The Storm Peak Lab Cloud Property Validation Experiment (StormVEx)

An ARM Climate Research Facility

AMF2 Maiden Deployment

Project Team:

- **Jay Mace (PI), University of Utah**
- **Sergey Matrosov, CIRES, University of Colorado and NOAA/ESRL**
- **Matthew Shupe, CIRES, University of Colorado and NOAA/ESRL**
- **Paul Lawson, Stratton Park Engineering Corporation**
- **Gannet Hallar, Desert Research Institute**
- **Ian McCubbin, Desert Research Institute**
- **Roger Marchand, University of Washington**
- **Brad Orr, Argonne National Lab**
- **Rich Coulter, Argonne National Lab**

The Storm Peak Lab Cloud Property Validation Experiment (StormVEx)

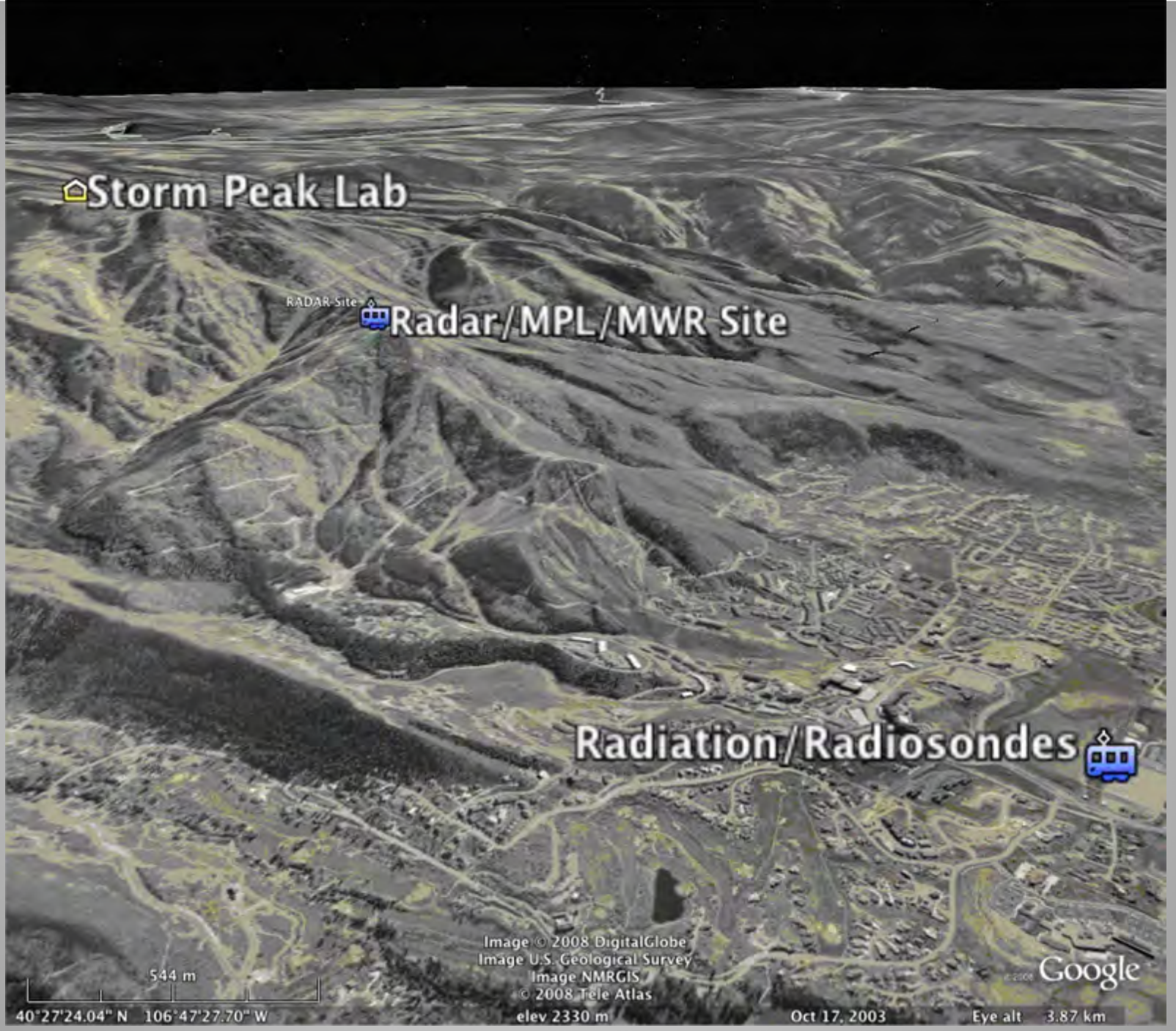
What: Deployment of the 2nd ARM Mobile Facility to Steamboat Springs Colorado to operate in close coordination with Storm Peak Lab

