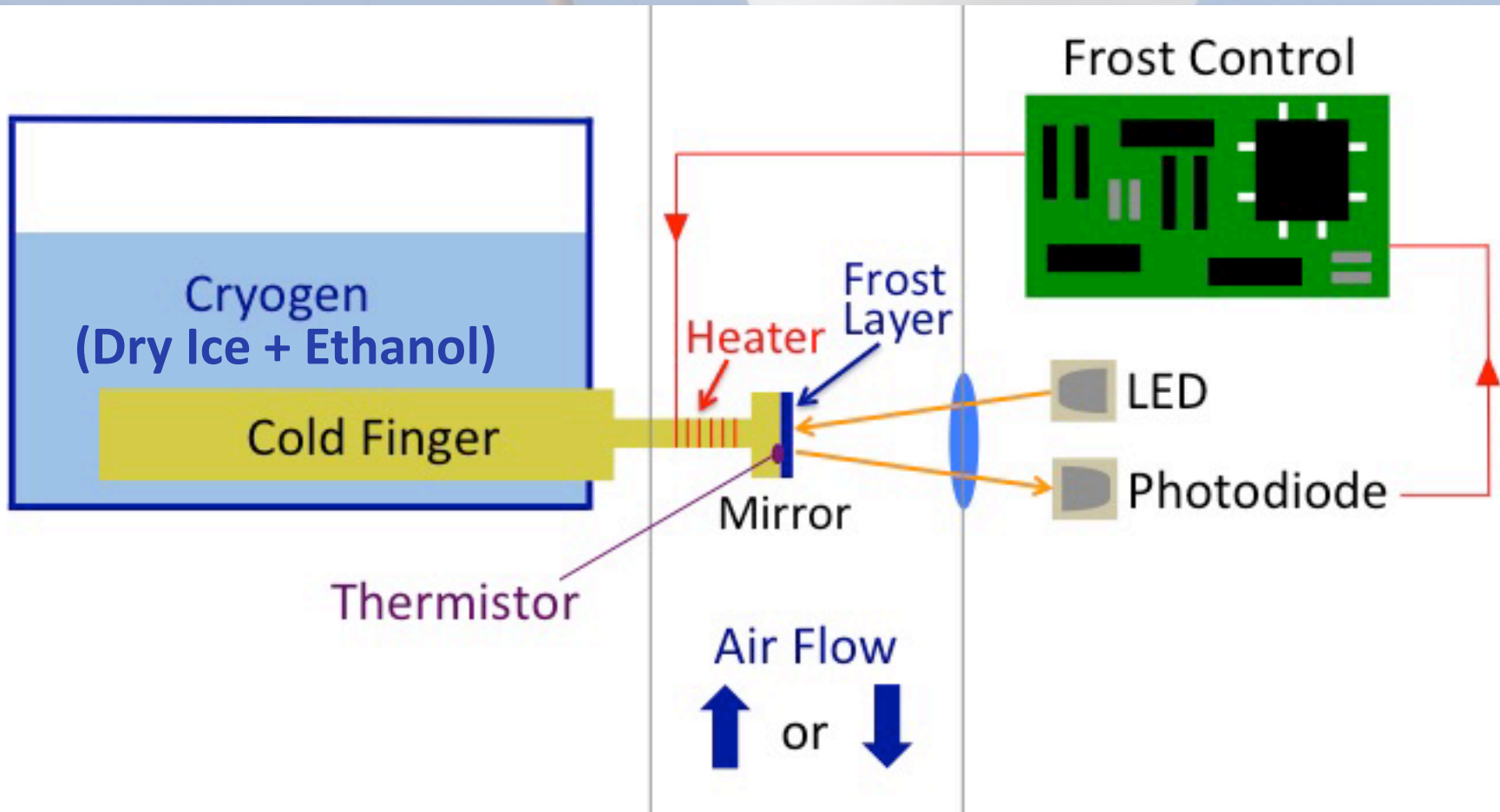
## Concerns about the availability of FP cryogen (HFC-23, “R23”)

