

# The Integrated Characterization of Energy, Clouds, Atmospheric state, and Precipitation at Summit

(ICECAPS, 2010-2018...)

Von P. Walden, Washington State University

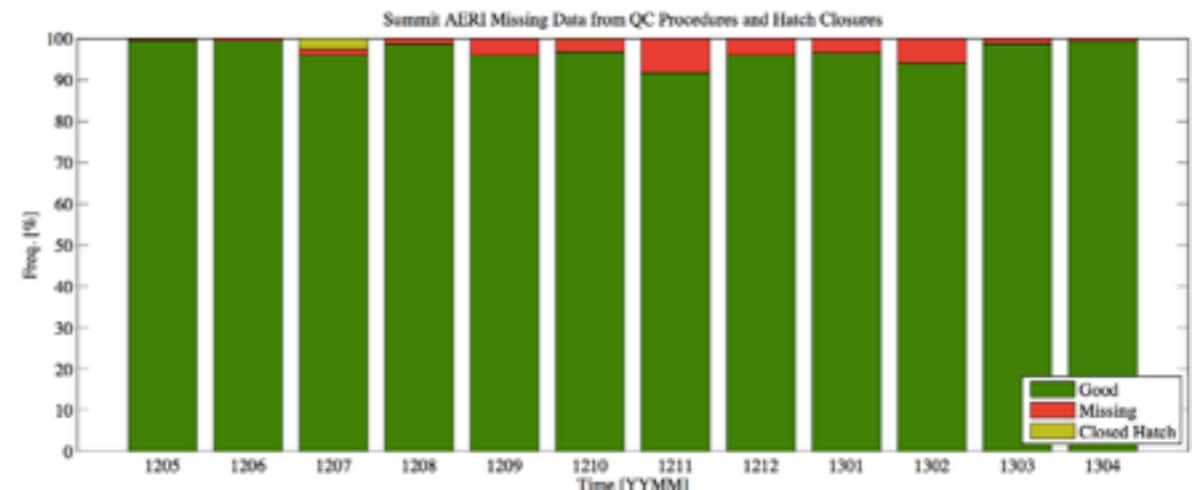
Ralf Bennartz, U. Wisconsin/Vanderbilt

Matthew Shupe, CU/NOAA

Dave Turner, UO/NOAA

# Timeline

Successful “Uptime” (indicative of ICECAPS instruments)



- **Past**

- Deployed in May 2010

- **Present**

- Recently funded through summer of 2018

- **Future**

- Plans are to move from the Mobile Science Facility (MSF) to the Atmospheric Watch Observatory (AWO)

