

## Passive Microwave Sensing during Precipitation

R. Ware<sup>1</sup>, A. Kennedy<sup>2</sup>, M. Tuftedal<sup>1</sup>, R. Stone<sup>3</sup>, N. Bassill<sup>4</sup>, D. Berchoff<sup>5</sup>,  
L. Bosart<sup>4</sup>, W. Conway<sup>6</sup>, M. Mahaffey<sup>1</sup>, K. Dill<sup>1</sup>, T. Wilfong<sup>1</sup>

<sup>1</sup>Radiometrics (Boulder, CO), <sup>2</sup>University of North Dakota (Grand Forks, ND),

<sup>3</sup>RHS Consulting (Minden, NV), <sup>4</sup>State University of New York (Albany, NY),

<sup>5</sup>TruWeather Solutions (Reston, VA), <sup>6</sup>Weather Decision Support Systems (Norman, OK)

More than two feet of snow fell in the morning on December 17, 2020, at Albany, NY. We present microwave radiometer data at Albany including this event (Figs. 1,3,4) and compare microwave radiometer and radiosonde measurements (Fig. 2). Supercooled liquid water (>0.4 gm<sup>-3</sup>, -8°C) was observed by the radiometer during the snowfall event. The New York State Mesonet provided the radiometer data; the radiosonde data are available from the National Weather Service. We also present collocated radiometer and weather radar data during convective rain (Figs. 5,6,7).

