The role of the Saharan Air Layer (SAL) in modulating tropical cyclone genesis and intensity has received considerable attention recently. Early studies by Keaumes and Carney (1979), and Carneiro and Pompili (1996) suggested that the SAL can have a positive influence on the growth of eyewall clouds and tropical cyclones through downdrafts and enhanced convections and by enhancing rain motion south of the SAL. More recent studies have focused on potential negative influence on storm development. Dunion and Velden (2004), Zehr et al. (2006, 2007), Jhun and Velden (2007), Crotteau and Velden (2008), and Sun et al. (2010) have presented initialized forecast experiments focused on increasing SAL dryness and finding ways to reduce the fast SAL dry tongue wrapping around Helene.

MOSIS/ROD evolution

The figure to the right shows the MOSIS/ROD initialized from August 9th and 10th and 32 km resolution (including model initialization). Also shown is the SAL 800-600 hPa relative humidity field for values <50%.

The figure shows the development of a slow- or no-dust tongue of very dry air moving southwest along the western edge of the storm. The RHs in the tongue are lower than in the original SAL air mass, as well as the resulting lower dry tongue and perhaps contain sides.

Thermodynamic Structure of the SAL

The figure shows a sounding from the NASA DIS D jet near the middle of the SAL layer on Sep. 9. The main jet is situated on the left side of the SAL, with the SAL dry tongue wrapping around the jet.

Conclusion

This study suggests that the direct negative effects of the SAL (vertical shear, dry and stable air) were not a primary influence on the evolution of Helene. At early stages, there is little evidence for ingestion of SAL air into the storm core. Most of the SAL air moved westward of the storm at the time of its intensification. Trajectory calculations suggest that the dry air wrapping around Helene between Sep. 15 and 16 was predominantly non-humid and instead was associated with strong subsidence. Even if the air remained at large radius, so that its impact was probably not a primary driver of storm intensity.

On the Role of the SAL in the Evolution of Hurricane Helene During NAMMA: Lessons Learned for GRIP

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Introduction

The sounding in the middle of the SAL layer on Sep. 9, 2006 (top left) shows an intense stationary jet, with the SAL dry tongue wrapping around the jet. The 850-700 hPa relative humidity is <50%.

ABS RH

ABS RH shows the ABS layer ages averaged relative humidity (850-700 hPa, top row; 700-600 hPa, bottom row) from September 12-16. Decreasing pressures correspond to ~11 UTC, ascending passes to ~11 UTC. Also included is the coincident AIRS rainfall field within the data void regions of the ABS product. Of particular note is the shallow dry tongue on the 850-700 hPa layer, which we propose as the motive of this radar-dry tongue, as opposed to processes specifically related to the SAL.

SAL Representation in the Analysis

Shown above is the 700 hPa RH (shaded) and wind speed (contours) from NCEP (left) and MOSIS (right). 48 h backward trajectories suggest that the dry air wrapping around Helene is not SAL. Shaded fields in other regions indicate convective conditions.

CROSS-SECTION LOCATIONS AT 00 UTC 14 SEPTEMBER

This study was conducted over the western North Atlantic (10-40°W, 20-35°N). Observations were performed at the following times:

- 00 UTC 14 September
- 06 UTC 14 September
- 12 UTC 14 September
- 00 UTC 15 September
- 06 UTC 15 September
- 12 UTC 15 September

The C-130 soundings were performed south of the SAL, while the GRIP AIRS close-up and TRMM data were used to observe the SAL dry tongue wrapping around Helene.

Summary of G-IV soundings on Sep. 15

- Soundings further west show clear SAL, similar to sounding S14. SAL air, >10° lat/lon from storm.
- Soundings S19 and S20 show deep dry tongue, wrapping around the storm. Deep dry tongue moves largely by the storm.
- Soundings S5 and S6 show deep dry tongue, wrapping around the storm. Deep dry tongue moves largely by the storm.
- Soundings S15-17 show shallow dry tongue, wrapping around the storm. Shallow dry tongue moves largely by the storm.
- Soundings S9 and S10 show shallow dry tongue, wrapping around the storm. Shallow dry tongue moves largely by the storm.

Trajectory Calculations

Calculated from NCEP final analysis, this 6-day backward air trajectories suggest that the dry air wrapping around Helene is not SAL. Shaded fields in other regions indicate convective conditions.

SUMMARY OF G-IV SOUNDINGS ON SEPTEMBER 15, 2006

- Results for parcels released at 00Z 14 Sept.
- 6-day backward air trajectories suggest that the dry air wrapping around Helene is not SAL. Shaded fields in other regions indicate convective conditions.

Simulated Intensity Evolution

The simulated intensity evolution very closely tracks with the observations, which are evaluated from satellite prior to the 17th. The intensity difference is within the error range expected from the model run and includes the effect of the SAL dry tongue wrapping around the storm.

Time Series of Surface Wind Fields

This study was conducted over the western North Atlantic (10-40° W, 20-35° N). Observations were performed at the following times:

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