Middle East Health & Air Quality Utilizing NASA EOS in the Saharan and Arabian Deserts to Examine Dust Particle Size and Mineralogy of Aerosols

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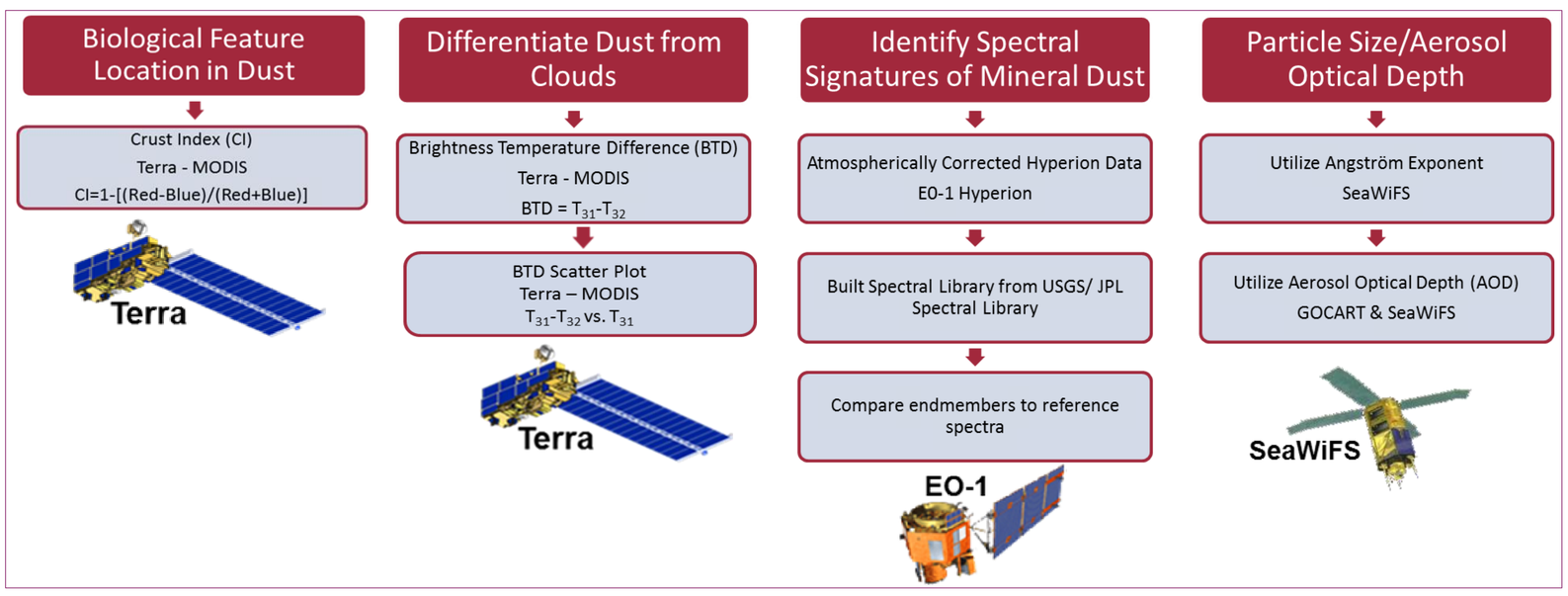
Abstract

Ground-based studies conducted in Iraq have revealed the presence of potential human pathogens in airborne dust. According to the Environmental Protection Agency (EPA), airborne particulate matter below 2.5μm (PM2.5) can cause long-term damage to the human respiratory system. NASA's Earth Observing System (EOS) can be used to determine spectral characteristics of dust particles and dust particle sizes. Comparing dust particle size from the Sahara and Arabian Deserts gives insight into the composition and atmospheric transport characteristics of dust from each desert. With the use of NASA SeaWiFS DeepBlue Aerosol, dust particle sizes were estimated using Angström Exponent. Brightness Temperature Difference (BTD) equation was used to determine the area of the dust storm. The Moderate-resolution Imaging Spectroradiometer (MODIS) on Terra satellite was utilized in calculating BTD. Mineral composition of a dust storm that occurred 17 April 2008 near Baghdad was determined using imaging spectrometer data from the JPL Spectral Library and EO-1 Hyperion data. Mineralogy of this dust storm was subsequently compared to that of a dust storm that occurred over the Bodélé Depression in the Sahara Desert on 7 June 2003.