### Heavy Snow

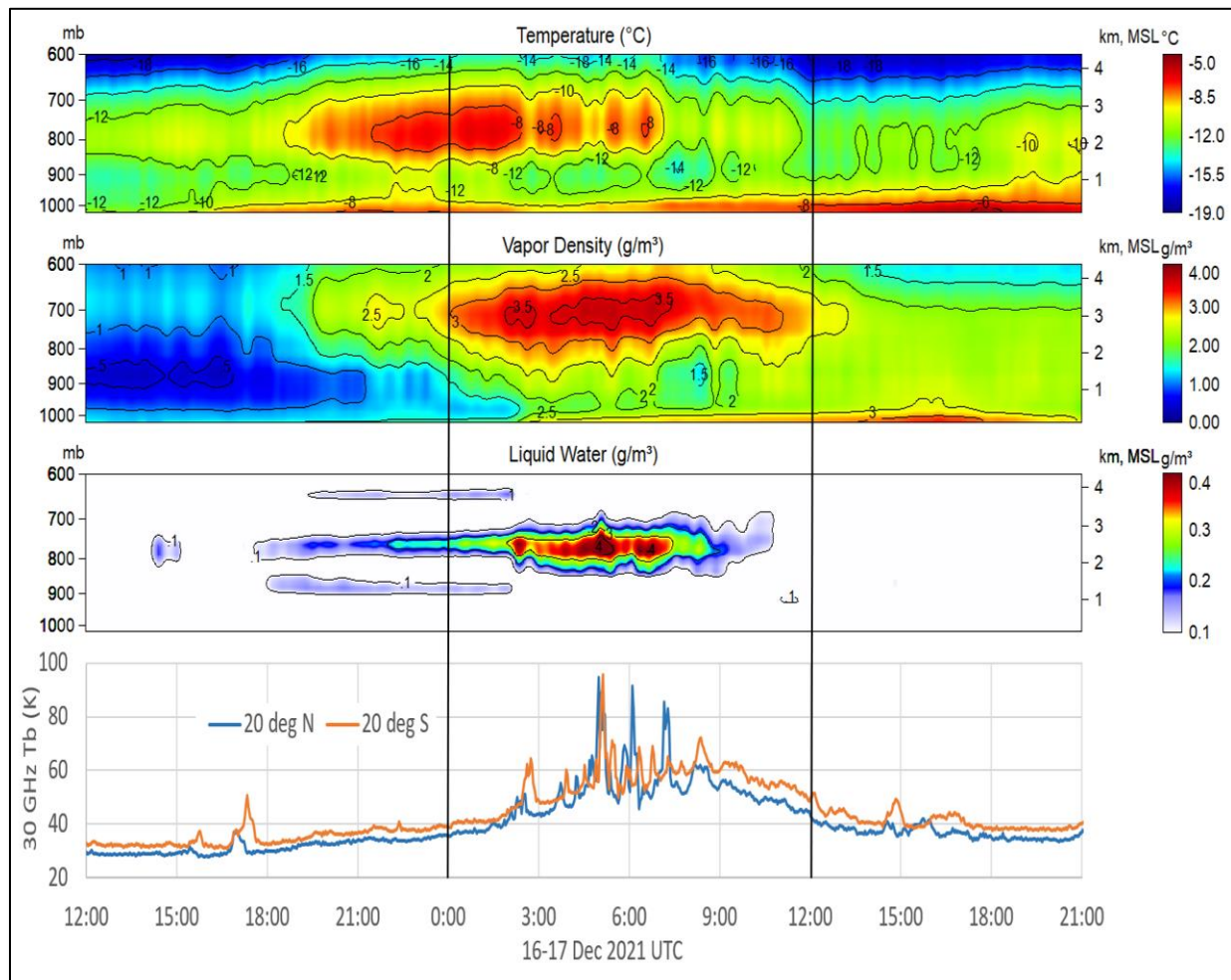


Figure 1. Radiometer 20° elevation south profiles and 20° elevation north and south 30 GHz brightness temperatures (Tb); Albany, NY. Black lines mark radiosonde launch times.

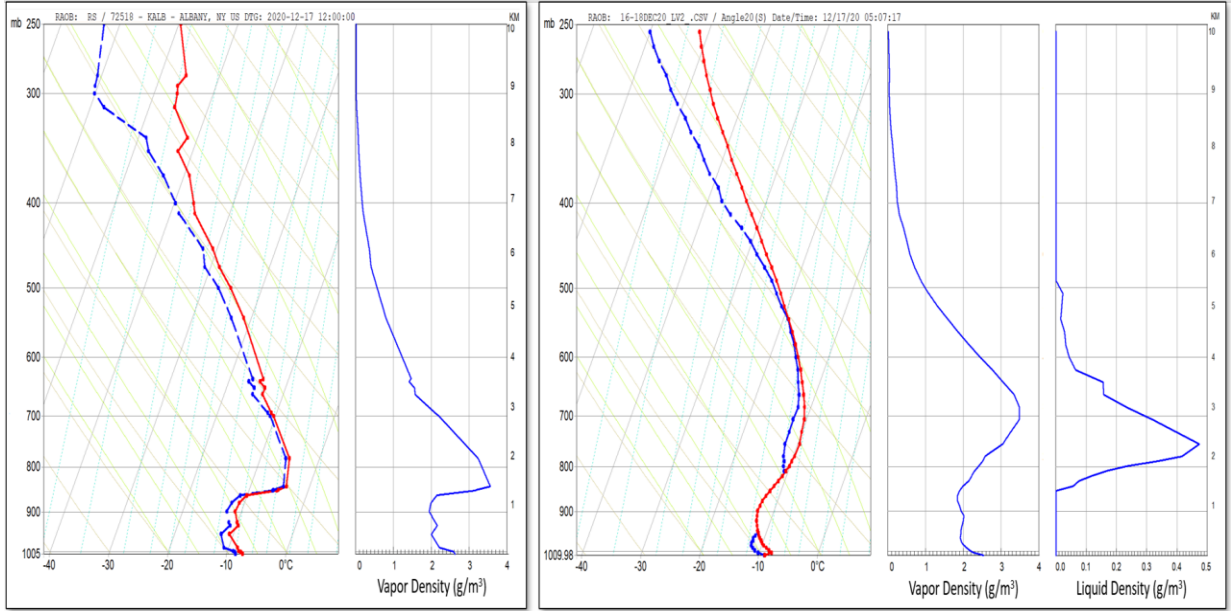


Figure 2. Left: 12:00Z radiosonde (high vertical resolution), Right: 05:07Z radiometer (high time resolution) at time of maximum liquid density; Albany, NY, 17 Dec 2020.