When: October 2010 – March-April 2011 (whenever the snow melts)

Why: Primary objective – Use SPL as in situ data collection platform for validation of cloud properties retrieved by ground-based remote sensors

The Storm Peak Lab Cloud Property Validation Experiment

Anticipate > 1000 hours of correlative in situ and remote sensing data during StormVEx!!

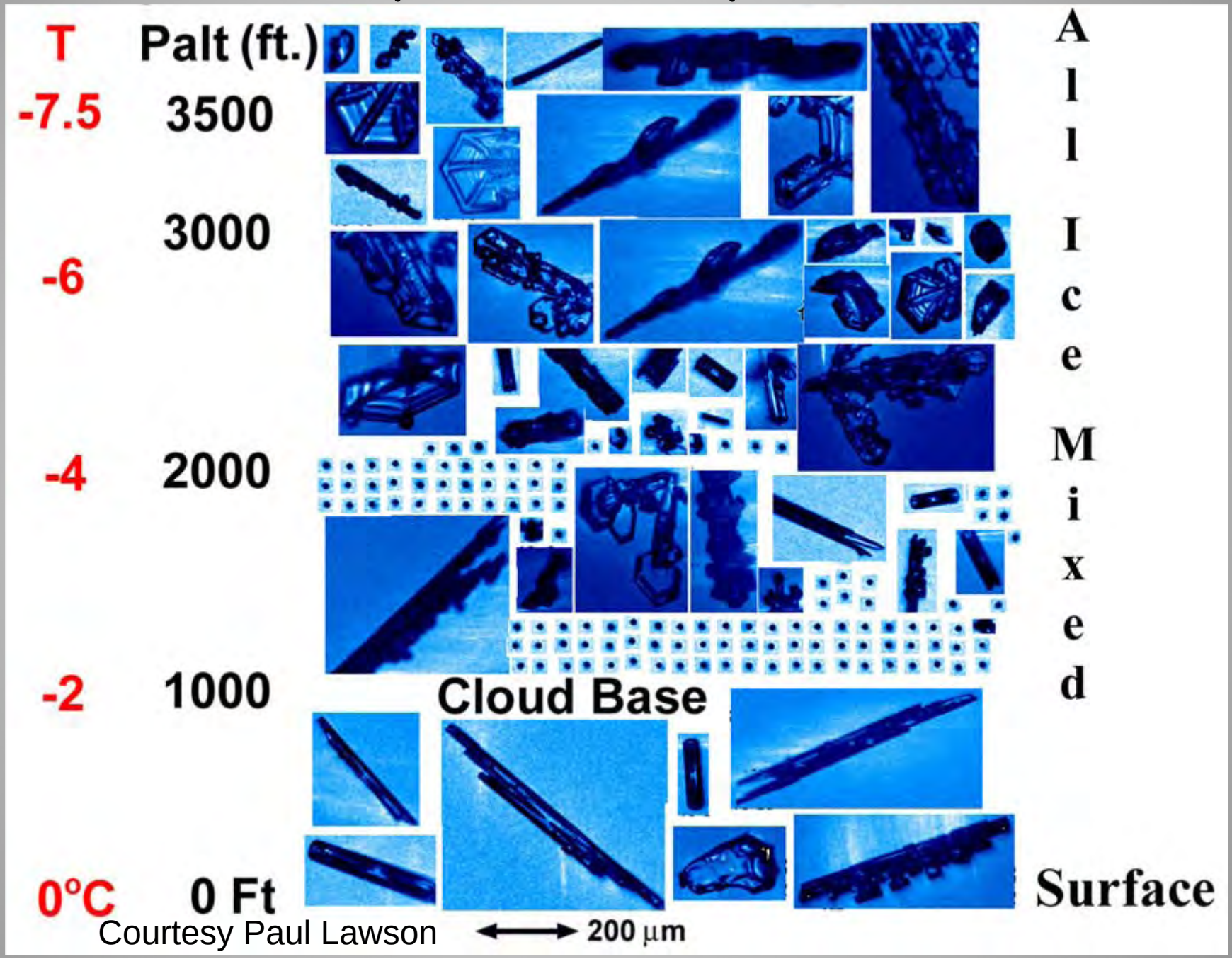

Storm Peak Lab
RADAR Site
Radar/MPL/MWR Site
Radiation/Radiosondes
Image © 2008 DigitalGlobe
Image U.S. Geological Survey
Image NMRGIS
© 2008 Tele Atlas
544 m
Google
40°27'24.04" N 106°47'27.70" W
elev 2330 m
Oct 17, 2003
