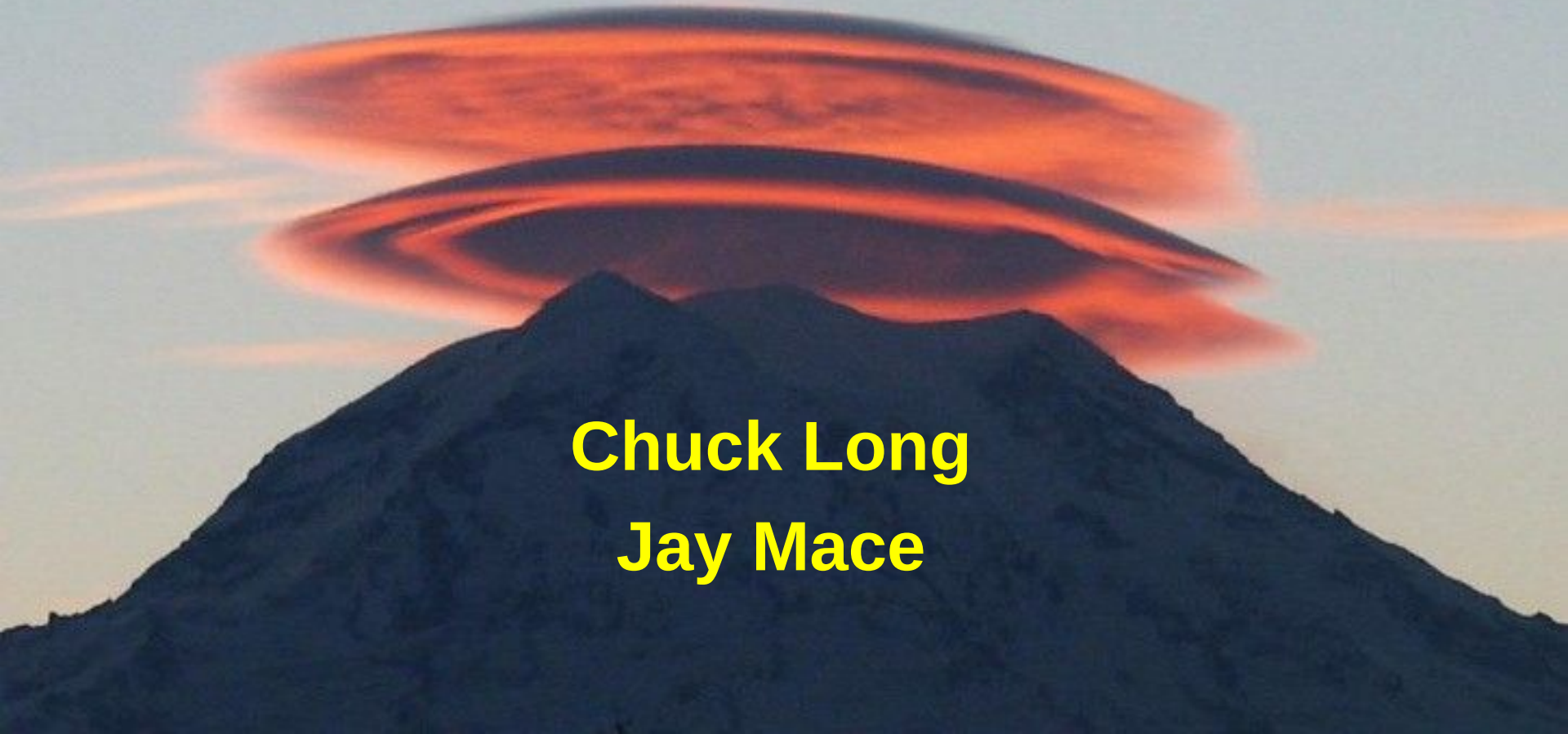
Thunderhead Radiation Measurements and Radiative Flux Analysis in Support of STORMVEX