### Convective Rain

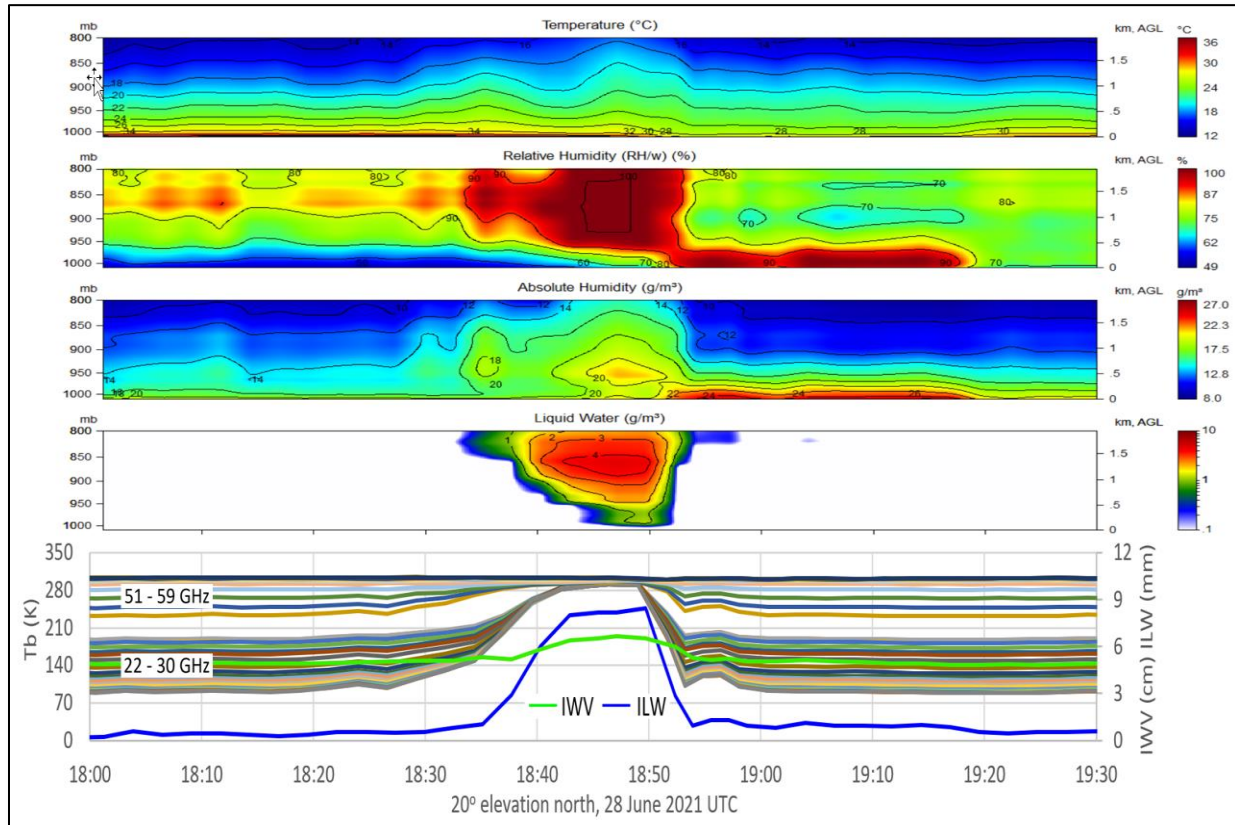


Figure 3. Albany radiometer 20° elevation north profiles, brightness temperatures ( $T_b$ ), integrated water vapor (IWW), and integrated liquid water (ILW) including rain event.



