Horizontal Supercooled Liquid Water Observations @ 170-183 GHz

December 8, 2014
Boulder, Colorado

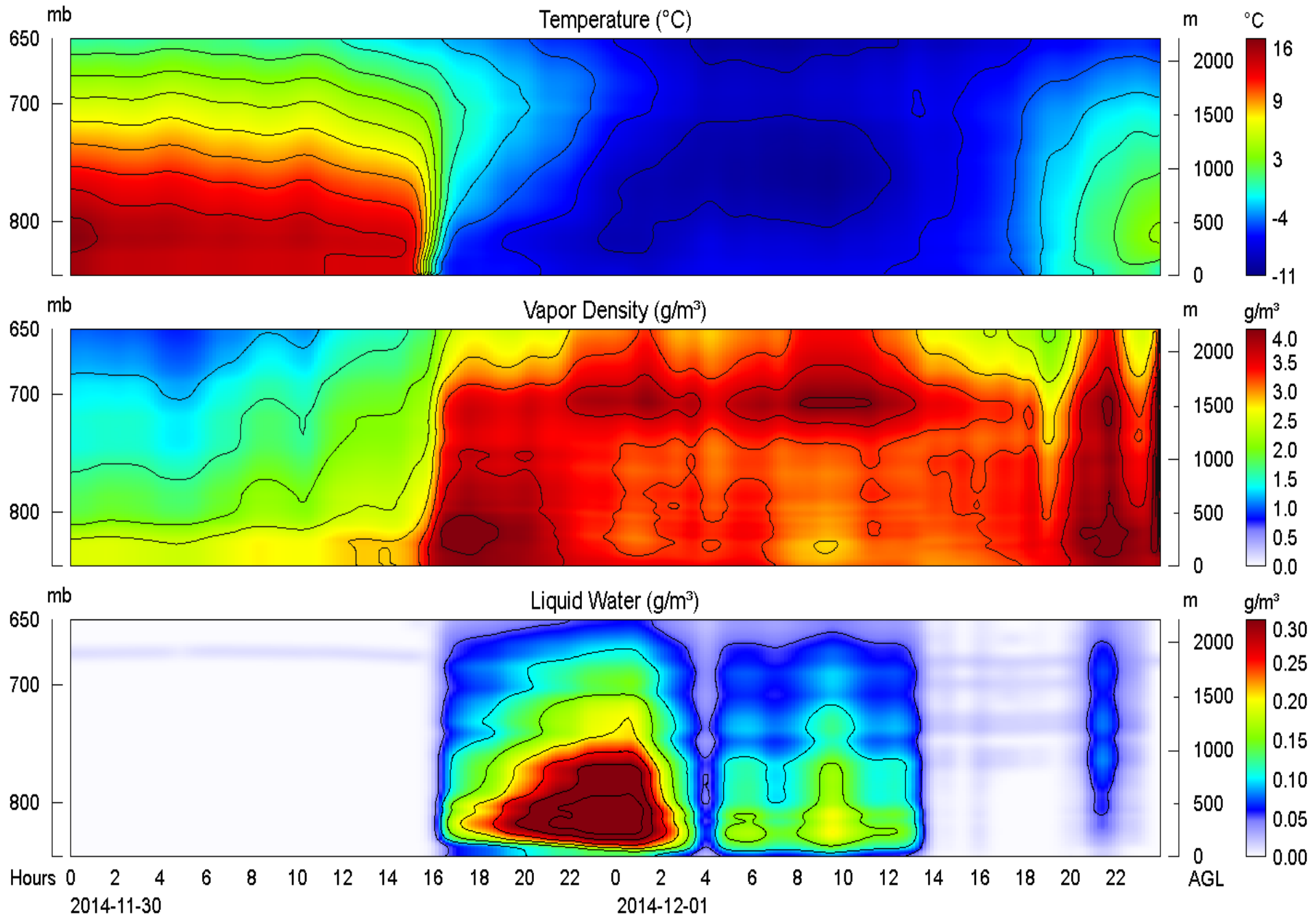
Randolph 'Stick' Ware

Chief Scientist, Radiometrics Corporation
Visiting Scientist, NCAR Earth Observing Laboratory
Senior Research Associate, CIRES (NOAA, U. Colorado)