Eye alt 3.87 km

Burgess Creek
Storm Peak
Labratory
Mt.
Werner
3200m
AMF2 Location
Radar/MPL/MWR
Burgess Creek
Valley Floor Site
Radiation, Radiosondes
and, 915 MHz Wind Profiler
Proposed
AMF Location
2.4 km Horizontal
500 m Vertical
Mt.
Werner
3200m
Storm
Peak
Labratory

The Storm Peak Lab Cloud Property Validation Experiment

Cloud Probes from SPEC will augment the SPL probe array

May 7, 2008 in Ny-Ålesund



Courtesy Paul Lawson

Doppler Spectra Analyses in “Mixed-Phase” Clouds

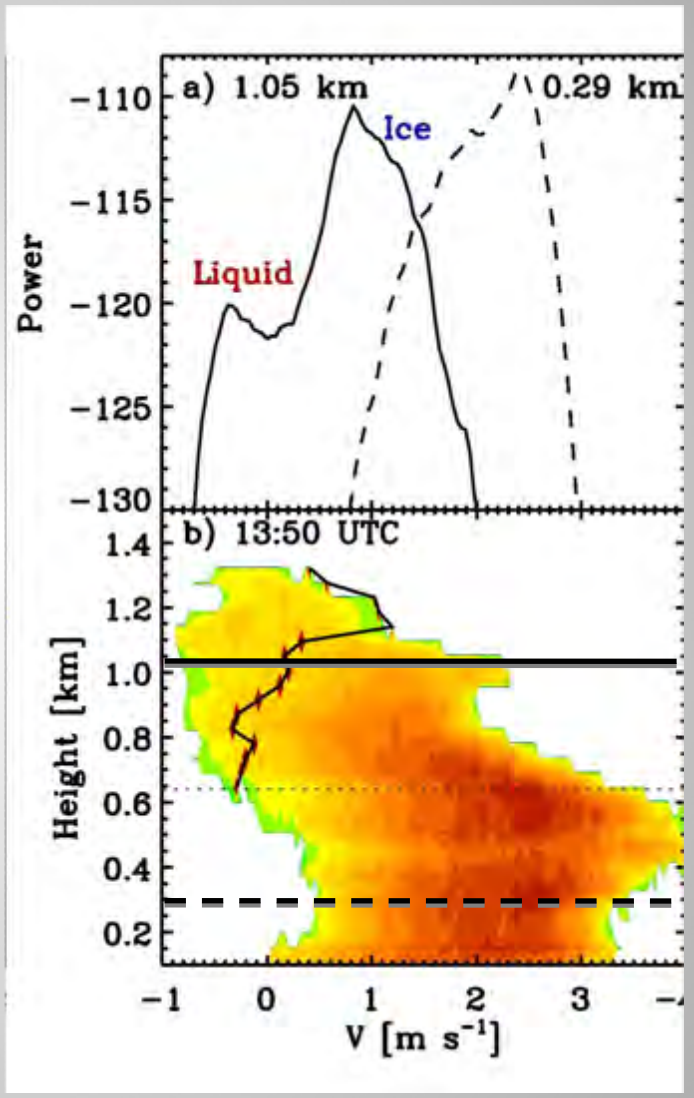
• Graphic (bottom) shows returned power as a function of Doppler velocity (i.e. Spectra).