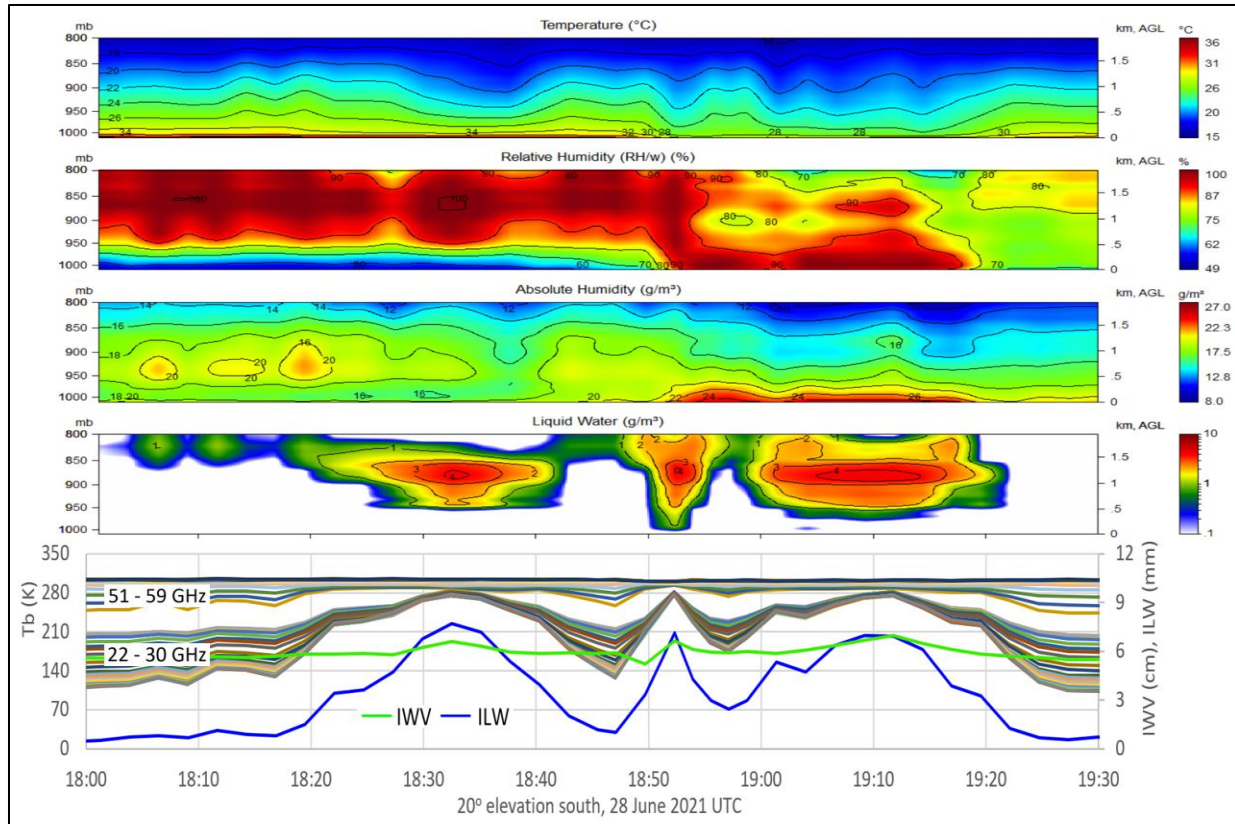


Figure 4. Albany radiometer 20° elevation south profiles, Tb, IWV, and ILW including rain event; Three liquid water maxima are observed to the south, compared with one to the north.

