

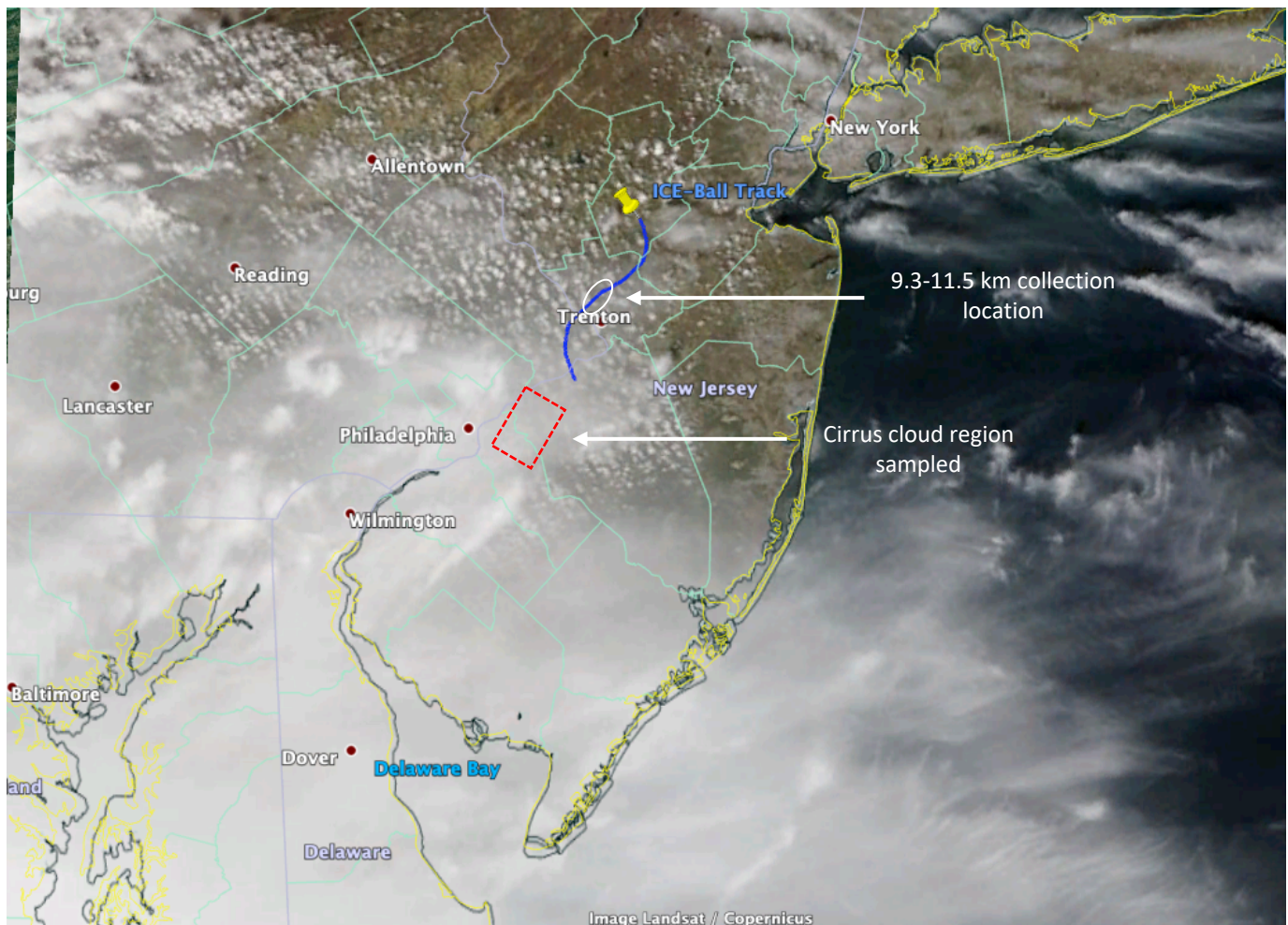
### SUPPLEMENT 3.

## Weather, Flight Path, and Collection Efficiency

ICE-Ball flight, April 24, 2018  
(corresponding to Fig. 1, Fig 2., Table 1.)