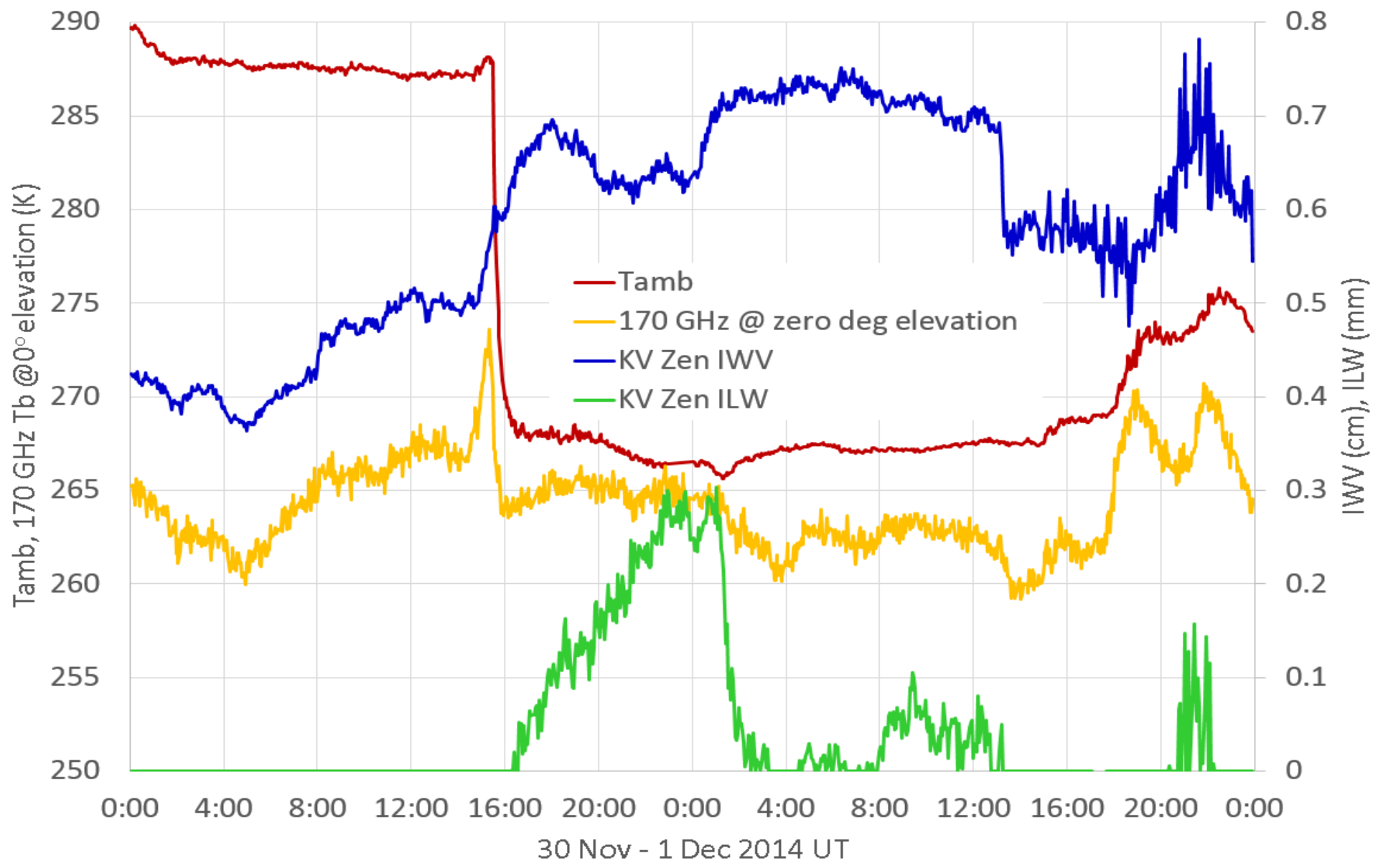
radiometrics

Background Information

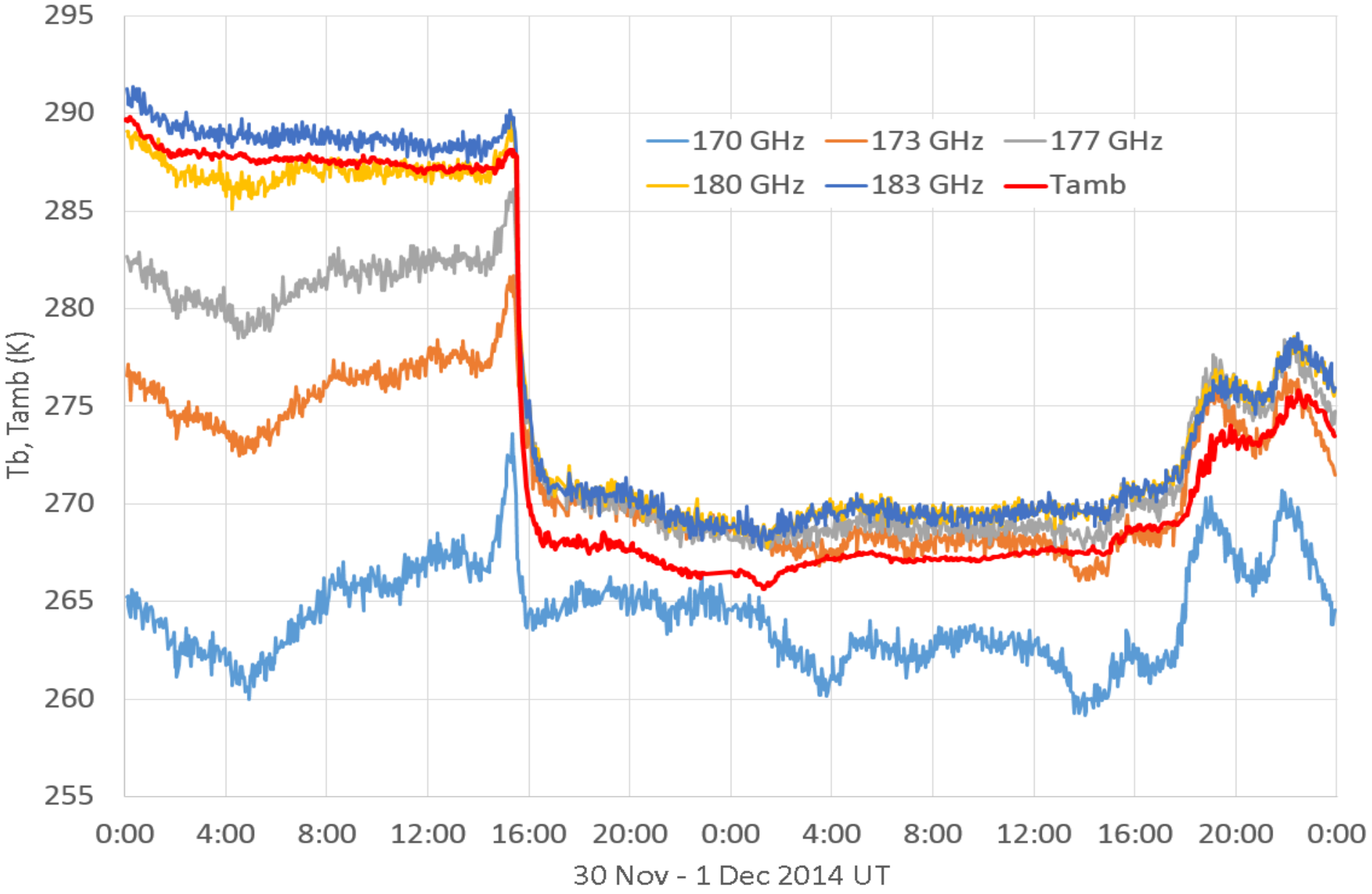
- Supercooled liquid water arrived with a Denver area winter upslope storm on 30 Nov 2014
- Multi-channel 22-59 GHz zenith observations at Boulder and Denver
- Multi-channel 170-183 GHz zenith and horizontal observations at Boulder
- These data are useful for passive forward-looking airborne icing hazard remote sensing system range estimation and design development