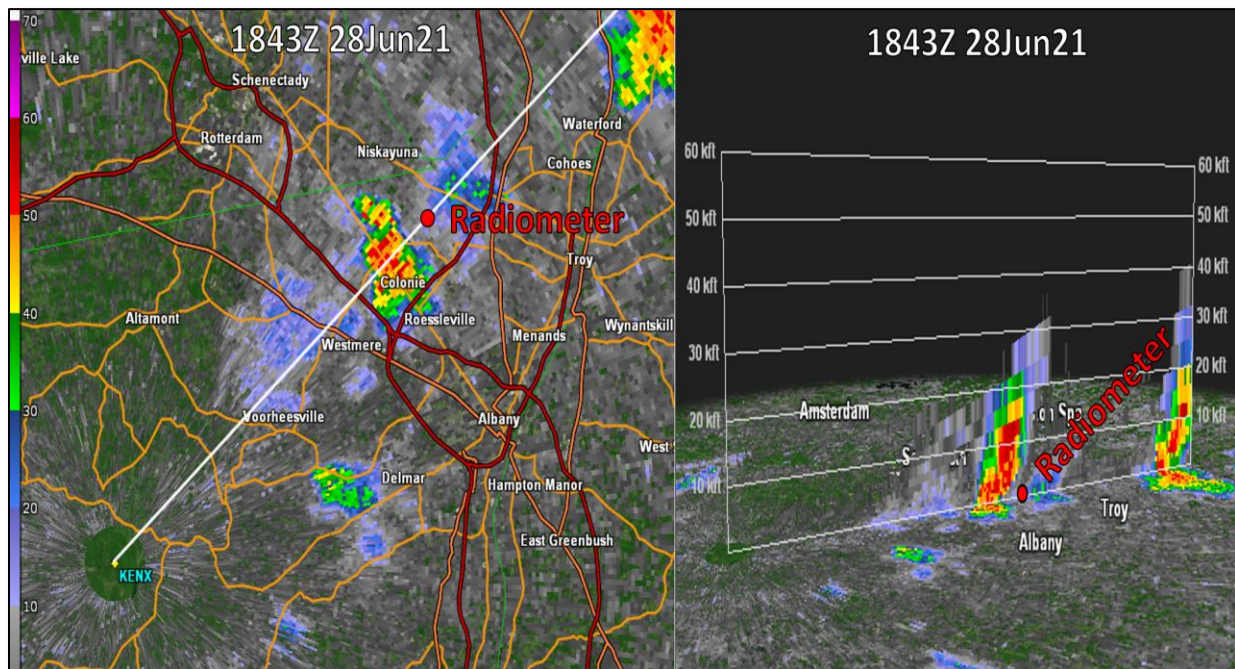


Figure 5. Left: Albany Nexrad Plan Position Indicator (PPI) and radiometer location (red dot); Right: Nexrad Range Height Indicator (RHI) and radiometer location (red dot).



Figure 6. Radar (KENX), radiometer and radiosonde locations.

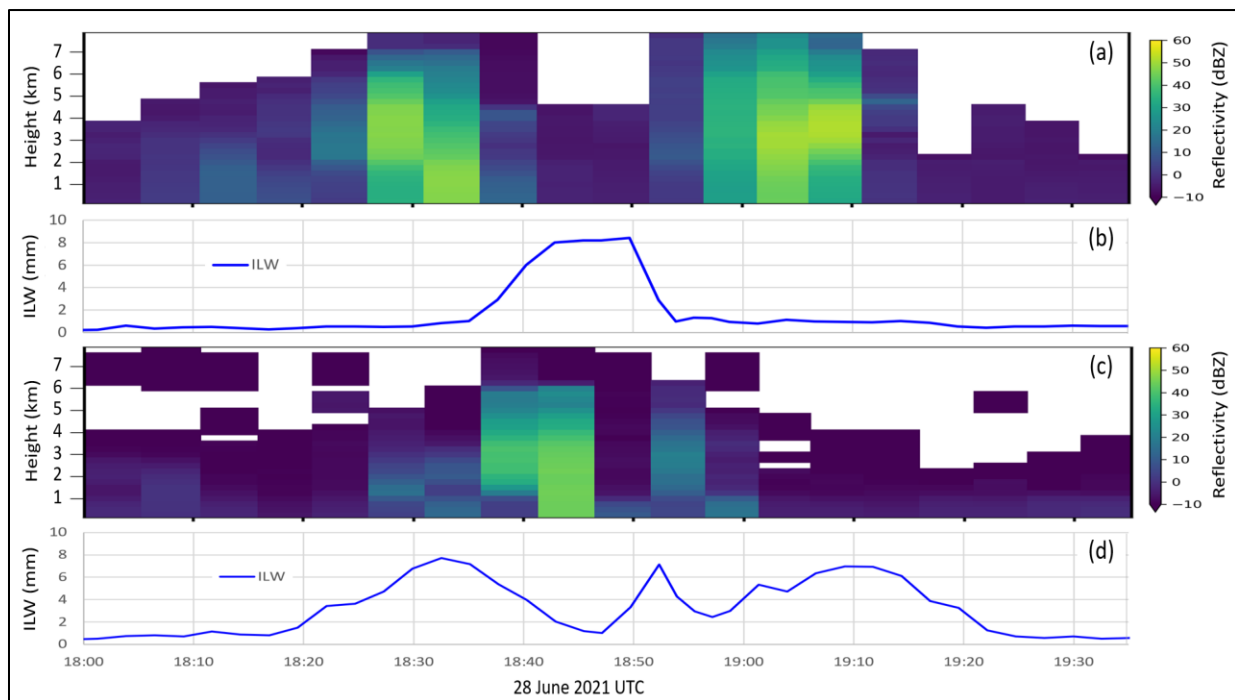


Figure 7. Radar reflectivity along line intersecting 20° elevation north (a) and south (c) radiometer 5-km height field-of-view, and corresponding radiometer ILW (b) and (d).

Maximum radar reflectivity and radiometer brightness temperatures ( $T_b$ ) are offset in space and time (Figs. 5 and 7). We attribute this to  $10^4$  hydrometeor diameter ( $d$ ) sensitivity differences: the radar scales as  $d^6$  and the radiometer as  $d^2$ . Further investigation and better understanding of complementary radar-radiometer observations may allow development of new hail suppression and weather modification tools and procedures. In addition, the radiometer detects supercooled liquid water associated with near-surface and upper air icing risk.