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Rapid Atmospheric Boundary Layer Evolution During the Great American Solar Eclipse of 2017

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Background

- A network of UAH weather balloons was set up co-located with UAH atmospheric profiler systems around Clarksville, TN, and Hopkinsville, KY to study The Great American Total Solar Eclipse.
- A key goal was to capture the evolution of the Atmospheric Convective Boundary Layer (CBL) through the total eclipse compared to the natural sunrise and sunset using high temporal resolution soundings and mobile atmospheric profilers.
- Soundings were launched during the mid-morning hours, during the eclipse, immediately following the eclipse, and during the evening transition to capture this evolution.

Fig 1. UAH students launching a weather balloon in front of the UAH Mobile Integrated Profiling System (MIPS) during the 21 Aug 2017 solar eclipse.

Fig 2. Series of UAH Mesodome photos showing the decrease in convective clouds during the eclipse.

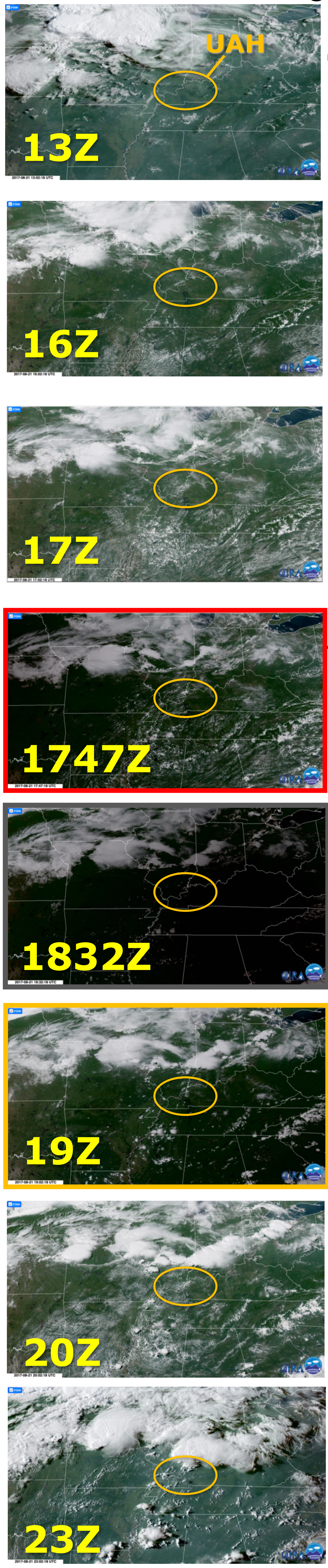

Fig 3. Sequence of GOES-16 visible satellite images during the solar eclipse of 21 Aug 2017.

