Jobsheet

GOES Sounder-Based Red-Green-Blue (RGB) Airmass Product

Objectives:

1. Develop a basic understanding of how the product is developed and what differences it highlights.
2. Understand some of the shortcomings of the current products related to its construction.
3. Develop a feeling of how to interpret the temporal evolution of features displayed in this product through the use of a pre-assembled case study on 24 May 2011.

Product Overview:

The product was developed using RGB recipes developed at EUMETSAT and is designed, as its name implies, to highlight differences between different atmospheric air masses. The GOES-Sounder is used as a proxy for the Advanced Baseline Imager (ABI) that will be available from GOES-R, and the resulting products will have much greater spatial and temporal resolutions. Despite the very limited resolution of this GOES-Sounder product, it still provides enough resolution to accomplish its primary task of air mass discrimination.

Jobsheet Overview:

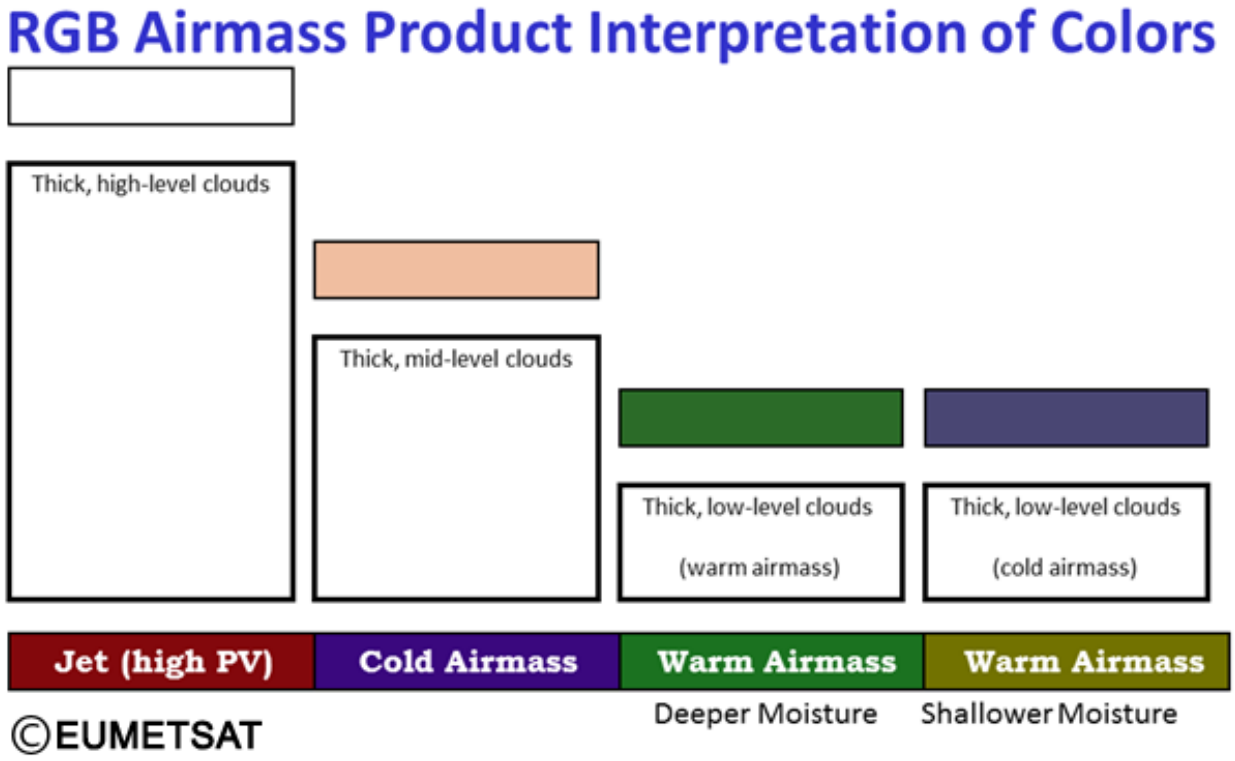
This jobsheet contains a sequential set of procedures that you will follow to view and observe RGB Airmass output in the AWIPS environment. In addition, you will answer 2 questions along the way. Answers to these questions will be provided in the answer key document.

Objective #1: Develop a basic understanding of how the product is developed and what differences it highlights.

The RGB Airmass Product is assembled from four sounder channels. These are channels 8, 9, 10, 12 that have central wavelengths located at 11.03μm, 9.71μm, 7.43μm, and 6.51μm, respectively. More importantly these are related to the atmospheric infrared window where in the absence of clouds the surface is typically sensed, the wing of the ozone absorption band, a weak water vapor band and a strong water vapor band, respectively. The difference between the two water vapor channels (i.e. 12 minus 10) is assigned red colors, the difference between the ozone channel and IR window (i.e., 9 minus 8) is assigned green colors, and the strong water vapor band is assigned blue colors. The three components are stretched to cover the entire color spectrum as shown below.