#### A.

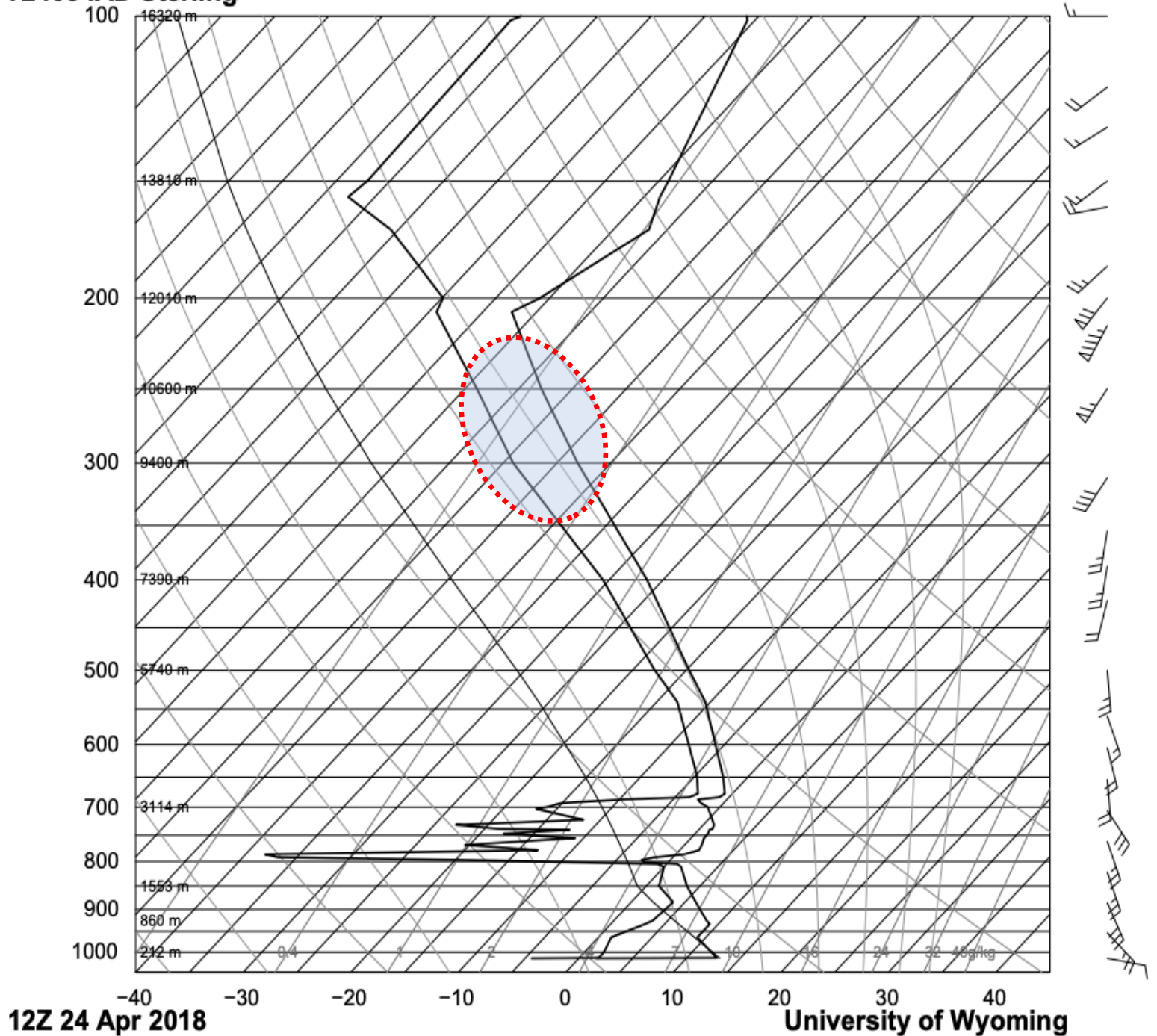
MODIS-Terra satellite image from 4/24/2018, 15:15Z, with ICE-Ball flight path overlay. Flight time was from 15:25 -> 16:25 Z, with collection beginning near 15:50Z (9.3 km -11.5 km cirrus layer) and lasting ~7 minutes. The high resolution MODIS satellite image is about 35 minutes prior to the cirrus penetration, thus zone of cloud sampled was advected from estimated upstream red outlined cirrus cloud region. Cloud optical thickness was 3-4 within red outline; cloud particle effective radius 30-40  $\mu\text{m}$  (MODIS cloud optical properties retrieval).



