## Why is the DEBRA product important?

The DEBRA-Dust product is useful for dust identification. It provides a simple, intuitive indication of dust with yellow colors. All other (non-dust) features are grayscale. The intensity of the yellow increases with increased algorithm confidence in dust. The product isolates dust from other elements of the complex scene, while suppressing land-surface artifacts. The 5-min imagery is mapped onto a 1 km grid over the Continental U.S. for AWIPS.
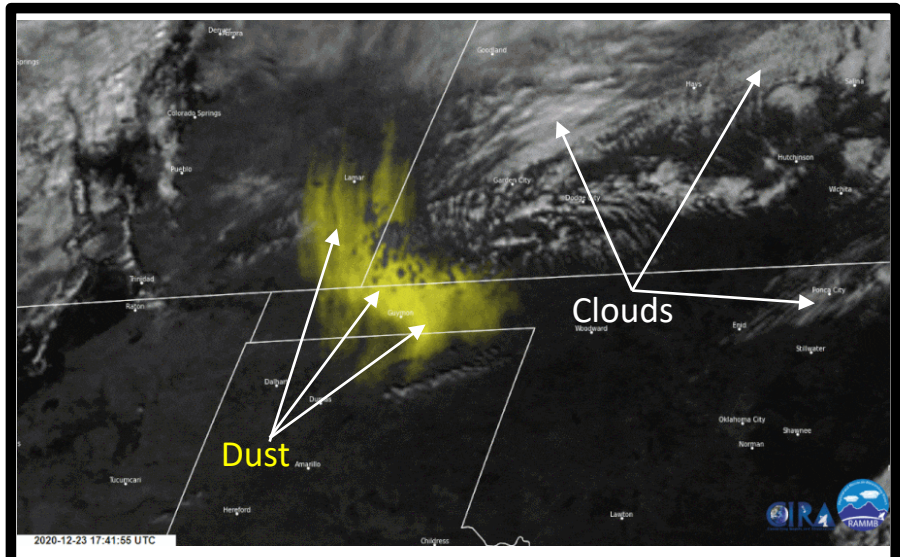
DEBRA-Dust product at 1741 UTC, 23 December 2020

How is the DEBRA-Dust product created?

Dust detection is accomplished through 2 band difference products: 12.3 minus 10.3 μm and 8.5 minus 10.3 μm.
The Dynamic Enhancement Background Reduction (DEBRA) algorithm employs a 4-step approach:

1. Application of a simple cloud mask (using ABI bands at 0.64, 1.6, 3.9 and 6.2 μm) to construct an equivalent clear sky signal for a given pixel.
2. Utilize surface emissivity information with ABI band difference product dust signals against this clear sky signal to achieve a relative difference.
3. The relative difference is used to construct a confidence factor which allows for use as a quantitative mask
4. Results presented as enhanced imagery using confidence factor to serve dual use visual analysis aid and quantitative mask.
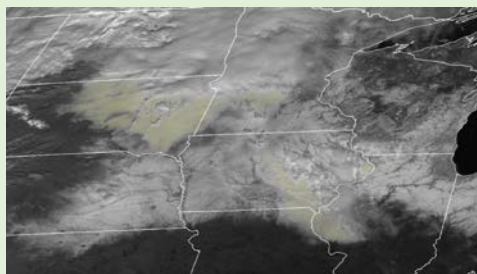
Impact on Operations

Applications:
- **Dust identification (day or night)**
  - **Reduced visibility**
  - **Dust storm warnings**
  - **Aviation hazard warnings**

False alarms possible:
- **Tends to over enhance low-cloud situations**

Limitations

- **Obscuration of dust beneath clouds**
- **Non-operational product**
- **May not capture more transparent dust**
- **Less likely to capture dust at night**
- **Dust thickness typically unknown**
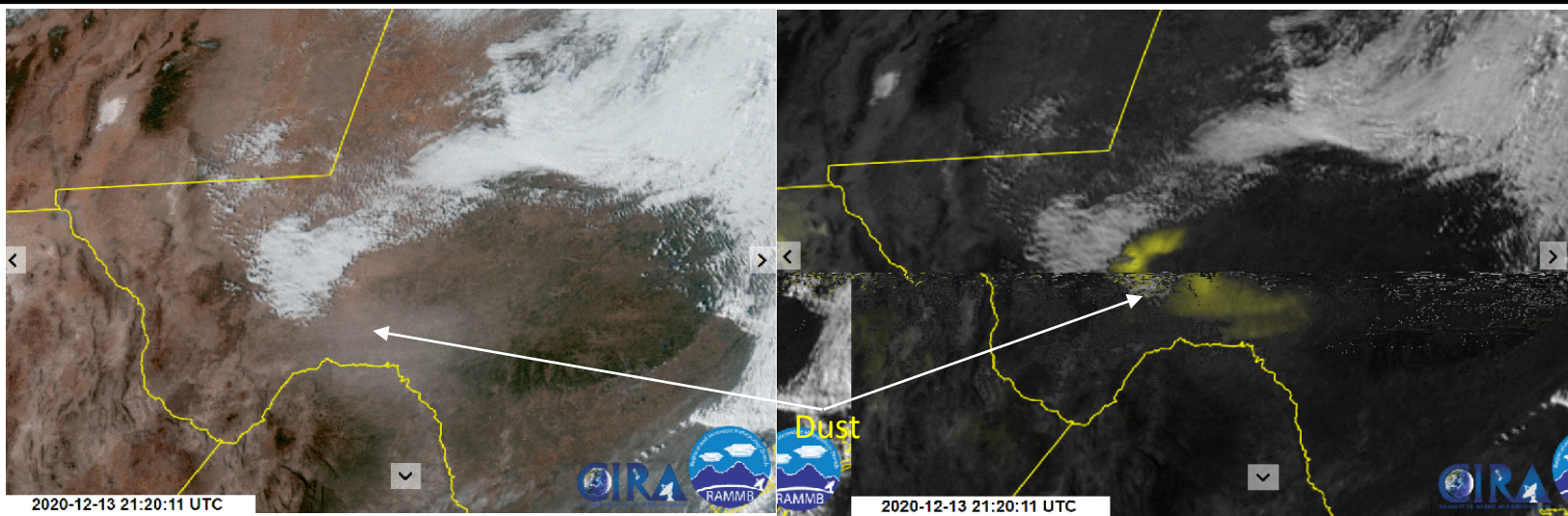
False alarms possible:
- **Land surface features at night**

