# Exploring ocean waters to characterize atmospheric aerosols

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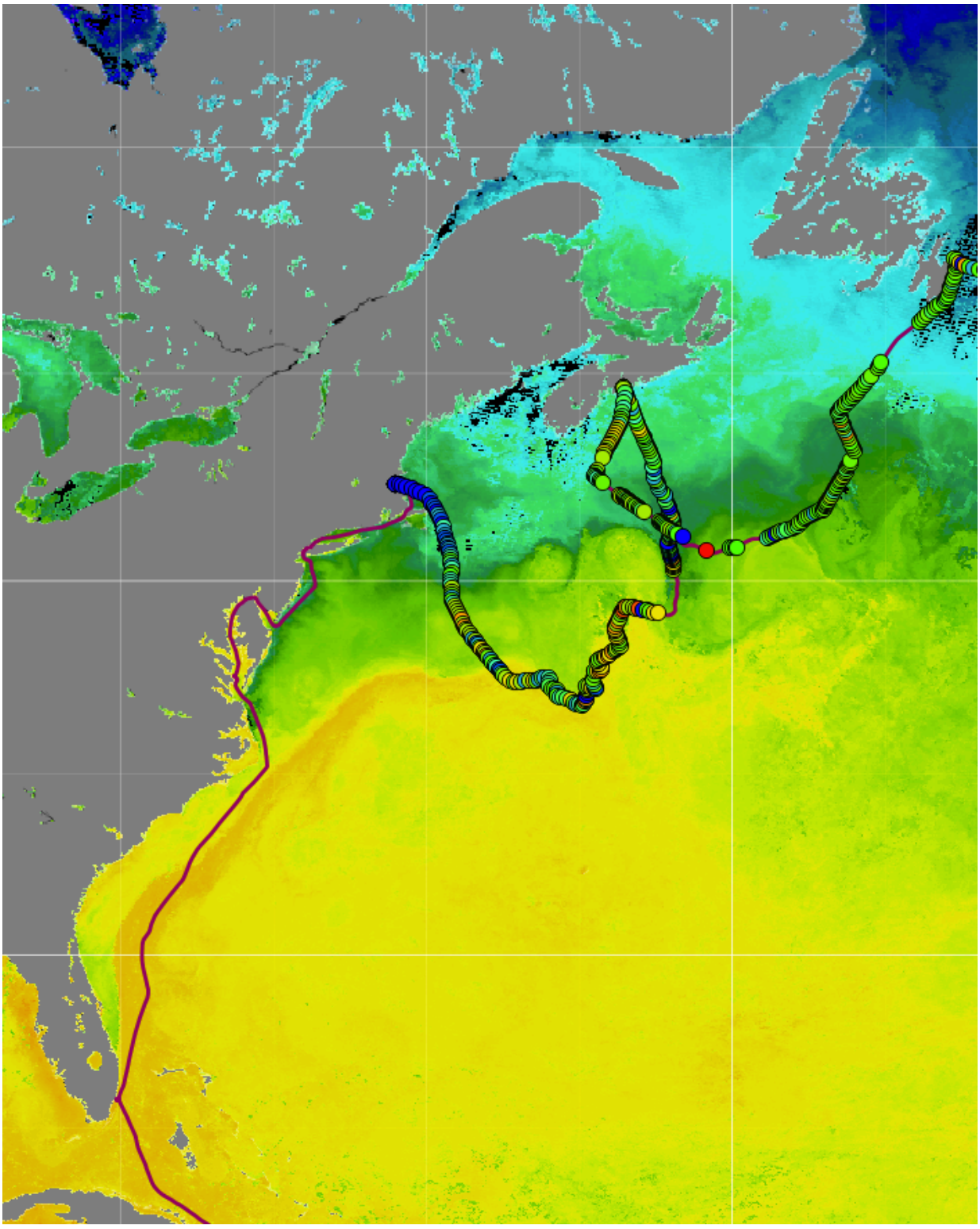

Representation of the temperatures on the surface of the Atlantic Ocean near the north-american coast. In blue, the colder bodies of water where biological

activity is more important. In yellow, warmer bodies of water where biological activity is weaker. Along the PlanetSolar itinerary, the colored dots represent the concentration of organic aerosols, from blue (light concentration) to red (strong concentration). Credit: ©UNIGE

Aerosols are collections of fine particles, either biological or of other types, suspended in a gaseous medium. They play a major role in cloud formation and therefore have a strong impact on climate models. They are, however, extremely hard to study due to the small size and immense variety of their constituent particles. But researchers from the University of Geneva (UNIGE), Switzerland, members of the PlanetSolar Deepwater expedition, have now linked the composition of marine biological aerosols—and therefore their influence on the climate—to the composition of bodies of water within the Atlantic Ocean, thereby paving the way to an indirect study of these aerosols through water analysis. This study, which has been published in *Scientific Reports*, will contribute to making climate models more accurate.

Over the oceans, some aerosols contain organic or biological ingredients (bacteria, degradation products of microscopic algae) which come from sea spray, others are transported in the air (mineral dust, smoke). They serve as seeds for forming clouds and also reflect light. Their role is extremely important for modelling clouds, and therefore for the climate in general. But due to the small size of the particles and their large quantity, it's difficult to accurately study them. So researchers at the University of Geneva (UNIGE) asked themselves if it were possible to characterize biological aerosols through the composition of the water where they originate.

"To answer this question, we needed two tools," explains Jérôme Kasparian, professor in the Department of Applied Physics at the

UNIGE Science Faculty. "The first is a detector of fluorescence which we designed, called Biobox, and which enables us to analyse aerosol particles one by one. The spectrum gives us information on their composition and distinguishes the organic particles, which are fluorescent, from the other particles. Then we needed PlanetSolar." Indeed, this research could only be undertaken over a long time period without any disturbances of water and air. Only PlanetSolar, a solar boat, remains at sea for three months and produces no emissions, making the study possible.

During the expedition, scientists carried out analysis of the salinity, temperature, dissolved oxygen and the microalgae contained in the various bodies of water in the Atlantic, and then compared this data with that obtained by the Biobox. "And we found that they matched!" exclaims Jérôme Kasparian. The physicists discovered that biological aerosols are related to the temperature and salinity of the sea. According to previous criteria, water creates large bodies that don't inter-mix, which allows them to be differentiated. Thus, when the characteristics of a water mass were favourable for reproduction of microalgae, researchers noticed that after a certain amount of time, the aerosols detected above this same water mass contained more biological particles. The biological fraction of aerosols is therefore linked to the history of biological activity of bodies of water close to the surface. "Provided that this is also valid in oceans and seas other than the Atlantic, our research location, our results would allow us to estimate biological aerosols by directly studying the bodies of water, which would simplify aerosol characterization and make climate models more accurate," adds Kasparian. Difficult to study directly, aerosols are now being studied via the sea, which, unlike aerosols, can easily be analysed by satellites.

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