

WP-3D-0124 (24 Jan 2020)

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1. Objective

Coordinated research flight with EUREC4A platforms. WP-3D intended to fly a smaller circle (90 km radius) at FL100 within the circle being flown by HALO (FL320, center point 13.3N, 57.717W), traveling in the opposite direction (counter-clockwise) to maximize comparisons between the W-band aboard the WP-3D and the K-band radar on HALO. After 2.5 circles the WP-3D would sample clouds in an area extending from the eastern part of the circle and somewhat constrained by the location of other platforms. No dedicated isotope sampling was performed although descents and ascents were performed at nominal 1000 ft/min.

2. Crew

Eleven crew, one videographer (Maurice Bland), four science: R. Pincus (flight scientist), Adriana Bailey (isotope sampling), G de Boer (W-band radar, observer), R. Webb (observer).

3. Synoptic Situation

Beyond flying 20 km within the HALO circle the WP-3D passed by (and saw) the Meteor on two occasions.

A large fish-like structure extended across the south-east quadrant of the HALO circle and to the east. When flying two parallel cloud sampling legs running north-south to the east of the circle the WP-3D encountered a persistent line of vigorous convection extending to and above our flight level, visible as repeated deviations in the fly track as the pilots sought to avoid the features.

4. Flight Elements

Element	(°N, °W)	Flight Level (FL)	Time (UTC)	Notes
Takeoff-Ferry	GAIA	Ascent to FL100	13:20	
Circles	(13.3, 57.717)	FL100	13:35	
Cloud 1	(14, 56.75)	FLs 5, 18.5, 22, 100	17:00	
Cloud 2	(12.75, 56.5)	FLs 100, 35, 17, 5	19:13	
Transit		FL100	21:16	

Circles: Position noted is circle center at center of HALO; the WP-3D's circle/dodecagon was 90 km in radius, flown at FL100 to maximize repeated near-intersections with HALO.

After circles were performed the aircraft descended at a nominal 1000 ft/min to the start point of the first cloud sampling leg. Cloud top and base heights were noted.

Cloud sampling 1: performed on a longitude 56.75 starting south from 14N and running to 12.75. Level legs of roughly 15 min duration at FLs 5, 18.5, 22, and 100. The highest flight level was sampled twice. Substantial rain showers, and pilots diverted off the longitude line between roughly 13.5 and 13.75N to avoid small-scale vigorous convection.

Cloud sampling 2: Similar strategy to cloud sampling leg 1 on a line displaced 0.25 deg E. (A course 0.25 deg W was considered but avoided given aircraft weather radar indications of even stronger convection.) Flight levels were adjust to sample slightly lower (FL 18.5 was replaced with FL17) to

be more consistently below cloud base, and higher (FL22 was replaced with FL35) to sample between layers of convection. The convection avoided by the pilots in the first leg was encountered again, slight displaced to the south, suggesting a large and persistent structure.

5. Instrument Status

Radiosondes: Launched only during cloud modules. All provided good data.

Cloud physics: probes were not operational due to a failed data acquisition computer.

W-band radar: operational after 17Z; turned off below ~1500 m during cloud modules

