EUREC^{4}A Break out group on ship planning

Atalante:

The Atalante will leave port on Guadeloupe on the 18th of January arriving at the BCO for calibration late on the 19th. Until January 22 it will work a line between the BCO and the Meteor on the tradewind alley so as to facility isotope measurements, also in coordination with airborne measurements, and the Ron Brown, further upwind toward the NTAS.

On the 22nd of January it will move to the South for coordinated buoy work with the Maria S Merian. There it will work on ocean mesoscale Eddies and submesoscale filaments , deploying drifters, gliders and Argo floats, staying west of 52 ºW and north of 7 ºN, with an increasingly north-westward emphasis of its measurements as it tracks eddies in their drift along the "Boulevard des Tourbillons" (i.e., in the ocean mesoscale eddies corridor undertaken by North Brazil Current – NBC – rings while drifting northward towards the Caribbean Islands).

During transit times, Ocean/Atmosphere underway observations will be acquired en route while during mesoscale and sub mesoscale sampling phases, very high-resolution sampling of the upper ocean (depending on the type of station it will sample down to 200m or as deep as 2000m) and ocean-atmosphere exchanges will be undertaken.

In parallel, 5 saildrones (2 under the responsibility of NOAA and 3 under the responsibility of ESR-NASA) will be deployed in early January from Barbados to be able to navigate and reach the ship working area (in the Tradewind Alley for the 2 NOAA saildrones and in the "Boulevard des Tourbillons" for the 3 ESR-NASA) in time.

Meteor:

The Meteor will follow a race-track pattern with long-legs perpendicular to the mean wind, and short legs closing the loop. The track should take two days, and will consist of three hour segments with (i) two hours of steaming at 8-9 kn; and (ii) station (CTD) work with ship pointed into the wind for one hour per station. The track is optimally position at the upwind end of the HALO circle. During the period of Maria S. Merian (MSM) operations in Tradewind Alley this position may shift to the East (or west) to make room for the MSM. The time on station and ship orientation, as well as the leg-direction for underway has been determined by accounting for the needs of the surface flux measurements, the oceanographic sounding, the kite and the isotope measurements.

As part of the circuit selected station points for coordinating with the Autonaut and Gliders will be specified in coordination with the UAE team. There is some interest in having the gliders follow along part of the circular path of HALO for surface calibration.

Flexibility should be reserved to allow excursions to try different patterns for the cloud kite (up/down wind), or to help position and coordinate with the gliders. These excursions would best be limited to one or two days per week on non-flight days, or if short (i.e., 2-4 hrs) built into the planned ship legs.

Maria S. Merian:

After departure from Bridgetown (17. January) for the MSM89 expedition the Merian will do a short long (couple of hours) stop off BCO to acquire relevant inter calibration profiles/observations (Doppler LIDAR, scanning radar, standard meteorology, …). Then Maria S Merian will move south (about 8 kn) to the "Boulevard des Tourbillons". Ocean/Atmosphere underway observations will be acquired en route. On request sufficient stop time will be added to deploy/test instruments and start experiments (Incubations, Cloudkite, etc.).

When Merian is in the "Boulevard des Tourbillons" target area the deployment of autonomous observing devices (underwater glider, surface drifter) will be done, followed by a first doppler

profiler survey of the mesoscale velocity structure, with synchronous surveys of the atmospheric conditions. Several ocean/atmosphere surveys in close coordination with the NO l'Atalante will follow. The survey will be aligned considering the cloud specific targets for the Cloudkite group. She will work in waters perhaps as far south and east as 52ºW, 7ºS.

During an eight day period (spanning four flights) in early February (tentatively the 6th through 12th) she will work on coordination with the other platforms in the Tradewind Alley. There she will likely measure between the BCO and the Meteor in the Halo Circle, with the Meteor shifting further to the East to make room in the Halo Circle and help distribute the soundings.

Afterwards she will return to the "Boulevard des Tourbillons" to recover the autonomous devices she deployed at the beginning of the campaign. She will return to Bridgetown for her final port-call on Feb 20th. On the way to port a rendezvous with the R/V Meteor, likely on the 19. February, at a place of its convenience is planned to pass along water samples that R/V Meteor will keep for the port call on the Azores.

In general, survey patterns will consider on-board (CloudKite, LIDAR, radar, ocean physics & biology etc.), multiship/platform and remote sensing measurements to best serve the experiments needs. Initially tracks along the wind are anticipated, to allow the CloudKite to possible run with the clouds.

Ronald H. Brown:

The Ron Brown will have two research cruises, one between January 6th and January 26th, the other from January 28th through February 13th. The general idea is to do a combination of measurements, some in the South where more active eddy activity is anticipated, some in Tradewind Alley. It also must do roughly a week of work to exchange the NTAS buoy at 51 ºW, 14 ºN, and service the MOVE mooring. The scope of its activities to the South are constrained by an inability to work in the economic exclusion zones, but there is the hope that, as in the past years, that strong frontal activity associated with mesoscale eddies extends beyond the boundary of the 200 nm limit.

Despite uncertainty about its exact cruise plans there has been an agreement to coordinate with the Atalante and Meteor by positioning itself in the Tradewind Alley, likely between the NTAS and the Meteor during the January 19-22 period. Also there has been agreement to conduct at least the latter part of its second cruise in the Tradewind Alley during the period between Feb 5th to 12th, as it returns to port on the 13th. Presently there is also the intention of deploying drifters in or near the Boulevard at the start of its first cruise, and calibrating through a day of measurements at the BCO on January 6th.

Identified coordination periods

Jan 19- Jan 26 Coordination Period (Jan 19-22)

Coordinated isotope (and other boundary layer budget quantities, including aerosol) measurements following boundary layer air trajectories to take advantage of the L'Atalante availability as it moves to the eddy field to the South. The L'Atalante isotope measurements is advantageous for coordination with Ron Brown and aircraft. The present plan envisions a minimum window of coordinated measurements during the period from 19-22 Jan.

Jan 28- Feb 13 Coordination Period (Feb 6-12)

During this period the Maria S Merian will be working together with the Meteor and the aircrafts in the Tradewind Alley, planning to spend about 7-9 days in the Alley. This offers another opportunity to make a line of measurements coordinating most platforms, linking detailed cloud measurements of Maria S Merian (CloudKite, radar, lidar) to other platforms. The present plan envisions a minimum window of coordinated measurements during the period from 6-12 Feb.

Open Issues:

- The Maria S. Merian needs to fix its cruise plans for the time in the Tradewind Alley, this involves coordination with the cloud-kite and radar and lidar remote sensing teams
- The Maria S. Merian needs to fix the time period at which it intends to make coordinated measurements with the BCO.
- The L'Atalante and Maria S Merian should decide on how to coordinate their operations in the mesoscale eddies area south of Barbados (along the Boulevard)

Graphical cruise plans:

Tentative sketches of different phases of ship planning are indicated on the Strategy Schematics part of the EUREC^{4}A website.