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Intent

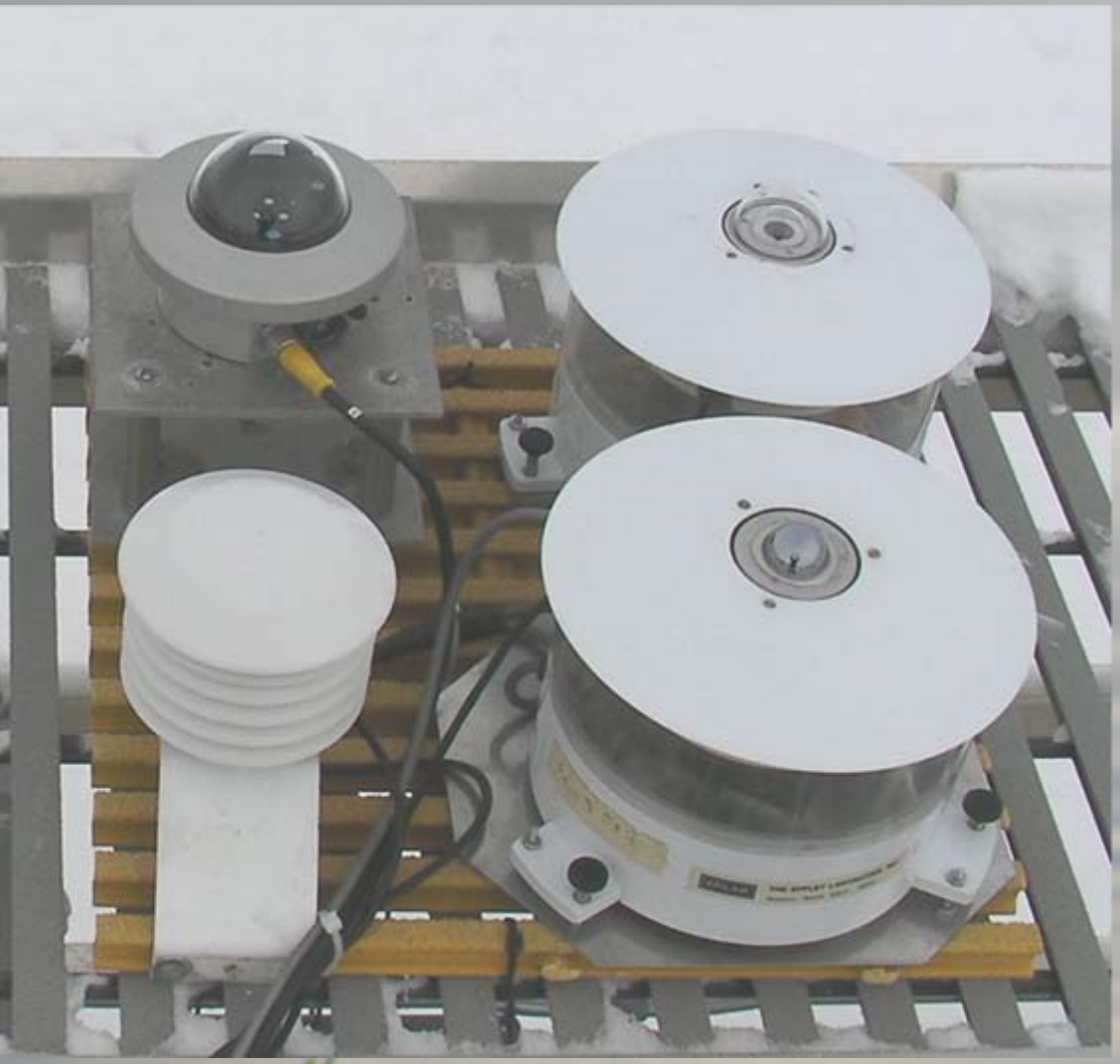
- **Provide downwelling broadband radiation measurements at Thunderhead**
- **Physically small footprint portable system**
- **Designed to provide inputs necessary for Radiative Flux Analysis**