WSRA surface wave radar: operational

SFMR: operational

Picarro isotope sampler: operational

6. Figures

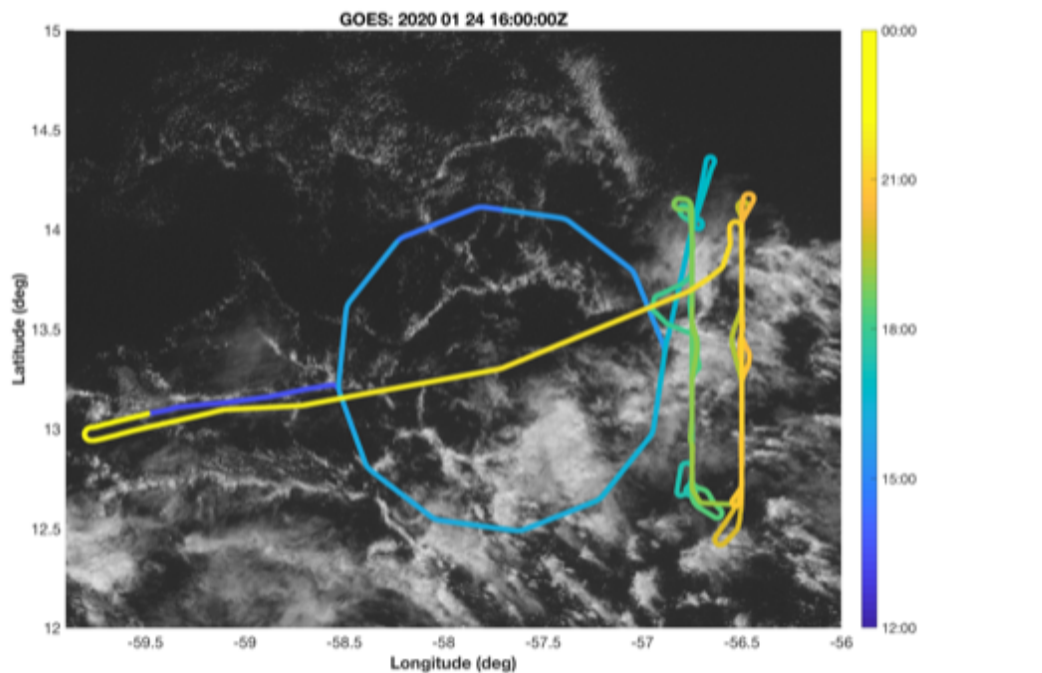


Figure 1. Plan view of flight path for WP-3D RF04. The track is superimposed on a satellite image from GOES-14 Channel 2 (red wavelengths in the visible) at 14:00Z

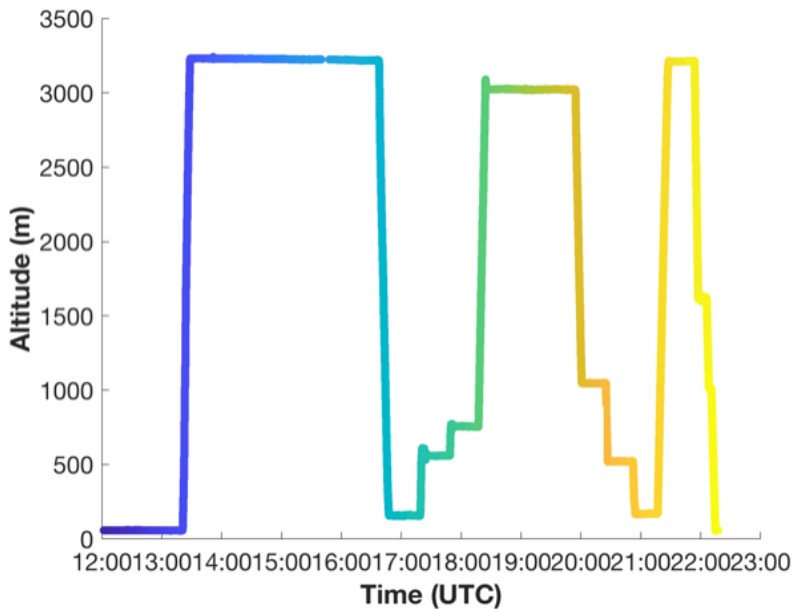


Figure 2. Profile view of flight plan.

OMIC (2020-01-24, DOY024, Hr-15). W-Band (motionread=1, Kongsberg=0)

