

Pre-EUREC⁴A – a virtual campaign sets the stage for future field study

Between 20 January and 20 February 2018 Pre-EUREC⁴A 2018, a virtual field study, will investigate the atmosphere over the downwind trade-winds of the Tropical Atlantic. During Pre-EUREC⁴A 2018 teams of scientists from several European institutions will focus their attention on the atmospheric conditions in the field area, so as to calibrate expectations for the actual EUREC⁴A field study planned for the same time period in 2020. In the course of the virtual field campaign, daily weather and instrument reports from the instruments at the Barbados Cloud Observatory (BCO), run by the Max Planck Institute for Meteorology (MPI-M), will be compared with daily satellite imagery. In focus will be a study region spanning 5°N to 30°N and from 20°W to 60°W. The first Pre-EUREC⁴A study took place in 2017, pre-EUREC⁴A 2018 will build on this, also with the addition of special measurements. The EUREC⁴A planning will culminate in Jan-Feb 2019, with a third virtual field study, pre-EUREC⁴A 2019.

The upcoming field study EUREC⁴A (**Elucidating the role of clouds-circulation coupling in climate**) is a French-German initiative in support of the World Climate Research Programme's (WCRP) Grand Science Challenge on *Clouds, Circulation and Climate Sensitivity*. It aims at advancing understanding of the interplay between clouds, convection and circulation and their role in climate change: How resilient or sensitive is the shallow cumulus cloud amount to variations in the strength of convective mixing, surface turbulence and large-scale circulations? How do the radiative effects of water vapour and clouds influence shallow circulations and convection? What are the implications for the spatial organization of clouds and convection in the tropics, and for climate sensitivity? By simultaneously, and for the first time, linking patterns of cloudiness to the larger scale circulations in which they are imbedded EUREC⁴A investigators hope to unravel some of the mysteries surrounding how clouds respond to and influence climate change.

To address these questions the core, and presently supported, EUREC⁴A measurements will focus on quantifying how cloud amount in shallow cumulus layers responds to changes in the large-scale environment, and how shallow clouds affect the radiation field and contribute to the aggregation of deeper, precipitating, convection. The measurements will also test retrievals of cloud and atmospheric properties, and numerical simulations of shallow cumulus cloud regimes by large-eddy simulation, weather prediction and climate models. Through international cooperation complementary objectives will also be explored, which range from investigations of the role of ocean mesoscale eddies in air-sea interactions, to the role of clouds in the momentum transport of the atmosphere, to the organization of shallow clouds to the much broader question of the dynamics of the Intertropical Convergence Zone over the Atlantic.

The nucleus for the field study involves the deployment of two research aircrafts (the German HALO and the French ATR42), an array of ocean going research vessels, advanced ground based remote sensing, a new generation of sophisticated satellite remote sensing and state-of-the-art turbulence-resolving modelling (100 m, over thousands of km). Operations will focus on an area over the shelf oceans east of Barbados (57°W 13°N) for six weeks period between 20 January and 20 February 2020. This period will overlap with *ADM-Aeolus* and perhaps also *EarthCARE*, two flagship satellite platforms of the European Space Agencies Living Planet Programme. These operations build on a decade of measurements in the tropical Atlantic, initiated with the establishment of the BCO in

2010, and continued with two aircraft campaigns with HALO: NARVAL in December 2013, and NARVAL2 in August 2016.

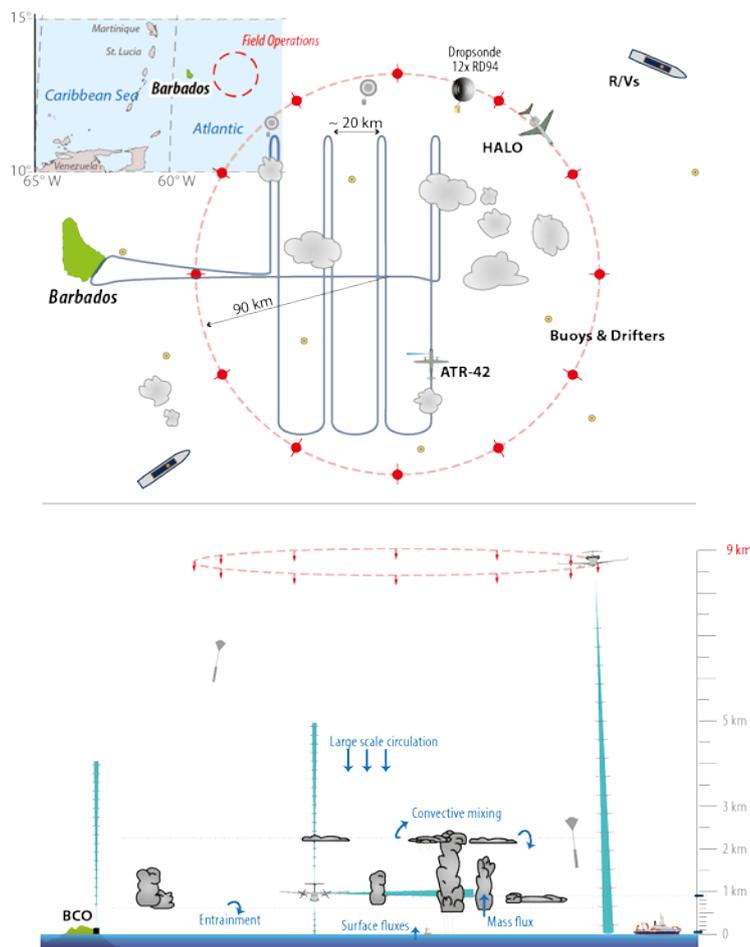


Figure: Schematic of planned EUREC⁴A flight operations, with surveying circles flown by HALO, and back and forth (mattress-spring-shaped) patterns flown near 1 km by the ATR-42. The low-level flight legs will map out the cloud conditions and constrain the mass budget of the sub-cloud layer, the surveying circles will document the large-scale conditions with sondes, and remotely sense the underlying cloud field. Ship-based surface remote sensing will complement aircraft measurements and also support insitu measurements using kite-borne sensors.

Overview Paper EUREC⁴A:

Bony, S., B. Stevens et al.: EUREC⁴A: A Field Campaign to Elucidate the Couplings Between Clouds, Convection and Circulation. *Surv. Geophys.* (2017) 38:1529–1568, <https://doi.org/10.1007/s10712-017-9428-0>

More information

EUREC⁴A project website: <http://eurec4a.eu/>

WCRP Grand Science Challenge: <https://www.wcrp-climate.org/component/content/article/30-grand-challenges/grand-challenges-clouds/61-gc-clouds-circulation?Itemid=267>

NARVAL experiments: <https://www.mpimet.mpg.de/en/science/the-atmosphere-in-the-earth-system/narval/>

'Focus on' NARVAL:

https://www.mpimet.mpg.de/fileadmin/grafik/presse/Forschung_aktuell/PDFs/1608_HALO_Stevens_ENG.pdf

EarthCARE at MPI-M: <https://www.mpimet.mpg.de/en/science/the-atmosphere-in-the-earth-system/earthcare/>

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