## B.

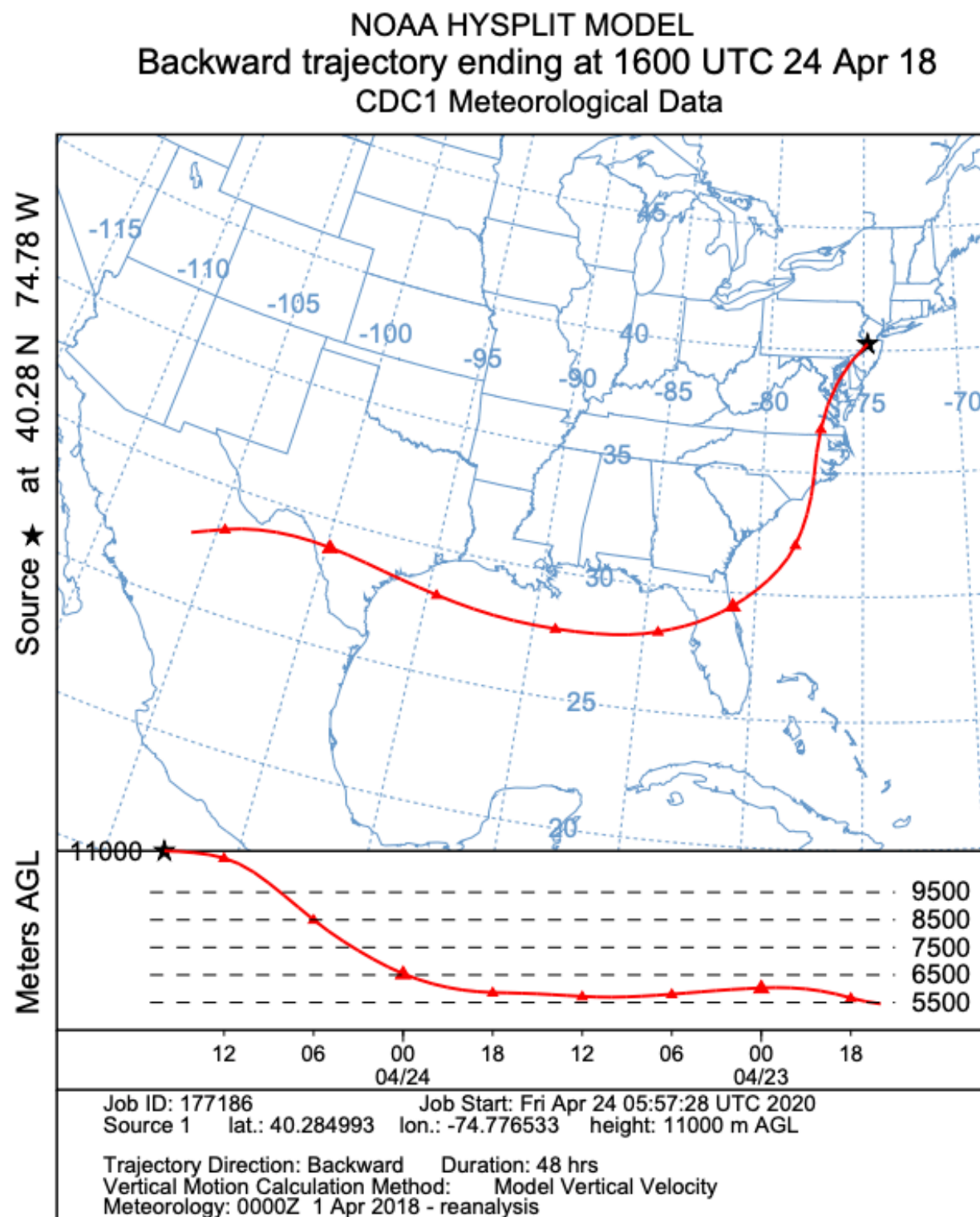
Skew-T upper air diagram from 12Z on Sterling, Virginia on 4/24/2018. The air sampled by this 12Z was near the cirrus collection zone at 15:50Z, and corroborates the -40 to -55C temperature range measured by the onboard thermistor. The next figure (Supplement 3.C.) displays the back trajectory of this air mass arriving at the collection zone.

