



NCAR



Update on Liquid Water Equivalent Efforts

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Motivation

- Need to replace **visibility tables** for determination of snowfall intensity with a direct determination of snow intensity by Liquid Water Equivalent (LWE)
- Two main efforts:
 - Development of standalone LWE system to show proof of concept
 - Snow, FZRA, FZDZ, IP, Frost
 - Implement snow intensity into METAR/ASOS using LWE measurements from All Weather Precipitation Accumulation Gauge (AWPAG), including SPECIs to indicate the start and stop of snow.

Gaps Associated with NAS Ground Sensors

Gap #	Gap Description	Product Impacts	Negative Airspace Impacts	Status
GS-4	Lack of real-time access to 1-min ASOS data.	Summer and winter CoSPA, TWA/F, C&V, IFI, GDI, RVR/WV forecasts, NP	Terminal and en route operations	Solution is in planning.
GS-5	Lack of an ASOS precipitation rate output parameter.	TWA/F, C&V, IFI, GDI	Terminal and en route operations	Solution is in planning. (LWE method)

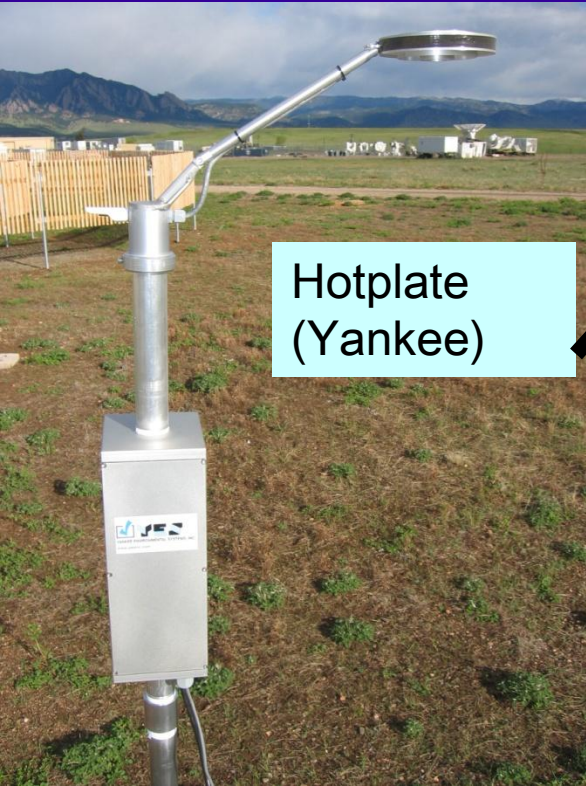
Precipitation Type sensor
(Vaisala PWD-22) EPI
sensor



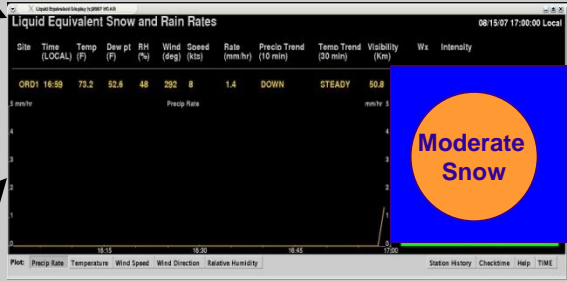
Freezing Rain sensor
(Campbell)



LWE System



Hotplate
(Yankee)



WXT temperature, humidity, and wind sensor (Vaisala)



Real-time LWE precipitation rate and type

Weighing Snowgauge (GEONOR)



Cleveland LWE System



Summary of LWE System Development

Efforts to Date

- Overall performance of the LWE system verified in the field:
 - Wind enhancement equation verified with pan data
 - Comparison of pan rate to LWE rate shows good performance
 - LWE system diagnoses snow well.
 - Need more data on freezing rain and freezing drizzle, but case studies examined so far looks encouraging, especially if the freezing rain sensor is used.
 - LWE system shows significantly more rapid changes in precipitation type than METAR
 - User feedback very positive
- Outstanding issues:
 - PWD sensor not reliably detecting ice pellets and freezing drizzle. May need to develop improved algorithm using data from other sensors.
 - 10 minute averaging period for precipitation type and rate too long
 - Need more ice pellet, freezing rain, and freezing drizzle data (plan for next year is to deploy at St. Johns the entire winter).
 - PWD temperature biased high during precipitation due to heater

Upgrades to ASOS

Proposed FAA Requirements

1. The ASOS shall detect the onset and end of snow events, and issue SPECI when these events occur
2. A frequently updated LWE snowfall rate shall be implemented in ASOS at AWPAG equipped sites and replace the existing visibility-based method of determining snow intensity
3. The ASOS shall determine snow intensities in one of three levels and issue SPECI when an intensity threshold is crossed