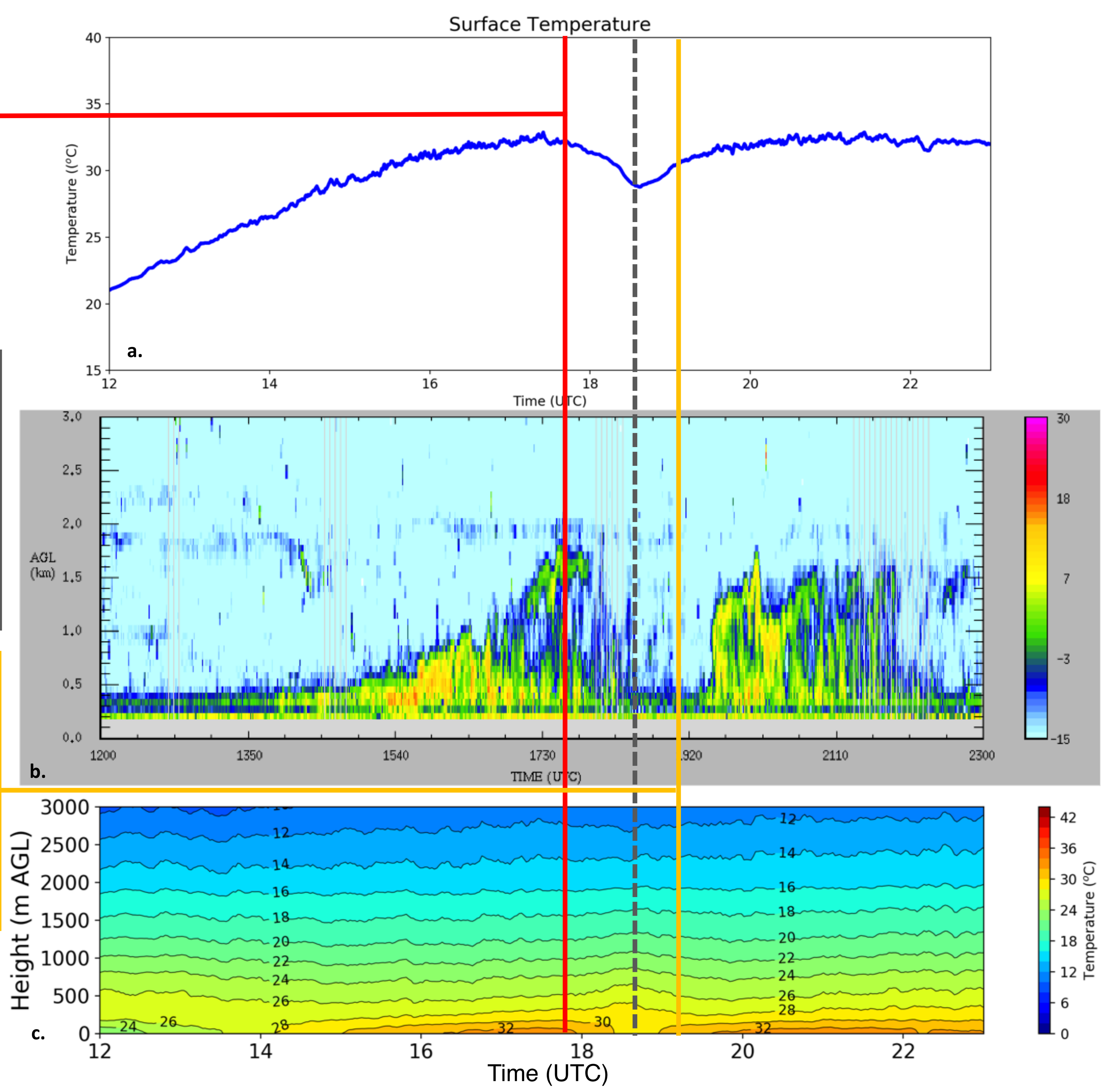

Fig 4. a) Surface temperature from the UAH Rapidly Deployable Atmospheric Profiling System (RaDAPS). **b)** 915MHz profiler Signal-to-Noise Ratio (SNR) from the UAH Mobile Integrated Profiling System (MIPS). **c)** Microwave Radiometer Temperature profile from UAH MIPS.

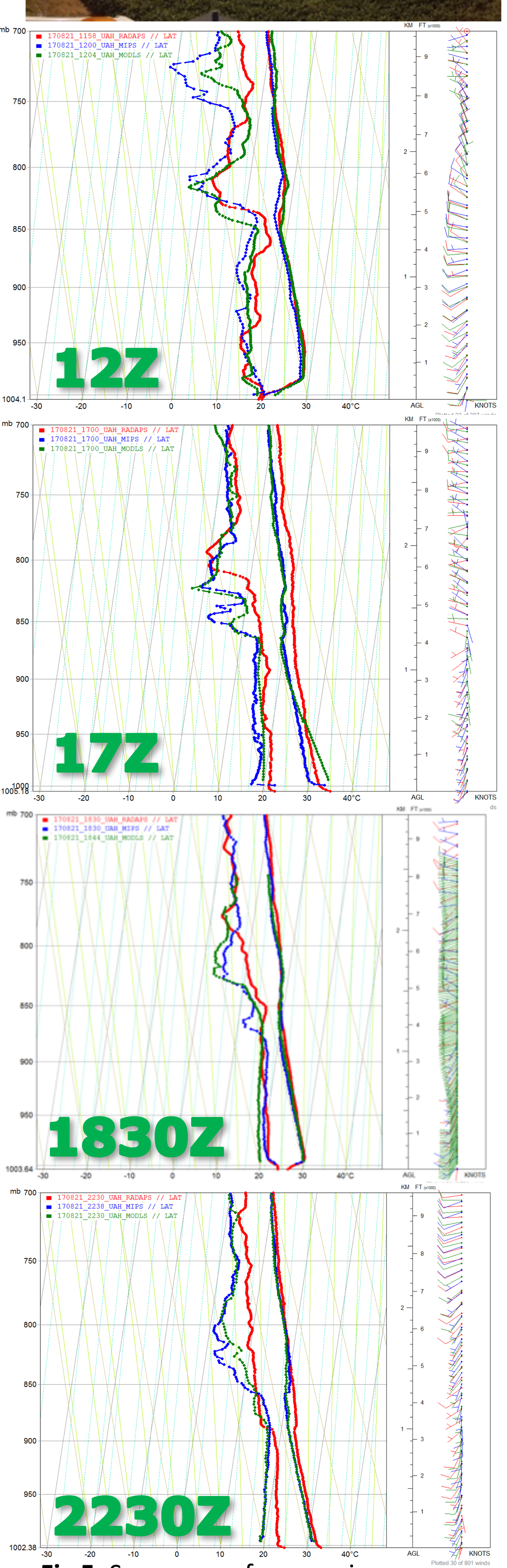

Fig 5. Sequence of comparison weather balloon soundings launched by UAH during the eclipse.

Conclusion

As the morning progressed, a gradual increase in CBL height was observed. The surface layer (lowest 300m AGL) rapidly cooled as the eclipse occurred, which promptly shut down the CBL. However, after the eclipse, the CBL quickly increased in height upon re-heating of the surface layer as compared to the gradual CBL height increase that occurred in the morning. The invigoration of evening thunderstorms shown in the satellite imagery is possibly due to this rapid response in increased height of the ABL immediately after the eclipse.

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