- Kigali Amendment of the Montreal Protocol to reduce HFC emissions  
*Production freeze in 2024; first mandated production reduction in 2029*
- EU has already implemented its own 2020 ban on certain uses
- Other countries are following suit with accelerated reductions
- Cost is certain to rise, now impossible to purchase in some countries

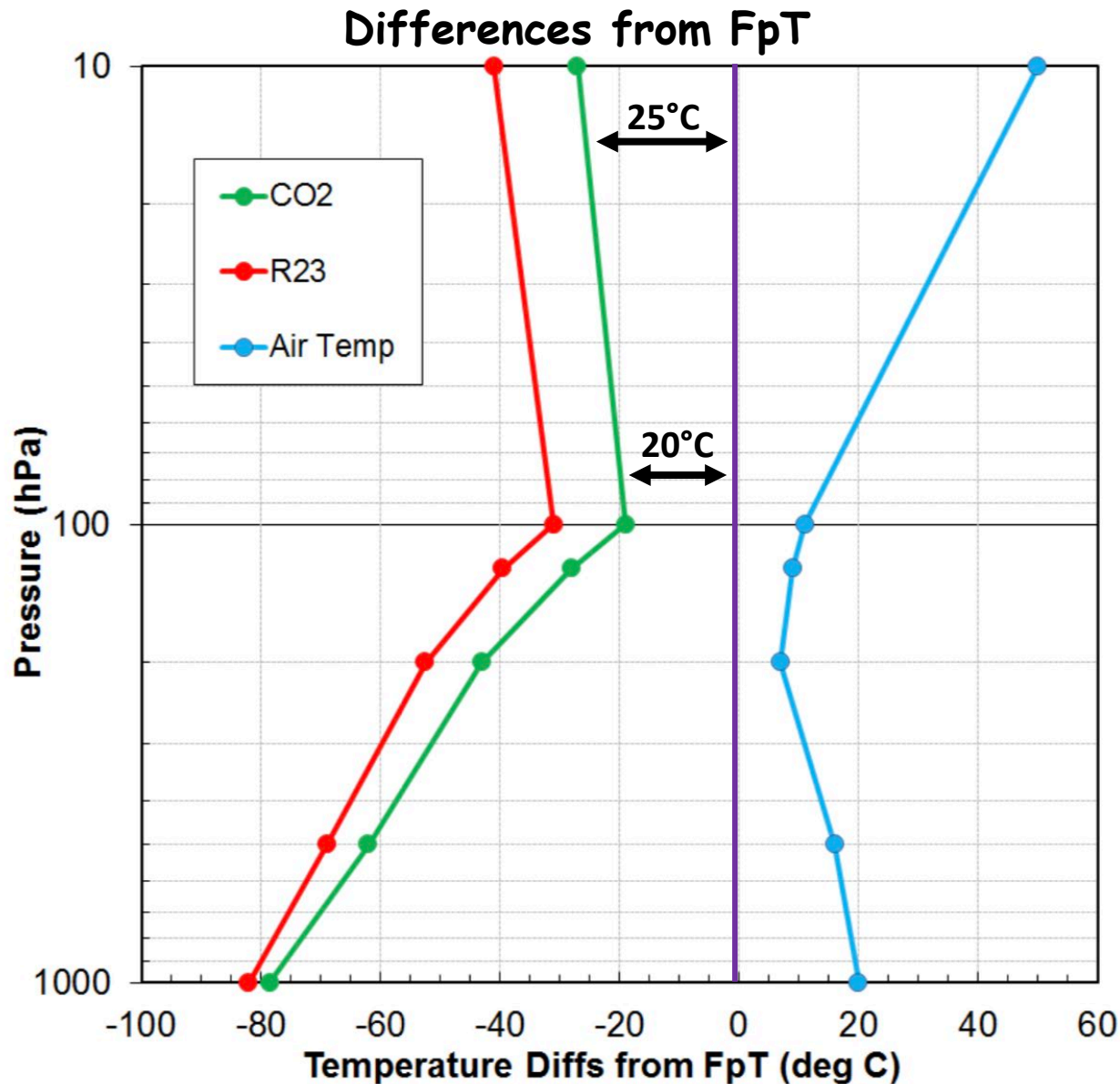
## Ongoing (known) research and tests to replace HFC-23 as the FP cryogen