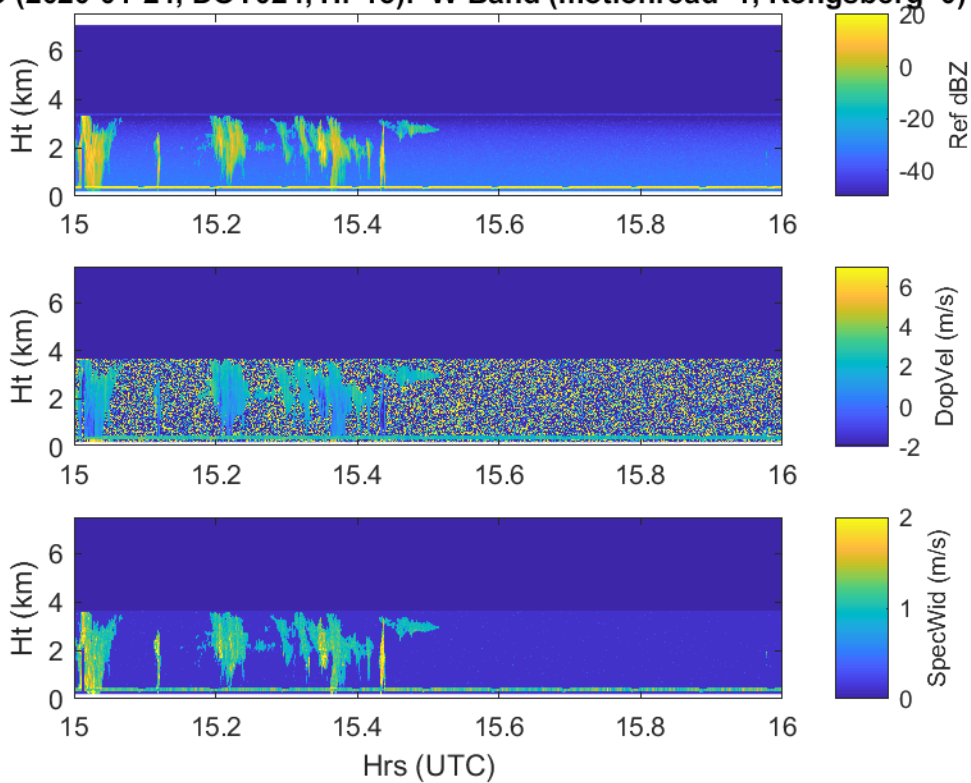


Figure 3. W-band radar data (reflectivity on top, doppler vertical velocity in the middle, spectral width on the bottom) from the hour starting at 15Z. Correction for aircraft altitude is imperfect, so the surface return is visible a few hundred meters above zero.

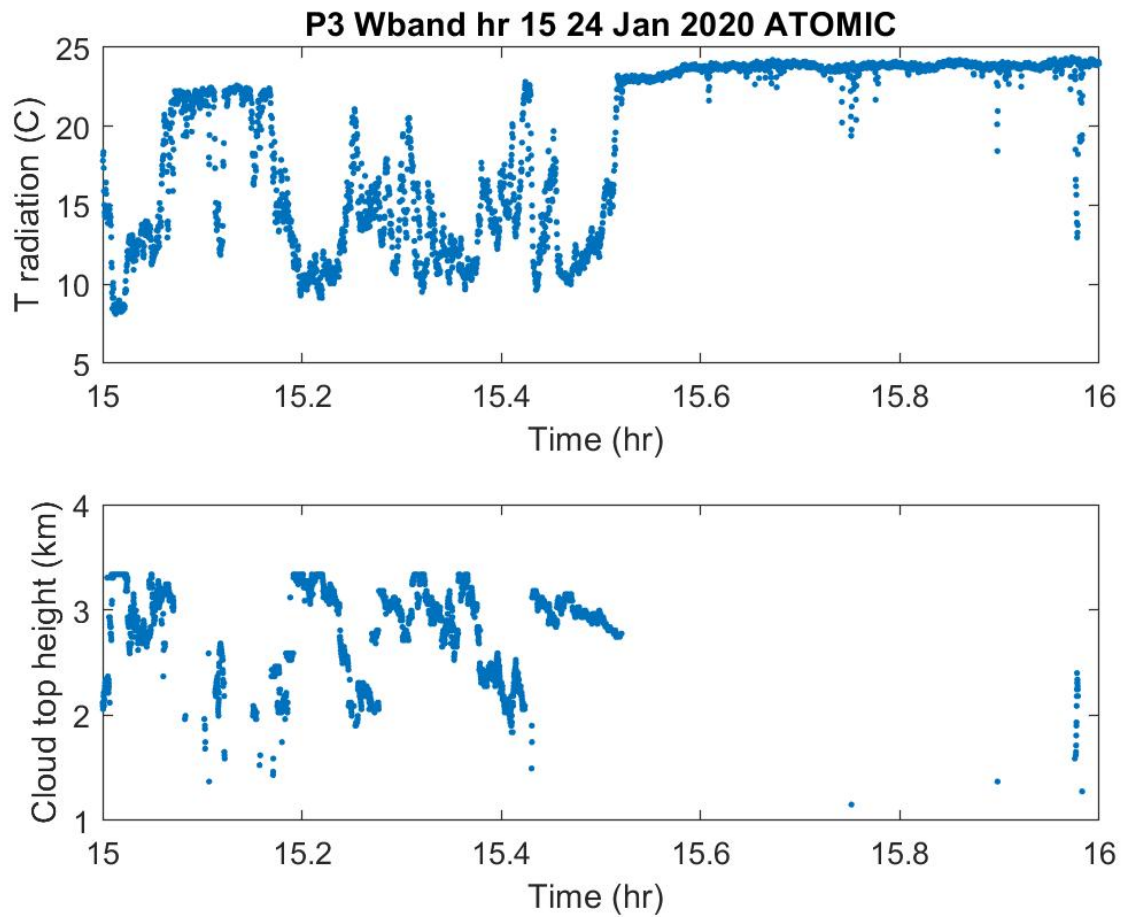


Figure 4. Cloud top height (top) and temperature derived from a downward looking infrared thermometer during the hour starting 15 Z. Both are rough estimates e.g. the brightness temperature is not corrected for the atmosphere between the aircraft and ship. As a sanity check this shows reduced upward infrared radiation in the presence of clouds.