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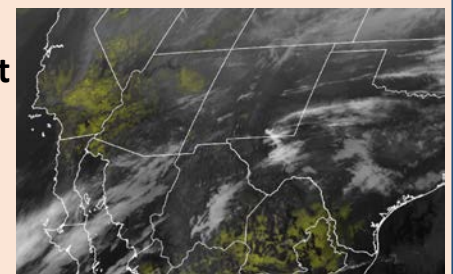
GeoColor (left) and DEBRA-Dust (right) products at 2120 UTC, 13 December 2020.

The images above show how the DEBRA-Dust product may be used in tandem with other imagery and products. This example illustrates the GOES-16 GeoColor on the left with the corresponding DEBRA-Dust product on the right. In the GeoColor image the dust is pointed out as a light brown color. The contrast is poor since the background surface color is a very similar light brown color. In the DEBRA-Dust product, the dust is colored yellow which has a large contrast with the background surface, making the dust stand out quickly.

On SLIDER, you may combine the DEBRA-Dust and GeoColor products for a more natural looking image while still being able to view the dust readily as yellow. You may need to adjust the transparency. An example of this combination is shown below at 50% transparency:
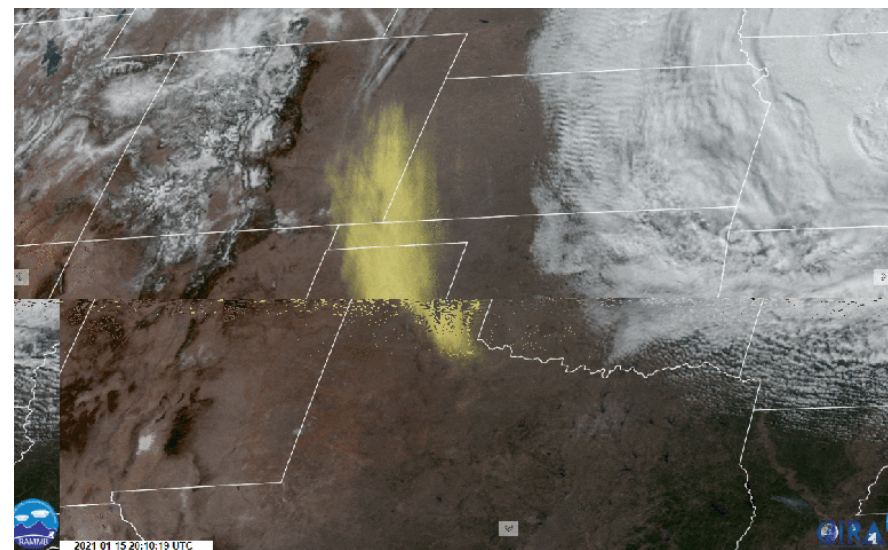
Combined DEBRA-Dust and GeoColor products at 2010 UTC, 15 January 2021.

DEBRA-Dust is a versatile technique for feature isolation in a complex scene, predicated on *a priori* knowledge about scene variability. A hybrid quantitative and qualitative application.

DEBRA-Dust is **_not_** a replacement for existing RGB products (i.e., Dust RGB) which provide broader insight on the scene constituents.

Resources

DEBRA-Dust on the Web
Use RAMMB/SLIDER for Full Disk, Full Resolution imagery:

http://rammb-slider.cira.colostate.edu

AWIPS
Available upon request from CIRA

Hyperlinks not available when viewing material in AIR Tool

Miller, S.D., Bankert, R.L., Solbrig, J.E., Forsythe, J.M., Noh, Y.-J., and L.D. Grasso, 2017: A Dynamic Enhancement With Background Reduction Algorithm: Overview and Application to Satellite-Based Dust Storm Detection. *Journal of Geophysical Research: Atmospheres*, **122**, 12,938–12,959. https://doi.org/10.1002/2017JD027365