Upslope winter storm observed by a microwave radiometer profiler at Boulder



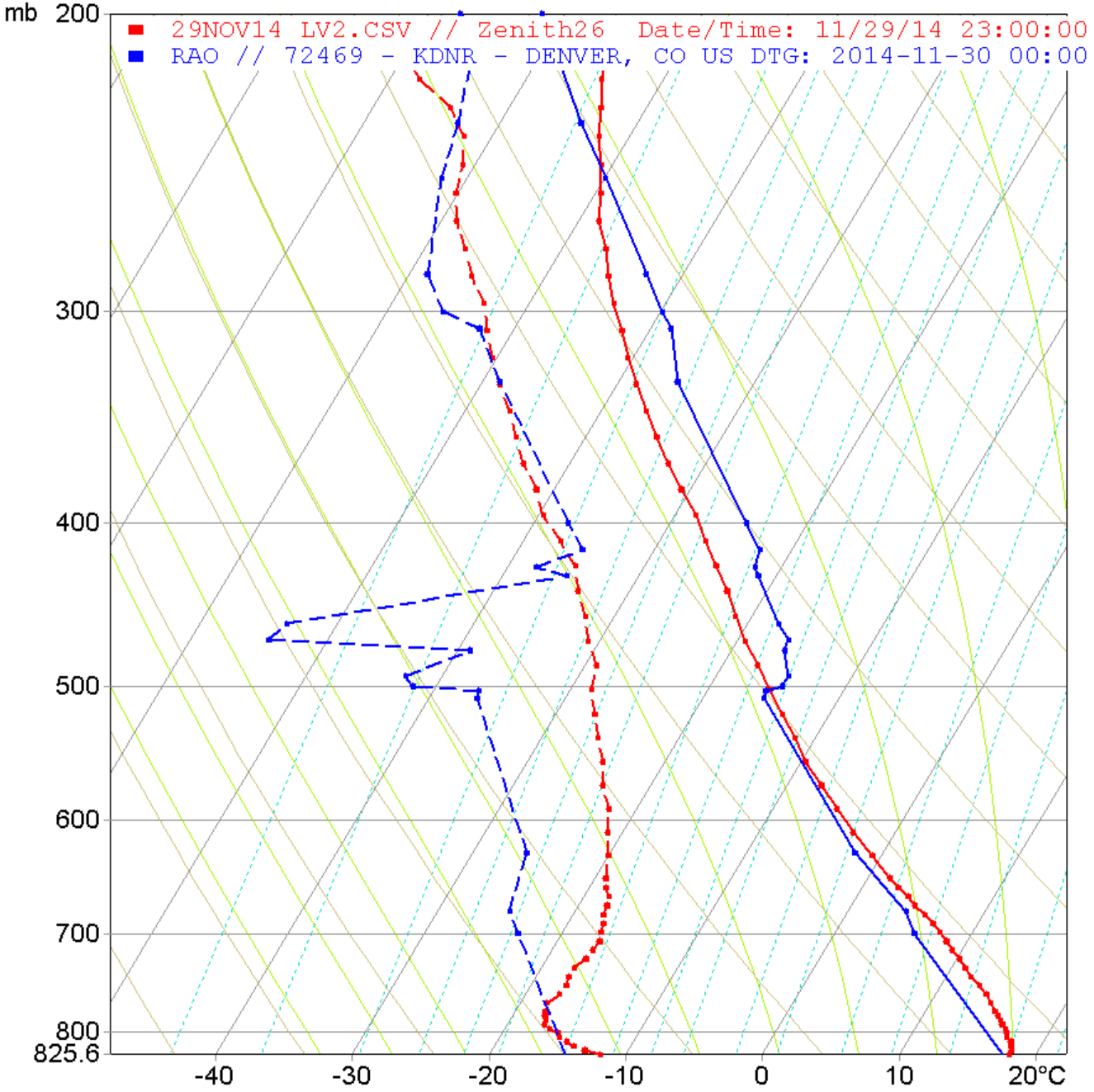
A 20 C temperature drop marked the arrival of an upslope winter storm with up to 0.3 gm^{-3} SLW retrieved from zenith KV-band (22-59 GHz) observations at Boulder. Zenith integrated water vapor retrievals and horizontal 170 GHz observations are also shown.