Objectives

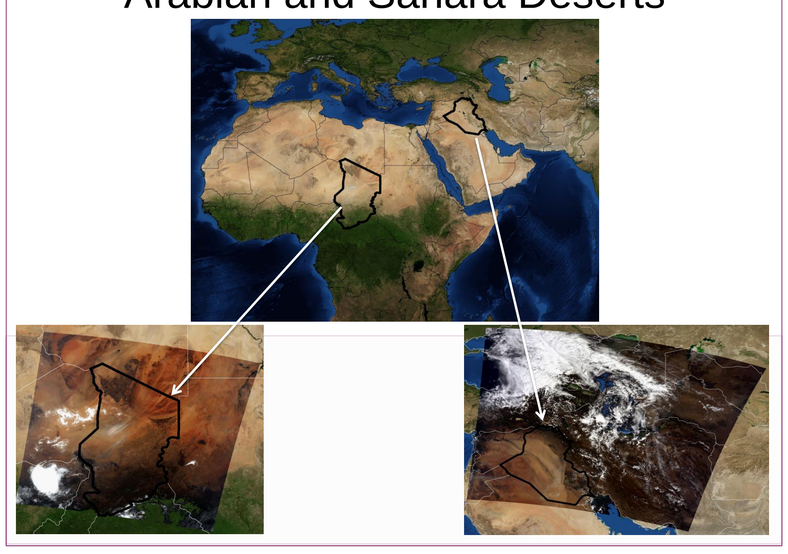
- Determine BTD and BTD vs. Band 31
- Determine Crust Index (CI)
- Determine spectral signatures of minerals present in a dust storm
- Compare particle sizes of the Arabian and Sahara deserts by way of Angström Exponent
- Determine visibility by Aerosol Optical Depth (AOD)

Methodology



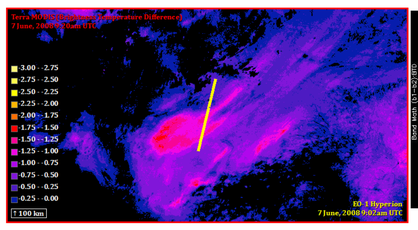
Study Area

Arabian and Sahara Deserts

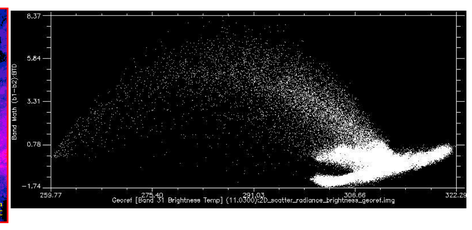


Results

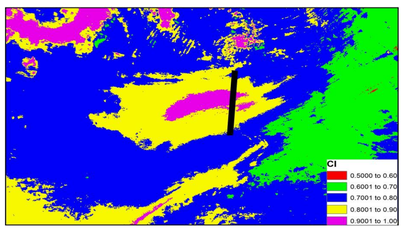
Sahara Desert - BTD



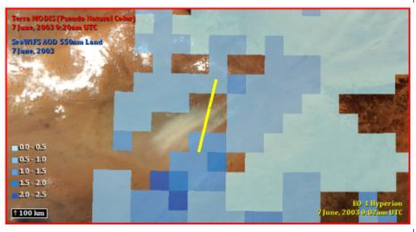
Sahara Desert - Scatter Plot



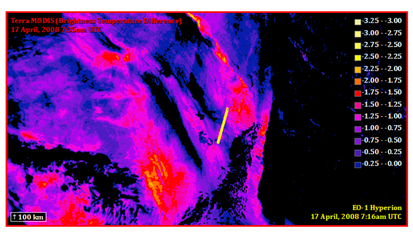
Sahara Desert – CI



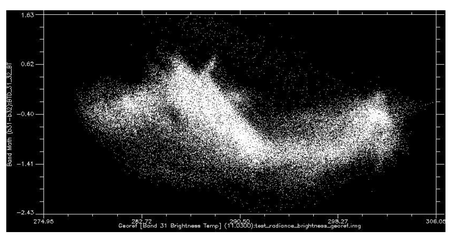
Sahara Desert - AOD



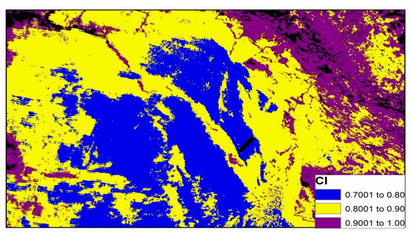
Arabian Desert - BTD



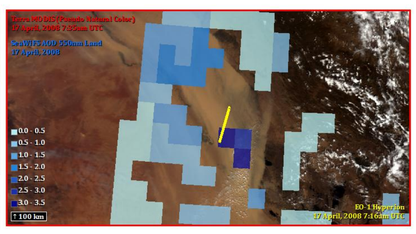
Arabian Desert – Scatter Plot



Arabian Desert - CI



Arabian Desert - AOD



Conclusions

- BTD shows lower values in portions of intense dust. The Sahara scatter plot shows higher temperatures are more associated with lower BTD values.
- The CI showed there was some biological components in the dust for each dust storm.
- Six pathogenic minerals were shown they were possibly in the dust.
- The mean particle size for Sahara is -.21 and for the Arabian Desert the mean is -.35.
- Sahara highest AOD was 2.5, indicating low visibility. Arabian Desert highest AOD was 3.5, indicating very low visibility.

Team Members

(L to R: Kirstin Cooksey, Steve Padgett Vazquez, Kevin Cowart, Tori Florence, Tiffany Keeton, Claire Herdy, Brad Barrick.)

Project Partners

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Acknowledgements

Ms. Africa Flores, University of Alabama in Huntsville

Dr. Dale Griffin, United States Geological Survey

Dr. Jeff Luvall, NASA Global Hydrology and Climate Center

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