•Graphic on top extracts power spectra from two heights – 0.29 Km (dashed) and 1.05 km (solid)

•“Mixed-Phase” spectrum near cloud top has distinct contributions from both liquid and ice particles (bimodal).

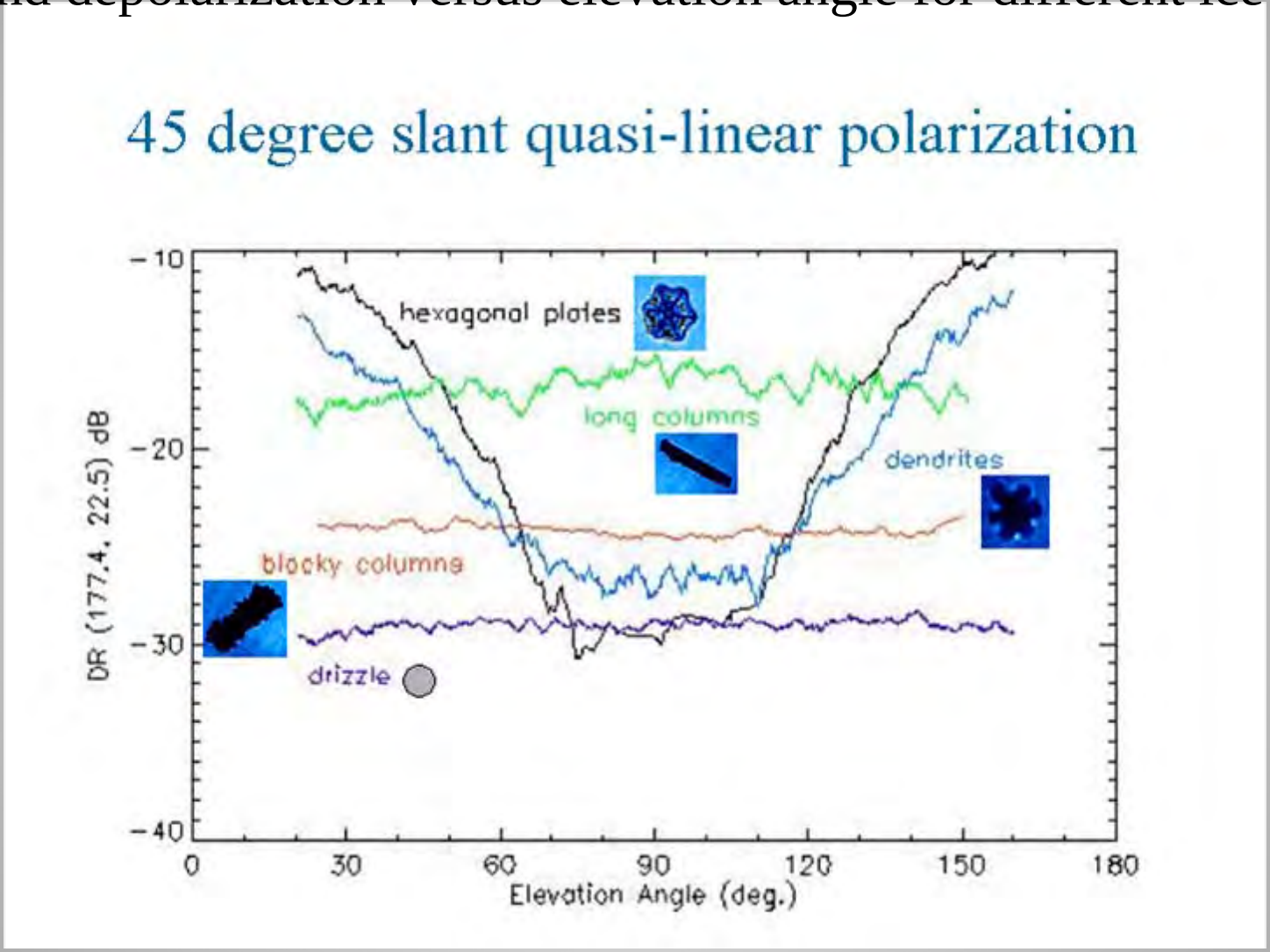
• Spectrum near the surface (0.29 km) is characteristic of ice/snow (monomodal)

• In some cases the contributions from each phase can be distinguished and used for retrievals.