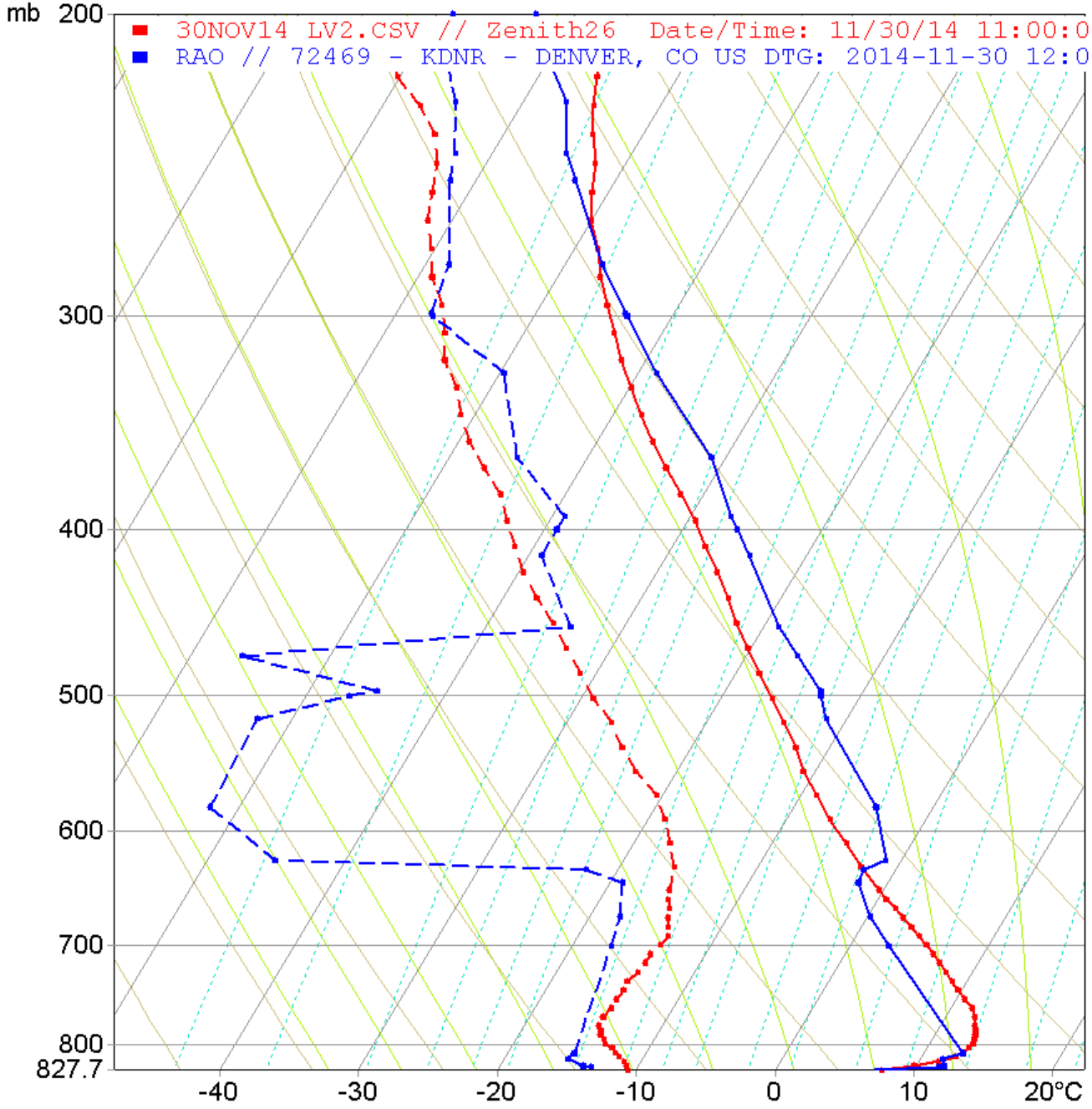
Horizontal observations allow preliminary 170 GHz effective range estimation: >50 km in clear sky and >10 km 0.3 gm^{-3} SLW.

