Quotations Sandrine Bony

What is special about the field campaign EUREC^{4}A?

The response to global warming of low-level clouds in the trade-wind regions will determine, to a large extent, the rate and the magnitude of climate change over the next decades. However, this response remains very uncertain. EUREC^{4}A is the first field campaign designed to tackle this problem and help reduce this uncertainty: by observing both the clouds and the environment in which the clouds are embedded, we will be able to understand what controls the cloudiness of the trade-wind regions, and how clouds interact with their environment.

Based on the unprecedented rich and comprehensive dataset that EUREC^{4}A will provide, we will be able to decipher the physical mechanisms that determine the clouds formation and properties, and to test the ability of weather and climate prediction models to represent these mechanisms. It will be essential to assess the credibility of the model predictions. Hopefully, it will allow us to determine eventually how sensitive our planet is to the increase of greenhouse gases in the atmosphere.

The original EUREC^{4}A initiative has raised a lot of interest across the international p community, and many groups worldwide have proposed complementary investigations. As a result, EUREC^{4}A will gather an incredible group of scientists and an unprecedented wide and rich collection of observing platforms including aircraft, ships, drones, ground stations. One thing that makes EUREC^{4}A special, is the will, from the outset, to consider all the different parts of EUREC^{4}A as different pieces of the same object, to look at the experiment as a whole without loosing sight of the original motivations for the campaign.

What makes EUREC^{4}A special is also that its preparation has been an opportunity for many young scientists to develop scientific and organizational leadership.

Why is it important for people here?

The people of Barbados attach great importance to knowledge, education and environmental issues. It is no surprise that for the last 50 years, Barbados has always been a focal point for meteorological and oceanographical field campaigns (e.g. BOMEX in 1969, NARVAL in 2013 and 2016).

Moreover, the Caribbean is an area of the world where the impacts of climate change are expected to be particularly severe over the next decades. The people of Barbados will have to face the consequences of the global rise of temperature and sea level, in addition to the expected regional changes in rainfall and extreme events. A better prediction of the response of trade-wind clouds to warming, which is the hoped outcome of the EUREC^{4}A field campaign, will help predict the rate and magnitude of global warming more precisely, which is a pre-requisite to predict sea level rise and changes in rainfall and extreme events more precisely as well. It should thus help Barbados to design better adaptation policies to climate change.

What is the benefit from this kind of concerted effort?

To understand how the climate system works, we need to consider all its constituents: the atmosphere, the ocean, the surface, the air aloft, the large scales, the small scales. We can only observe these different pieces together through a concerted effort. EUREC^{4}A will offer the unprecedented opportunity to observe all these elements and scales at the same time. It will allow us to understand how the small scales depend on the large-scale and vice-versa.

Why the Tropics are essential for cloud and climate research?

Estimates of climate sensitivity remain very uncertain, and most of this uncertainty stems from the response of low-level clouds in the tropics, especially in the trade-wind regions. Past studies have shown that the low-clouds near Barbados are representative of the low-clouds that populate the trade-wind regions over the whole Tropics, and the small cumulus clouds that form in the trade-wind regions constitute the cloud type with the highest frequency of occurrence on Earth. So, what we will learn from EUREC^{4}A will not only serve our understanding of Barbados clouds but of Earth's clouds in general.

Moreover, it is also in their prediction of the tropical atmosphere that climate and weather prediction models exhibit the largest difficulties. It is thus essential to better observe, characterize and understand the tropical physical processes if one wants to understand the origin of the models' difficulties and to propose remedies.

Why do you use so many platforms in this campaign (ships, aircrafts, cloudkites, drones, dropsondes, etc.)?

To understand how clouds work, we cannot only observe clouds. We need to observe cloud properties together with the environment in which they form. It means measuring the properties at the ocean surface (temperature, wind, evaporation, etc.) and within the atmosphere up to an altitude of almost 10 km (temperature, humidity, winds). It also means characterizing the turbulent flow between the ocean surface and the cloud base. Moreover, characterizing clouds means characterizing both the vertical and horizontal distributions of clouds, and many microphysical and macrophysical properties of clouds (e.g. the size of the cloud droplets, the presence of raindrops, the amount of liquid water within the cloud). To measure each property of the ocean surface, of the atmosphere or clouds, we need a specific instrument on a specific platform. Some platforms work best at the ocean surface or within the first few hundred meters of the atmosphere; others work best at higher altitudes. Some provide us with horizontal views of the atmosphere while others provide us with vertical soundings across the atmosphere. So, to observe the ocean and the atmosphere in three dimensions and both at the small scale and at the large scale, we need a large ensemble of platforms and instruments. By gathering so many platforms of measurements (aircraft, ships, drones, dropsondes, radiosondes, gliders, cloudkites, etc.), EUREC^{4}A will characterize the trade-wind cloudiness and its environment in an unprecedented way.