# Instruments and Results

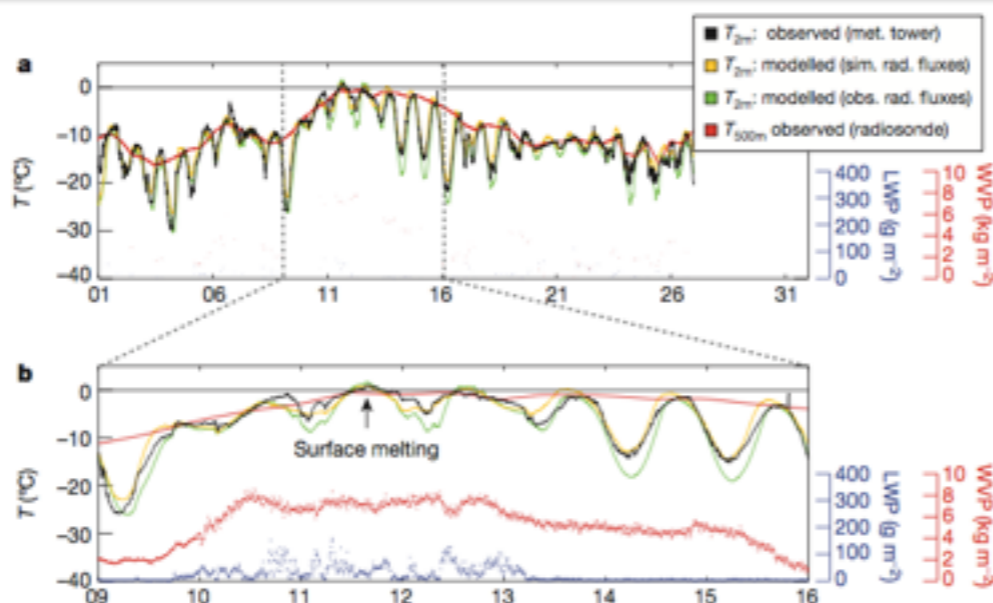
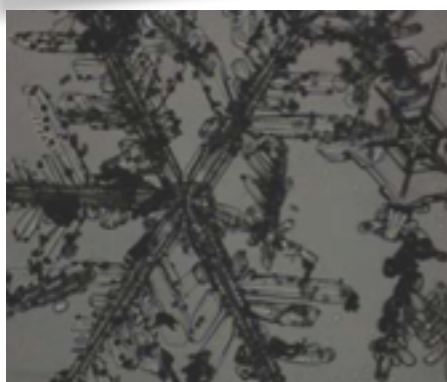
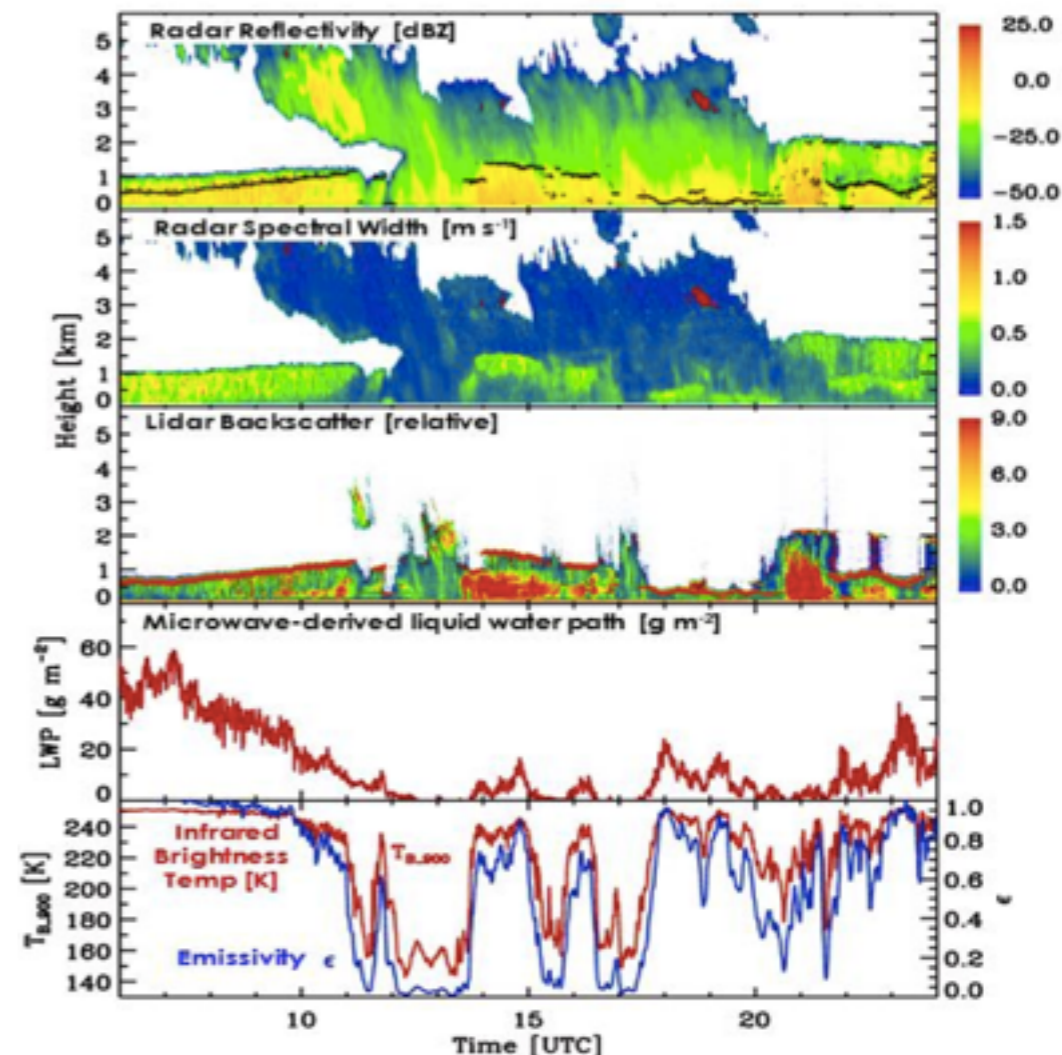
TABLE 1. ICECAPS Instrument specifications, measurements, and derived parameters. All instruments other than the IcePIC and radiosondes are pointed approximately in the zenith direction. Instrument resolutions are given as "res."