### 72403 IAD Sterling



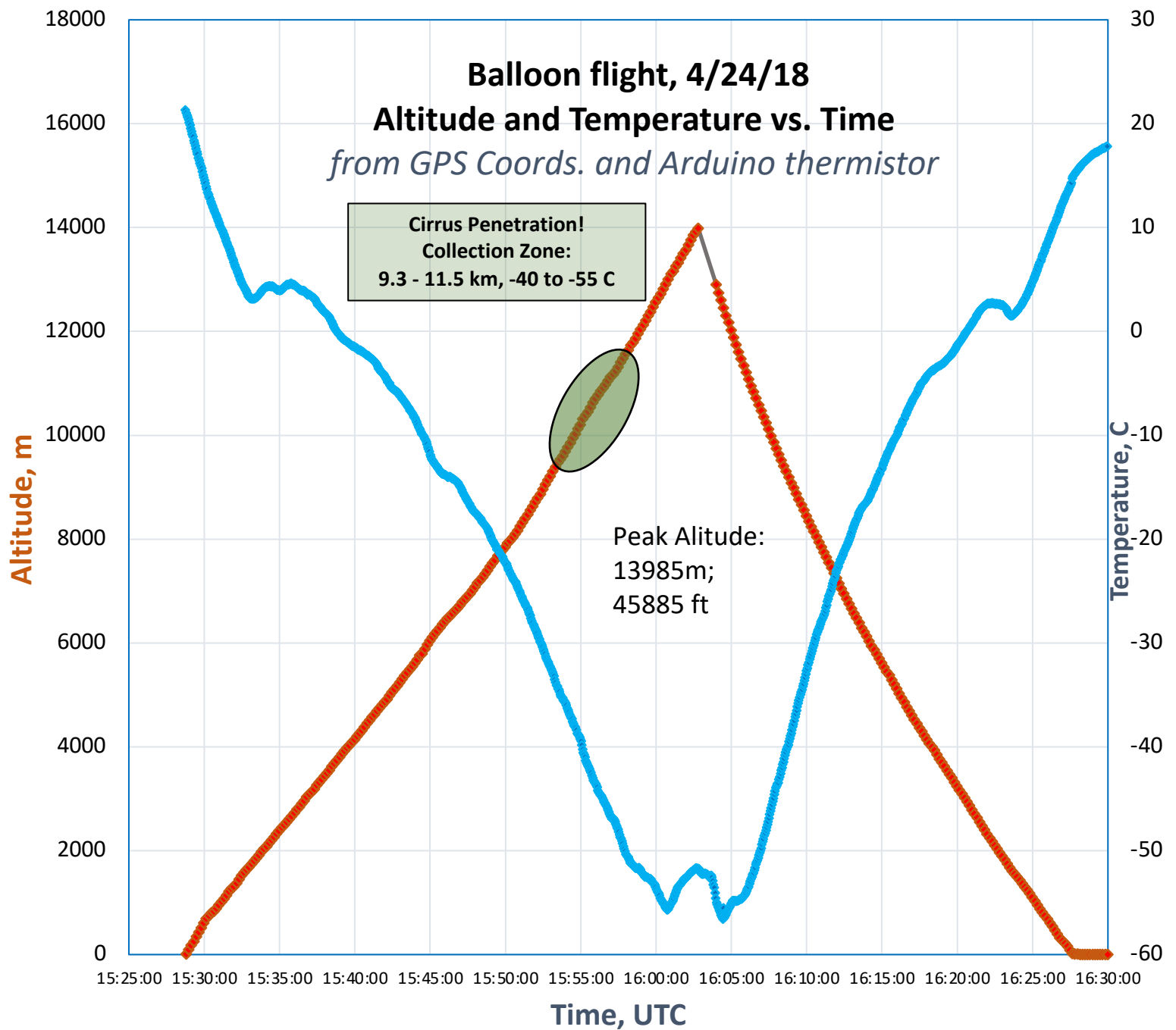
C.

NOAA-HYSPLIT Backward trajectory model from reanalysis data. The air mass arriving at the ICE-Ball collection zone at 16Z on 4/24/2018 originated in midlevels over northern Mexico two days prior. 1 day prior, the air mass was near Jacksonville, FL and began a steady upward ascent as it was drawn northward ahead of a mid-Atlantic low pressure system.



# D.

Greenalp onboard GPS tracking altitude (orange curve) and thermistor temperature vs. time during ICE-Ball flight of 4/24/2018. Thermistor response time lags actual air temperature changes by 1-2 minutes.





## E.

Computational Fluid Dynamics particle flow model (AutoDesk CFD) for cirrus ice particle collection efficiency in a 7 m/s vertical flow relative to the Ice-Ball instrument, at air pressure of 300 hPa. CFD results indicate that particles at 50  $\mu\text{m}$  diameter and larger are swept into the capture cell at near 100% efficiency, while capture efficiency 20  $\mu\text{m}$  diameter is reduced to approximately 10%.