StormVEx Question: Can these distinctions be made in orographic clouds with snow flakes, water droplets, and active dynamics?

K_a-band depolarization versus elevation angle for different ice crystals



Summary:

•Lots of time for planning and getting involved….

• Beyond the core science objectives, there will be many secondary objectives:
  - Aerosol dynamics, chemistry, and indirect effect
  - Modeling of the meteorology and precipitation in complex terrain
  - etc…

• Breakout session Thursday at 3 pm.

AMF2	Measurement	Location	Operation Plans	Calibration History/plans	Level 1 Data Availability	Level 2 Plans
SWACR Spectra	Z(Vd) ???point fft Co and cross polarization spectra (45 degrees) ??	Thunderhead	Scanning Strategy (Action item for Sergey) 24/7	Corner Reflector and Rain, Will disdrometers exist?, intercomparison	Possible download. Likely.	
SWACR Moments	Reflectvity Velocity Spectrum Width	Thunderhead	Scanning Strategy 24/7			
MPL Backscatter	Attenuated Backscatter (co and cross pol)	Thunderhead	Operate 24/7	Overlap will be done at SPL…	VAP MPLNOR	Optical depth/extinction retrievals –
AERI	IR Spectral Radiance	Thunderhead	24/7, Rapid Scan critical	Established	No issues/ spectra	
Microwave Radiometer	23, 31, 90 GHz	Thunderhead	Scanning strategy (Rich action)	Tip Calibration routine	Normally available	Retrievals- MWR Ret - VAP
MFRSR	Spectral Flux	Thunderhead	24/7	Langley Calibration (who?) Cal exercise	Normally available	VAP – Connor/Qilong
Long's Radiometer	IR and solar flux					