Radiometer–Radiosonde Comparison

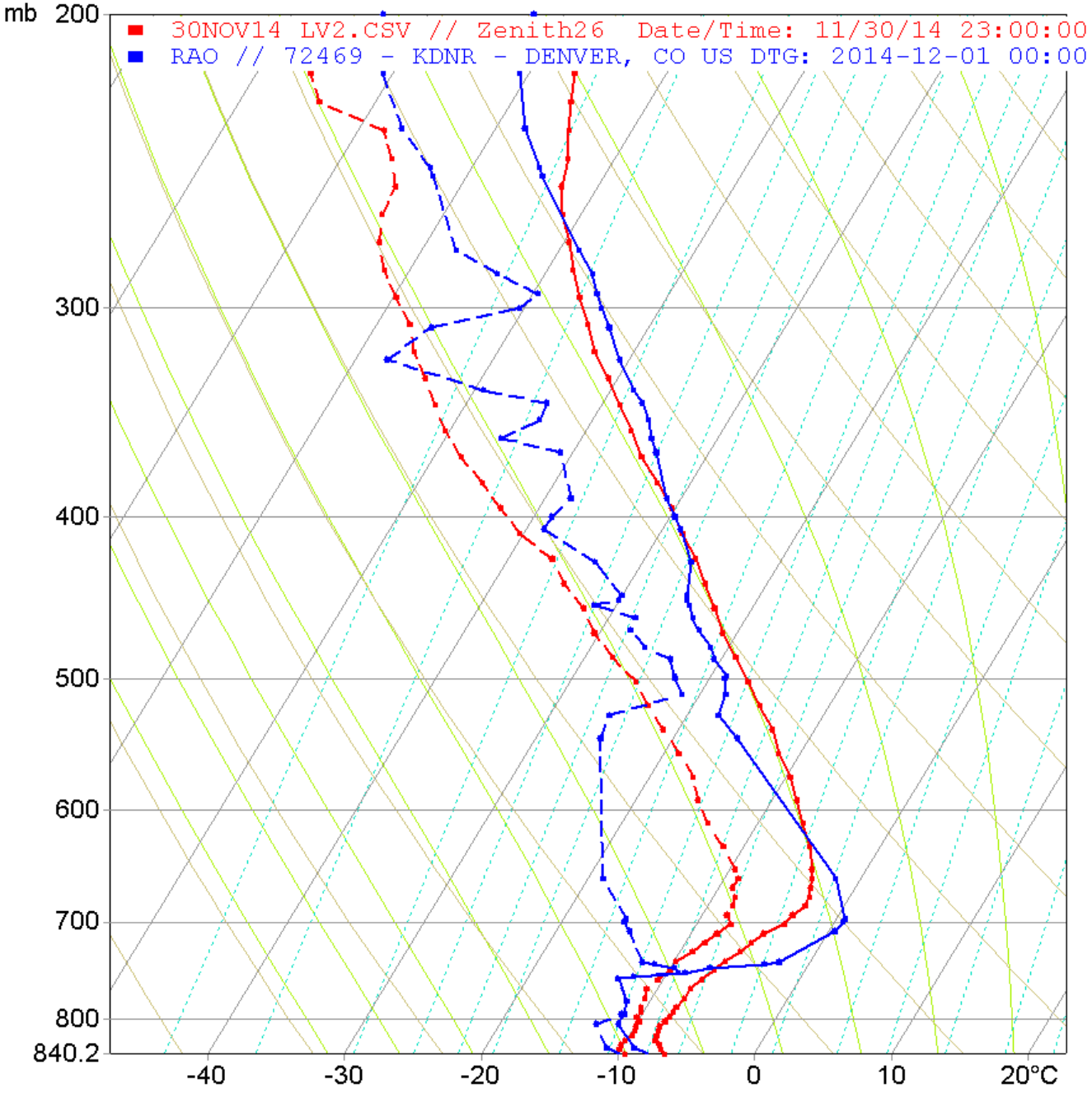
- The National Weather Service operates a Radiometrics MP-3000A radiometer at the Denver radiosonde station
- Radiometrics operates an MP-3000A at Boulder
- Radiometer and radiosonde temperature and dewpoint soundings are compared
- Good agreement is seen between Boulder and Denver radiometers and the Denver radiosonde



