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The Impact of Dry Saharan Air on Tropical Cyclone Intensification

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The controversial role of the dry Saharan Air Layer (SAL) on tropical storm intensification in the Atlantic will be addressed. The SAL has been argued in previous studies to have potential positive influences on storm development, but most recent studies have argued for a strong suppressing influence on storm intensification as a result of dry air, high stability, increased vertical wind shear, and microphysical impacts of dust. Here, we focus on observations of Hurricane Helene (2006), which occurred during the NASA African Monsoon Multidisciplinary Activities (NAMMA) experiment. Satellite and airborne observations, combined with global meteorological analyses depict the initial environment of Helene as being dominated by the SAL, although with minimal evidence that the SAL air actually penetrated to the core of the disturbance. Over the next several days, the SAL air quickly moved westward and was gradually replaced by a very dry, dust-free layer associated with subsidence. Despite the wrapping of this very dry air around the storm, Helene intensified steadily to a Category 3 hurricane suggesting that the dry air was unable to significantly slow storm intensification.

Several uncertainties remain about the role of the SAL in Helene (and in tropical cyclones in general). To better address these uncertainties, NASA will be conducting a three year airborne campaign called the Hurricane and Severe Storm Sentinel (HS3). The HS3 objectives are:

- To obtain critical measurements in the hurricane environment in order to identify the role of key factors such as large-scale wind systems (troughs, jet streams), Saharan air masses, African Easterly Waves and their embedded critical layers (that help to isolate tropical disturbances from hostile environments).
- To observe and understand the three-dimensional mesoscale and convective-scale internal structures of tropical disturbances and cyclones and their role in intensity change.

The mission objectives will be achieved using two Global Hawk (GH) Unmanned Airborne Systems (UASs) with separate comprehensive environmental and over-storm payloads. The GH flight altitudes (>16.8 km) allow overflights of most convection and sampling of upper-tropospheric winds. Deployments from Goddard's Wallops Flight Facility and ~26-hour flight durations will provide coverage of the entire Atlantic Ocean basin, and on-station times up to 5-22 h depending on storm location. Deployments will be in September of 2012 and from late-August to late-September 2013-2014, with up to eleven 26-h flights per deployment.
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