Capturing the Transition Between Saharan Air Layer and Convective Environments Using Radio Occultation

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Introduction

- The Saharan Air Layer (SAL) is a warm, dry, dusty region present between ~800-500 mb
- SAL interacts with convection on its southern edge
- Dry SAL air usually weakens convection within easterly waves and tropical cyclones, but its effects require further study
- Usually measured through IR, but unable to measure SAL if clouds are present
- Radio occultation (RO) solves this issue
- Looking to determine how temperature and dewpoint profiles transition from SAL to convective environments

Methods

- SAL Images were categorized into best dates for sampling in July 2022
- Images were overlaid with RO profiles
- Selected pairs in SAL and in convection

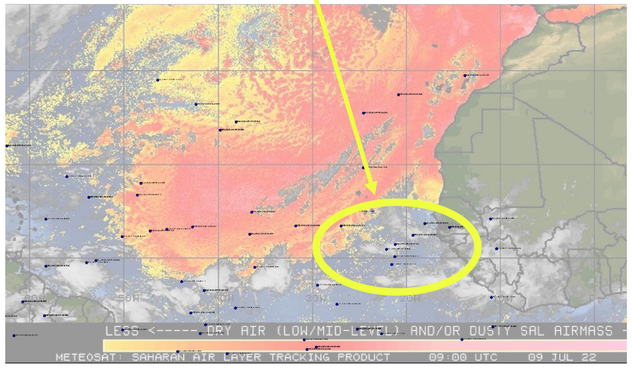

Figure 1: CIMSS SAL Multichannel IR Satellite Image overlaid with RO profiles on July 9, 2022, at 09:00 UTC

- Used wetPf2 files containing derived atmospheric temperature, pressure, and water vapor from RO
- Plotted data from wetPf2 files into Skew-T plots

Results

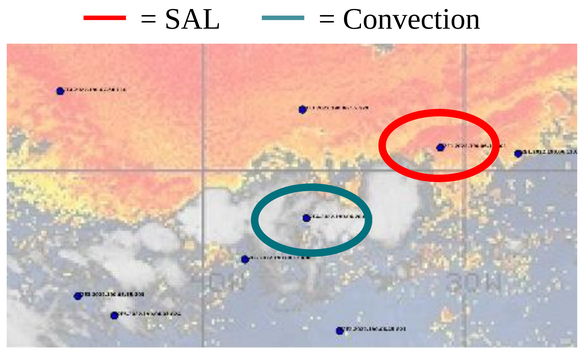

Figure 2: CIMSS SAL Multichannel IR Satellite Image overlaid with RO profiles on July 9, 2022, at 06:00 UTC

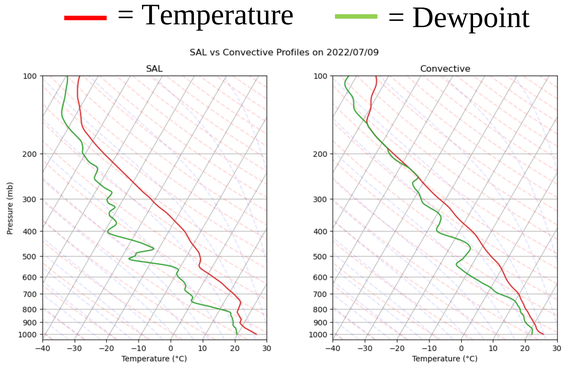

Figure 3: Skew-T Plots of SAL and Convective Profiles on July 9, 2022, at 06:12 Z and 06:20Z respectively

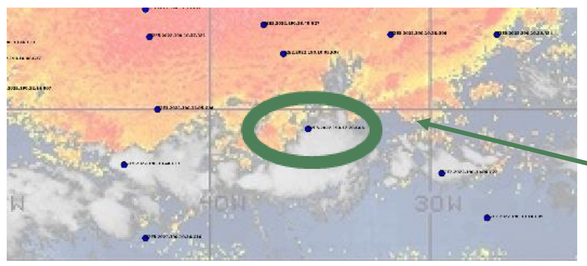

Figure 4: CIMSS SAL Multichannel IR Satellite Image overlaid with RO profiles on July 9, 2022, at 12:00 UTC

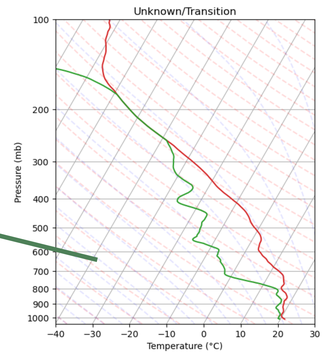

Figure 5: Skew-T Plot of a Profile in an Unknown/Transition Environment on July 9, 2022, at 12:28 UTC

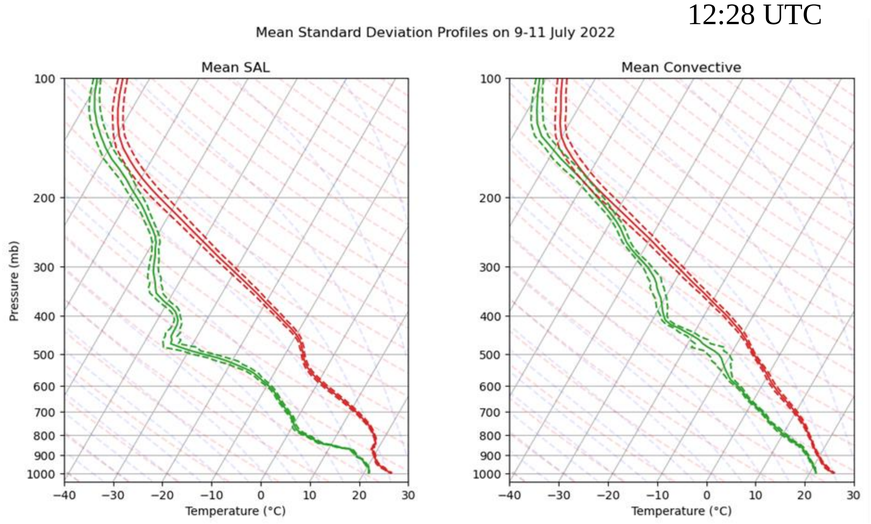

Figure 6: Skew-T Plot of 3-Day Mean (solid) and 2 Standard Deviations (dotted)

Discussion/Conclusions

- Identified transition profiles that show characteristics of both SAL and convective environments
- RO can be used to identify fine details within dry layers above and inside the SAL
- Nearly or completely saturated at 250-150 mb in most convective profiles, potentially indicative of cloud cover
- The SAL is not a clear boundary, more gradual
- Knowing more about the SAL lets us better predict storm systems and tropical cyclones in the Atlantic

Future Work

- Analyze more days, months, years to improve mean SAL and convective profile statistics
- Compare collocated radiosonde to models/reanalysis data (above 200 mb)
- Use ECMWF moisture advection products to shorten timescale
- Sample marine environments to measure surrounding dry air
- Average profile pairs according to bins of distance from SAL to convective profile

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Acknowledgements

This material is based upon work supported by the National Science Foundation under Grant No. AGS-2230301 (SOARS). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. This material is based upon work supported by National Oceanic and Atmospheric Administration Science (NOAA) Joint Polar Satellite System (JPSS) (Grant No. R4310383). Special thanks to: Hannah Huelsing, Jeremiah Sjoberg, John Braun, Michelle Harrold, Angelie Nieves-Jimenez, and Mark Irby-Gill. Email: saalegrias@tamu.edu