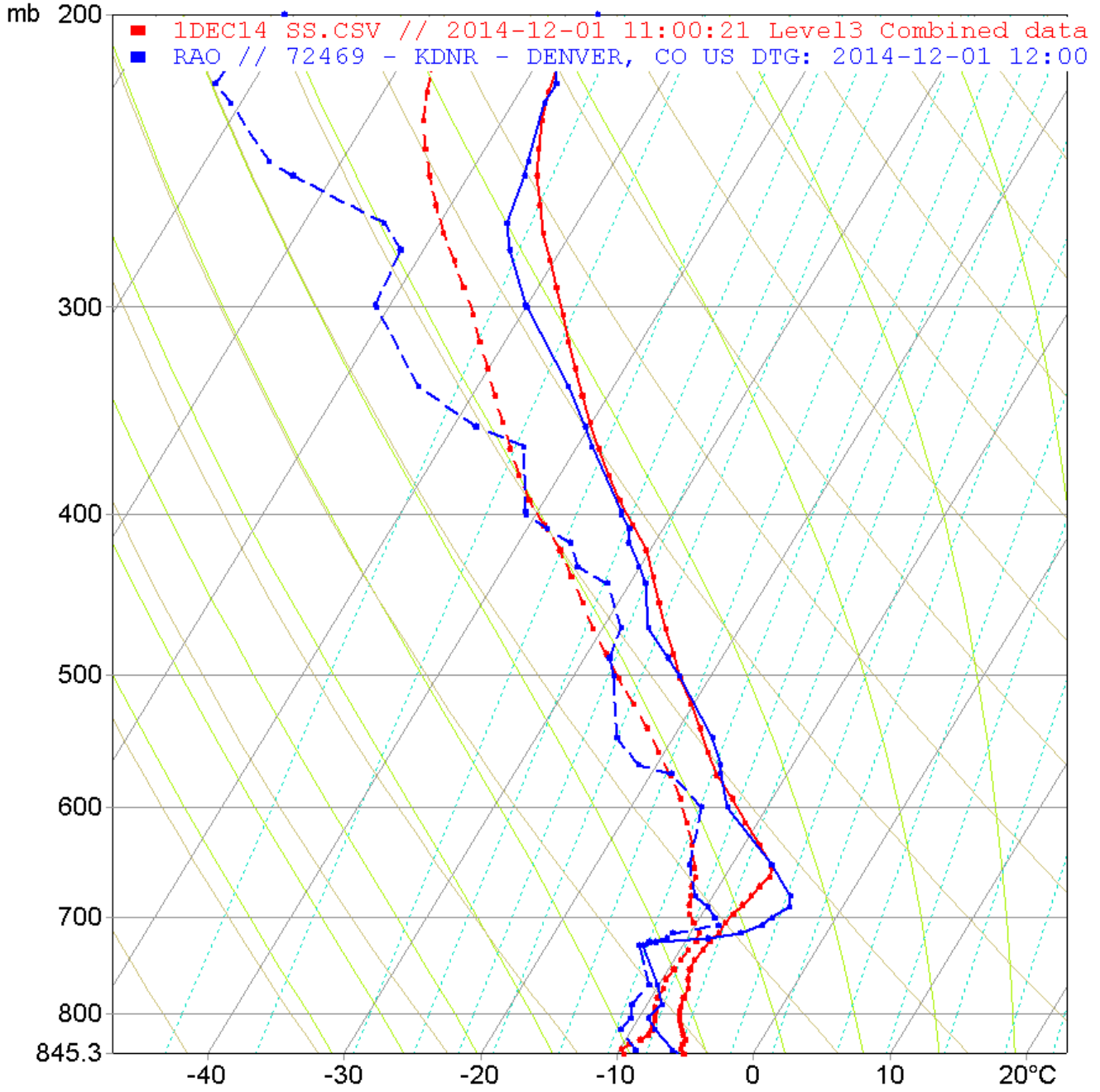
Boulder KV radiometer (red) and Denver radiosonde (blue) @ 0Z 30 Nov 2014



Boulder KV radiometer (red) and Denver radiosonde (blue) @ 12Z 30 Nov 2014



Denver KV radiometer (red) and radiosonde (blue) @ 0Z 1 Dec 2014



Denver KV radiometer (red) and radiosonde (blue) @ 12Z 1 Dec 2014

radiometrics

Comments

- Horizontal passive G-band (170-183 GHz) atmospheric SLW dataset was obtained
- Preliminary analysis supports G-band icing hazard detection and avoidance system feasibility
- A one-degree beamwidth can be obtained with a 6” antenna aperture
- A combined focusing and beam steering dual polarization Risley antenna concept is under consideration