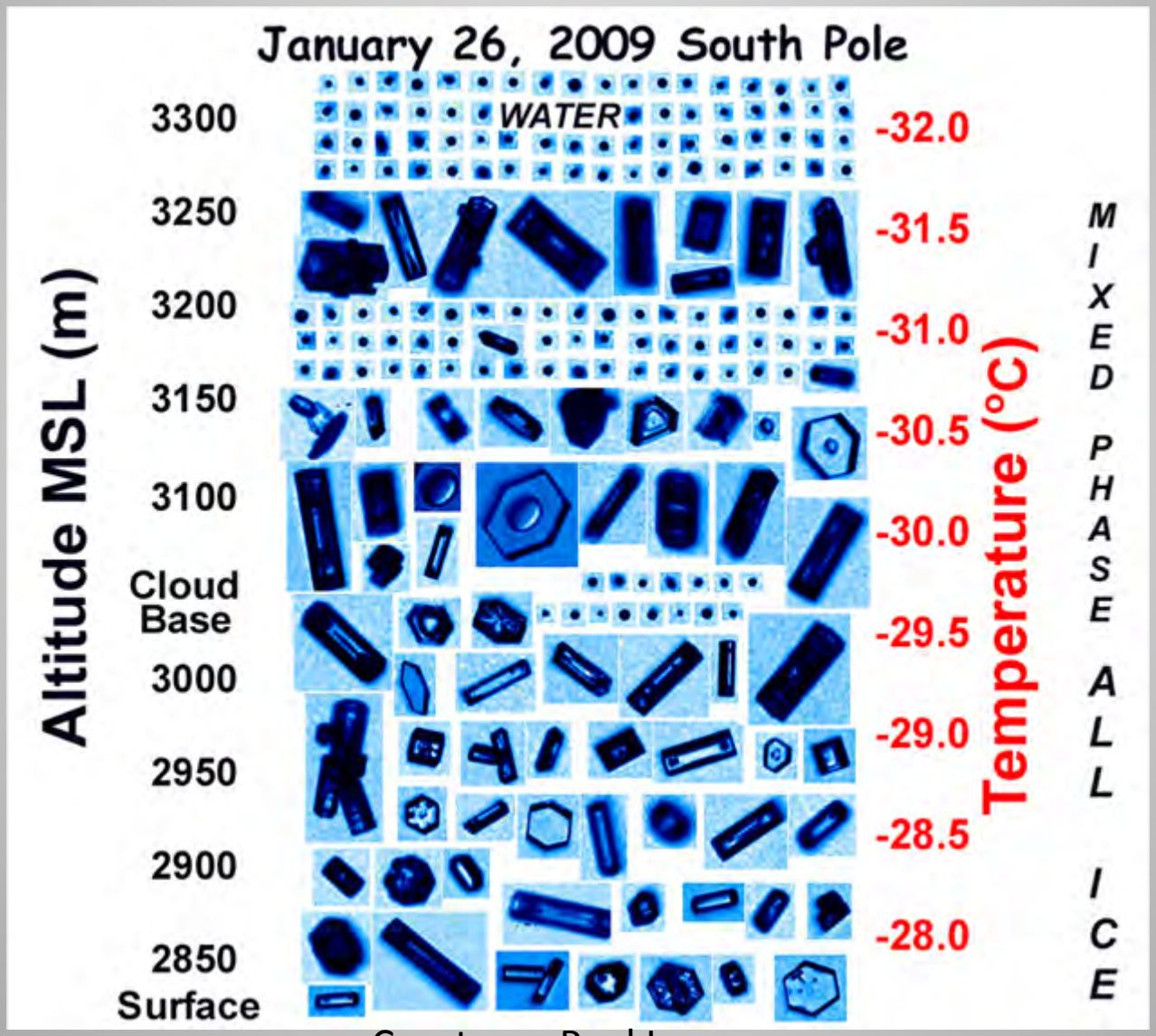
AMF2	Measurement	Location	Operation Plans	Calibration History/plans	Level 1 Data Availability	Level 2 Plans
915 Profiler	Z(Vd), V, W	Valley Floor	Mode/beams operation. High vs low modes #fft Scanning strategy? Order?	Disdrometer at the valley floor for calibration.	Z(Vd)	winds
Vaisala Ceilometer	Profiles of backscatter	Valley Floor	24/7	n/a	backscatter	Cloud base, mixing height,
Skyrad, Groundrad	Solar and IR Fluxes	Valley Floor	24/7	ARM bore cal process		Best estimate VAP needs to be run
Total Sky Imager	Sky Images	Valley Floor	Daylight	n/a	Imagery?	movies? Cloud fraction – VAP??
BBSS	P, T, Rh, Wind Profiles	Valley Floor	2 per day always. 4 per day sometimes. Occasionally more?		Routine	None
ECOR		Valley Floor				

SPL Instruments	Measurement	Location	Operation Plans	Calibration History/plans	Level 1 Data Availability	Level 2 Plans
PIP	Raw data needed 100 microns to 6.5 mm.	SPL	Whenever particles are around	Cal by dmt prior.	Raw data will be provided	Processing in plans.
fssp	Psd 1-50 microns	SPL	Whenever particles are around	Calibrated by dmt	Raw data to be preserved	Size distributions
Ccn counter	Number per cm3 per ss%	SPL	24/7	DMT calibration	Available upon request	n/a
Smps (scanning mobility particle sizer	8-500nm size distribution	SPL	24/7	TSI calibration annually; Not mission critical		
APS (aerodynamic particle sizer)	500nm to 20 microns	SPL	24/7	TSI calibartion annually; Not mission critical		
(U)Cpc (ultra)(condensation particle counter)	Aerosol concentrtion 10 and 3 nm cutoffs	SPL	24/7	TSI calibration annually; Not mission critical		
Trace gasses (ozone and co2)		SPL	24/7	Not mission critical		

SPEC	Measurement	Location	Operation Plans	Calibration History/plans	Level 1 Data Availability	Level 2 Plans
CPI	Particle Imagery	SPL				
Fast FSSP	1-50 micron PSD	SPL				
2D-S	10-3000 micron PSD	SPL				
HVPS	0.2-5 cm PSD	SPL				
Extinctiometer	Extinction	SPL				
Nevzorov	Total water mass	SPL				
Rosemont icing probe		SPL				

The Storm Peak Lab Cloud Property Validation Experiment

Why all the uncertainty with clouds?



Courtesy: Paul Lawson