Basic RFA System

COPS Hornisgrinde Deployment

1200m elevation

System Components

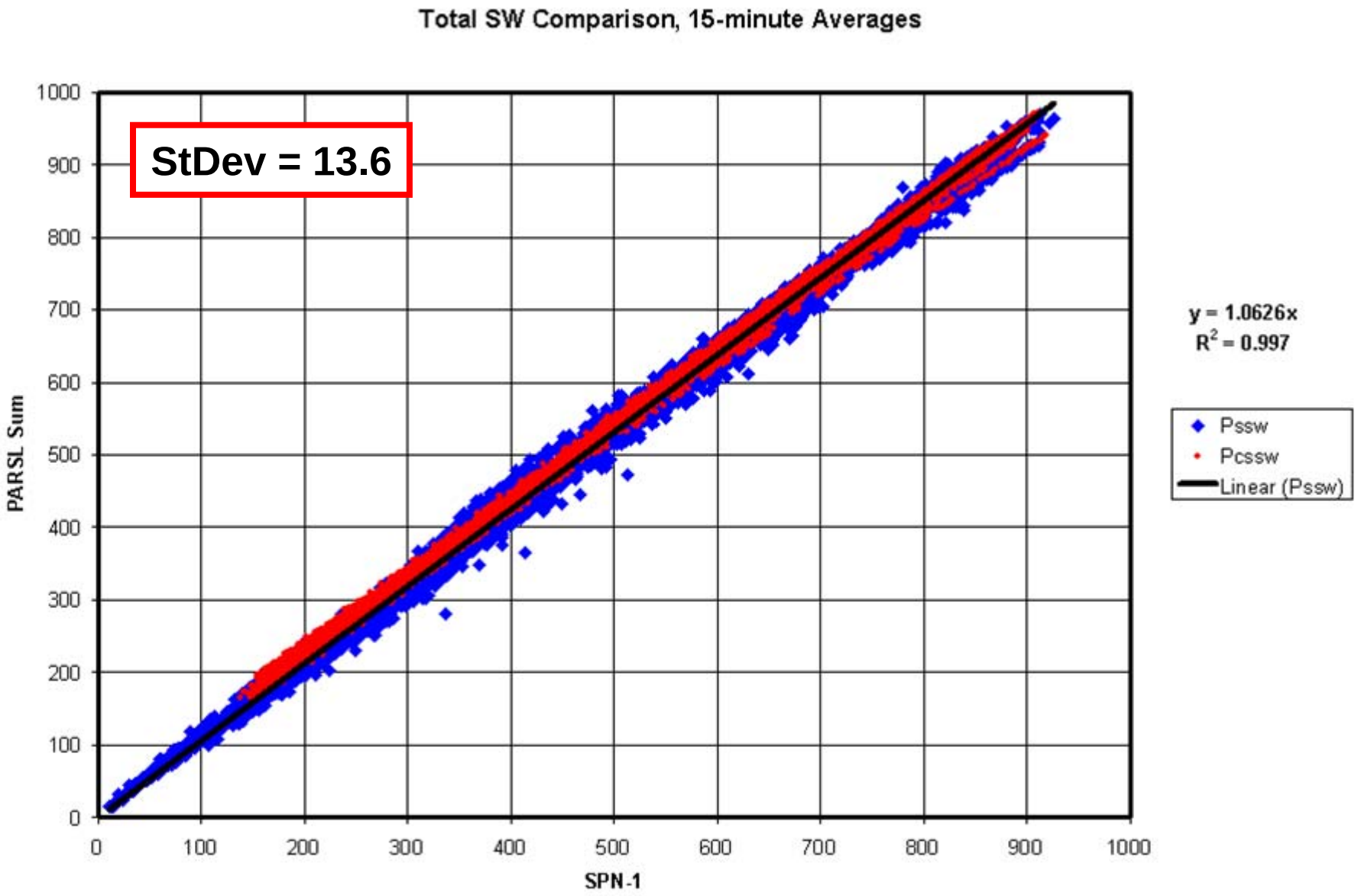


- Eppley ventilated PSP
- Eppley ventilated PIR
- Delta-T SPN-1
- Vaisala HMP-50 T/RH probe
- Campbell CR23X datalogger

SPN-1 Radiometer

- Uses 7 thermopile detectors and a patented shading pattern
- Measures Total and Diffuse SW with no moving parts
- Includes internal heaters

Relative accuracy



Winter Mountain Deployment

Frost/Snow Mitigation

- **NSA Heated Ventilator Evaluation IOP**
  - **Testing various configurations and amount of heat to mitigate frost/snow**
  - **Results now being compiled**
- **Heating DOES affect case/dome temperature relationship**
  - **This is “good news, bad news”**
  - **Does help mitigate frost/snow**
  - **Depending on ambient conditions (wind, etc.) also “confuses” IR loss correction relationship**

Suggested Deployment

- **Include heating in PIR ventilation**
  - **Case and dome temperatures measured**
- **Do not include heating for PSP**
  - **Will have better IR loss corrections**
- **Use SPN-1 to detect affected PSP data, use SPN-1 data for those times**
  - **Design mitigates IR loss in SPN-1**
  - **SPN-1/PSP agreement better than large IR loss in cold, clear mountain environment**

Additional System

- AMF system does not include heated ventilators
- Currently several possible BRFAS deployments “in the works”
- If one available, suggest it be deployed with AMF radiometers
  - Can use same frost/snow detection
  - Serve as comparative “bridge” between two sites

BRFAS Variables Provided

Parameter	Meas./Retr.	Comments
Downwelling SW	Measured	Eppley model PSP
Clear-sky SW	Retrieved	Long and Ackerman, 2000, JGR
Total SW	Measured	Delta-T Devices model SPN-1
Diffuse SW	Measured	Delta-T Devices model SPN-2
Clear-sky diffuse SW	Retrieved	Long and Ackerman, 2000, JGR
Direct SW	Measured	Calculated, Total minus diffuse SW
Clear-sky direct SW	Retrieved	Long and Ackerman, 2000, JGR
Downwelling LW	Measured	Eppley model PIR
Clear-sky LW	Retrieved	Marty and Philipona, 2000, GRL; Long, 2004, ARM
Clear-sky periods	Retrieved	Long and Ackerman, 2000, JGR [daylight only]
Air Temperature	Measured	Campbell HMP45 T/RH probe
Relative Humidity	Measured	Campbell HMP45 T/RH probe
Total Sky Cover	Retrieved	Long et al., 2006, JGR [daylight only]
LW Effective Sky Cover	Retrieved	Durr and Philipona, 2004, JGR; Long, 2004, ARM [low/mid cloud only]
Cloud Vis optical depth	Retrieved	Barnard and Long, 2004, JAM [Skycover>90% only]
Cloud SW transmissivity	Retrieved	Long and Ackerman, 2000, JGR [daylight only]
sky brightness temperature	Retrieved	Long, 2004, ARM
cloud radiating temperature	Retrieved	Long, 2004, ARM [LW Scv>50% only]
clear-sky LW emissivity	Retrieved	Marty and Philipona, 2000, GRL; Long, 2004, ARM

Thank you…