- Dry ice + ethanol: En-Sci (CFH) Jülich, La Réunion; NOAA (FPH) Boulder, Hilo
- Peltier-cooled: Hokkaido Univ/Meisei (SkyDew); ETH Zürich (PCFH)
- Liquid N<sub>2</sub> (pressurized dewar): Lindenberg/Jülich - N<sub>2</sub> freezes at P <100 hPa

# WV Sondes Update



# WV Sondes Update



Cooling source must be able to provide adequate cooling power to measure F<sub>p</sub>T as low as -95°C

Coolant must have low GWP & ODP, be non-toxic and provide cooling for 4+ hrs.  
FPH must remain a compact and lightweight instrument.



# WV Sondes Update



**Loading the Dewar with dry ice**



# WV Sondes Update



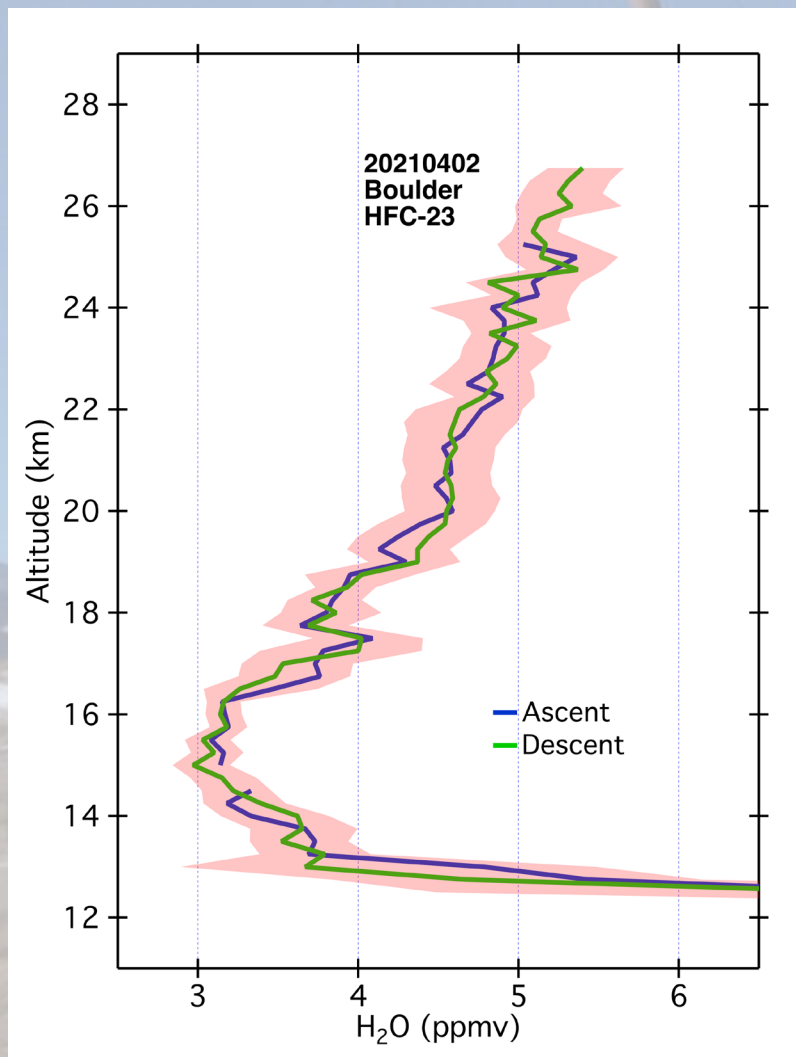