Instrument name	Key specifications	Primary measurements	Derived parameters	Institution
F-AERI	530–3,000 $\text{cm}^{-1}$ (3–19 $\mu\text{m}$ ), 1 $\text{cm}^{-1}$ res., <1-min time res.	Downwelling spectral infrared radiance	Cloud phase and microphysics, atmospheric temperature	University of Idaho
HWRHF	Frequencies: 90, 150 GHz, 2–4-s time res.	Downwelling brightness temperatures	Cloud LWP, PWV	University of Wisconsin
HATPRO	Frequencies: 7 channels 22–32 GHz, 7 channels 51–58 GHz, 2–4-s time res.	Downwelling brightness temperatures	Cloud LWP, PWV, atmospheric temperature	University of Wisconsin
HMCR	Ka band (35 GHz), 8-mm wavelength, 2-s time res., 45-m vertical res.	Reflectivity, mean Doppler velocity, Doppler spectrum width, Doppler spectra	Cloud boundaries, phase, microphysics; cloud-scale dynamics	NOAA Earth System Research Laboratory (ESRL)
MPL	532-nm wavelength, 5-s time res., 15-m vertical res., 2°–4° off zenith	Relative backscatter, hybrid linear–circular depolarization ratio	Cloud-base height, phase, microphysics	DOE ARM
CARAB	523-nm wavelength, 15-s time res., 30-m vertical res., three-channel receiver, 2°–11° off zenith	Backscatter, linear depolarization ratio, diattenuation	Cloud-base height, phase, microphysics	NOAA/ESRL
Callometer	905-nm wavelength, 15-m vertical res., 15-s time res.	Backscatter	Cloud-base height	DOE ARM
POSS	X-band (10.5 GHz), 1-min time res., single volume near surface	Reflectivity, Doppler spectra	Precipitation rate	Environment Canada
Sodar	2,100 Hz, <1-m vertical res., 1-s time res.	Reflectivity	Boundary layer depth	NOAA/ESRL
IcePIC	Canon D50 DSLR, ~5.6 magnification, 1.5 $\mu\text{m}$ res., 6.1 megapixels	Digital photographs	Ice crystal habit	University of Idaho
Radiosondes	1-s time res., twice daily, RS-92K or RS-92SGP sondes	Temperature, relative humidity, pressure, winds	Cloud temperature, tropospheric thermodynamic structure	University of Idaho and University of Colorado



Shupe et al, *BAMS*, 2013

## Baseline Case Studies Processes



Bennartz et al, *Nature*, 2013

## 2012 Melt Event Liquid water clouds



# Future

- **Science (new 3-yr ANS proposal)**

- Plans for analysis (SEB, Precipitation properties and processes, Cloud properties and processes, cloud-atmosphere-precipitation interactions, large-scale linkages)

- Collaborations



- **Challenges**

- Instrument upgrades and maintenance (starting in summer of 2014)
- Eventual move to AWO
- Transfer from “science” to “operations”; NOAA

***Collaborators***

Noone (CU),  
Steffen (Swiss FRI),  
Cadeddu (ANL),  
Kneifel/Lohnert (U. Cologne),  
Campo (NOAA-ESRL),  
deBoer (NOAA-ESRL),  
Mace (U. Utah),  
Hudak (Env. CA),  
Thayer (CU),  
Bergin (GTU),  
Tomasi (NRC-Italy),  
***Forbes (ECMWF)***,  
Hamilton (U. Adelaide),  
Lipzig et al (KU Lueven),  
***Paine/Chen (Smithsonian)***

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