# WV Sondes Update

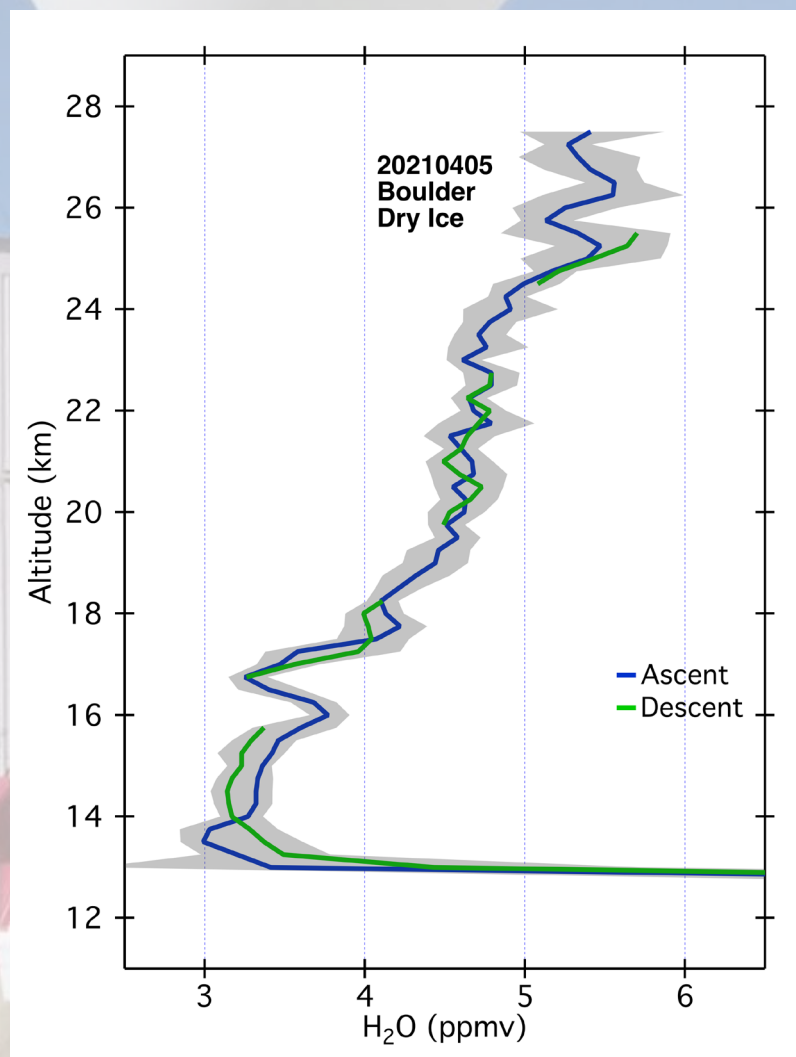




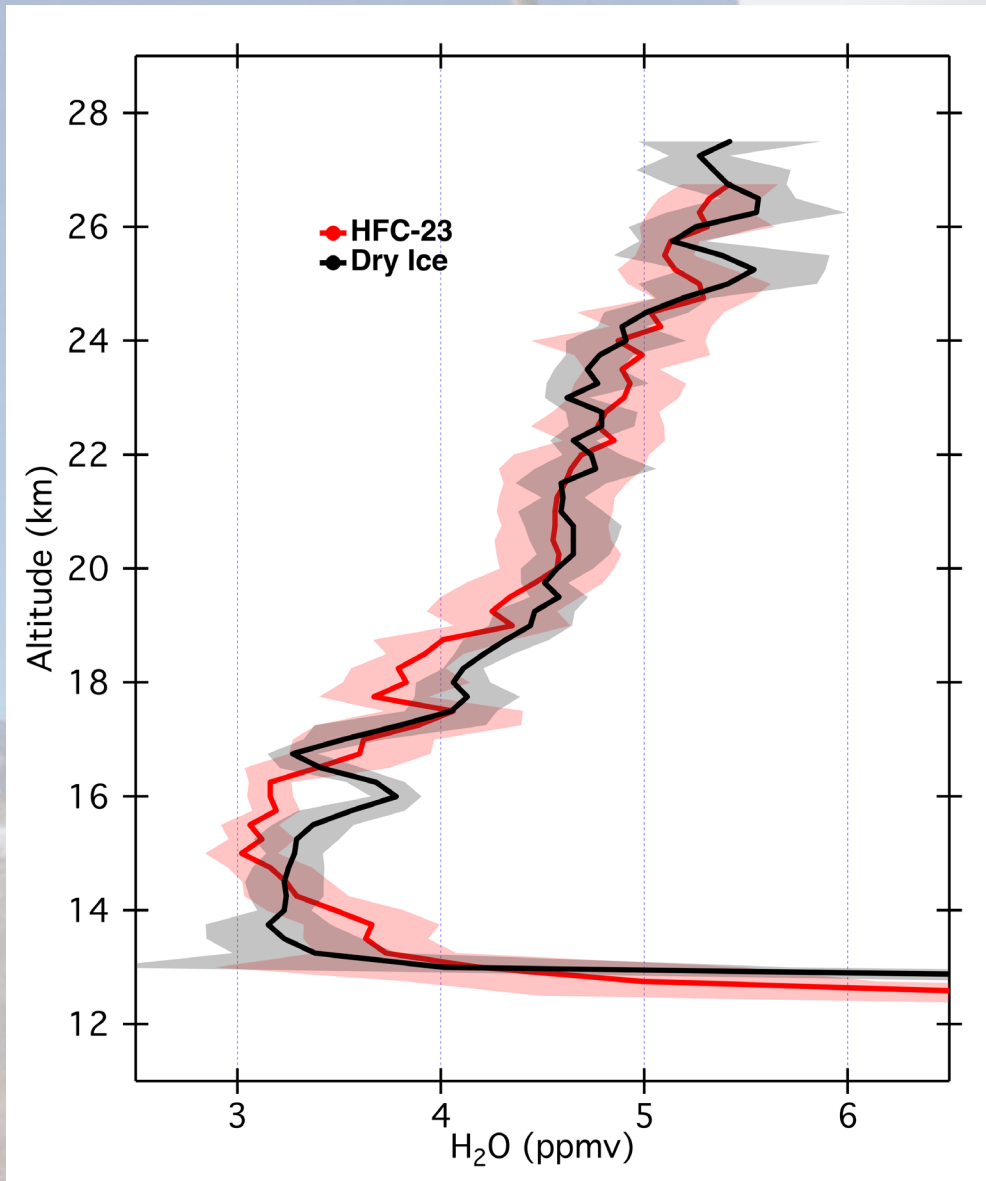
## Stratospheric Water Vapor Profile *R23 FPH*



## Stratospheric Water Vapor Profile *Dry Ice + EtOH FPH*



# WV Sondes Update



The two profiles agree within their 95% confidence intervals (small exception at 16 km)

The "bump" at 16 km may be geophysical variability (flights were 3 days apart)

The minimum frost point temperature measured was  $-90.2^{\circ}\text{C}$ . Need to perform test flights where minimum  $F_pT$  is  $-95^{\circ}\text{C}$  (tropics)



# WV Sondes Update

## Summary:

8<sup>th</sup> NDACC WV Sonde site is Beltsville, MD, USA. Site has not yet submitted data files or 2020/2021 site report

All other sites submitted 2020/2021 site reports and recent sounding data

Continuing increase in the number of WV Sonde data files submitted each year

R23 is being globally phased out and several research teams are working to develop and test fly non-R23-cooled FPs:

- Meisei “SkyDew” is commercially available in Japan

- Dry ice + ethanol FPs being developed and tested by several teams

- Peltier-cooled CFH being developed by ETH Zürich

All new instruments need adequate testing in the tropics!