RED (R)	GREEN (G)	BLUE (B)
WV6.51 - WV7.43 (-25 to 0 K)	IR9.71 - IR11.03 (-40 to +5 K)	WV6.51 (243 to 208 K)

The result of this recipe is a product that can discriminate moist, cold and high PV air masses. The following graphic was developed by EUMETSAT to describe how this product's colors provide air mass information:



WES Case Instructions

1. If AWIPS D2D is not currently open, double-click on the Launch AWIPS D2D icon to start up an AWIPS D2D session.

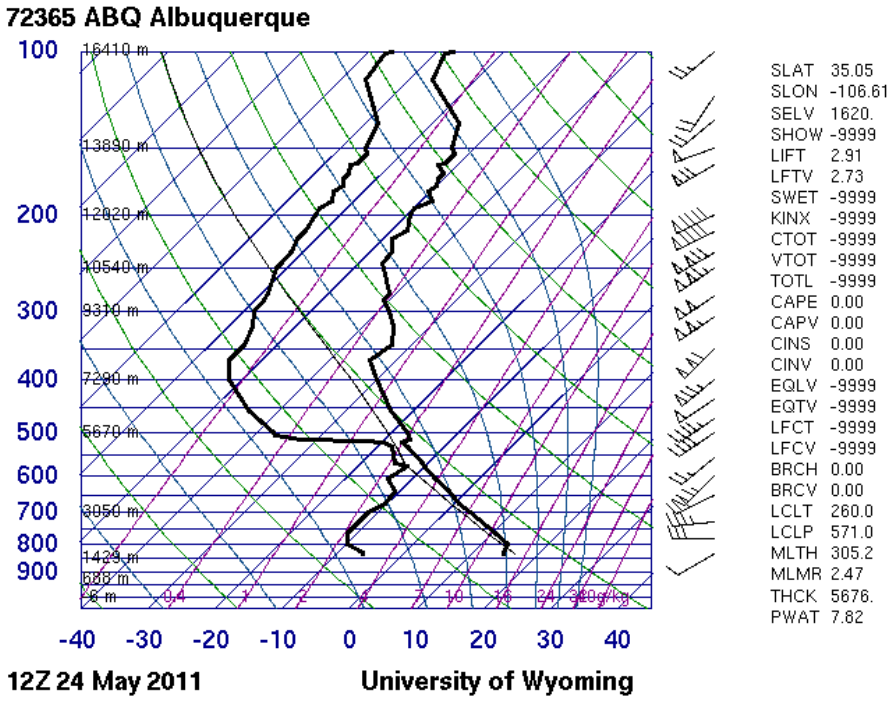
2. Ensure the map scale is set to CONUS.

3. Left click on the D2D clock in the lower-right corner of D2D.

4. Inside the "Set Time" window, set the D2D clock to **2011 May 24 12:05** UTC (don't bother changing the seconds) and check the "Freeze Time at This Position" box.

5. Load the RGB Airmass Product by clicking on the **Satellite → CIRA/SPORT GOES Sounder → GOES Sndr RGB Air Mass**.

   At 1200 UTC, high potential vorticity (PV) associated with the jet is easily seen extending from roughly Seattle to Phoenix with some evidence of higher PV air wrapping around the short wave trough into northwestern New Mexico. This can be confirmed by overlaying the 300-hPa wind field from the model analysis (unavailable in this case) or the 12 UTC sounding data above 500 hPa, as shown in the graphic below.



At this same time the cooler air masses are located north of the previously described jet and from eastern Colorado toward Ohio. A cooler air mass is also located over the southeast US. There is also evidence of a tongue of moist air extending from the Gulf of Mexico through Louisiana and up to Missouri. Clouds show up as white features with a large MCS located between Kansas and Nebraska and some evidence of a drier mesoscale environment extending to the South and Southeast of the MCS.

6. Clear out the D2D pane, using the 'Clear' button underneath the D2D menu bar.

7. Left click on the D2D clock in the lower-right corner of D2D.

8. Inside the "Set Time" window, set the D2D clock to **2011 May 25 00:05 UTC** (don't bother changing the seconds) and check the "Freeze Time at This Position" box.

9. Load the RGB Airmass Product by clicking on the **Satellite → CIRA/SPORT GOES Sounder → GOES Sndr RGB Air Mass**.

10. Set the frame count to **24** and let the product loop on the D2D screen.

Question 1: Where does the product show diurnal variations?

Question 2: What components or channels do you think are responsible for the diurnal variations?

Objective #2: Understand some of the shortcomings of the current products related to its construction.

WES Case Instructions

1. If AWIPS D2D is not currently open, double-click on the Launch AWIPS D2D icon to start up an AWIPS D2D session.

2. Left click on the D2D clock in the lower-right corner of D2D.

3. Inside the "Set Time" window, set the D2D clock to **2011 May 24 12:05** UTC (don't bother changing the seconds) and check the "Freeze Time at This Position" box.

4. Load the RGB Airmass Product by clicking on the **Satellite → CIRA/SPORT GOES Sounder → GOES Sndr RGB Air Mass** and examine the first image.

   The sounder RGB Airmass Product is constructed by combining the GOES-East and GOES-West sounder sectors, which start at times (H-1):46 and H:01, where H is any hour. By combining the two different view angles we introduce some shortcomings to the product. Both resolution and limb darkening/brightening are related to the viewing angle. As a result the product typically will have lower resolution in a line (the stitching line) extending just near El Paso to near Winnipeg, with the least resolution in central Canada where GOES-West if viewing things at the steepest angle.

   IR and water vapor channels are also affected by limb darkening and the ozone channel is affected by limb brightening. As a result, the product will typically have a more purplish color the closer the point is to the stitching line.

   While not a short coming per say, the diurnal variations caused by strong surface heating should be pointed out. These are manifested in both the water vapor difference (red) and IR differences (green) and are exacerbated by dry elevated terrain. This can be demonstrated by following the steps below:

11. Clear out the D2D pane, using the 'Clear' button underneath the D2D menu bar.

12. Left click on the D2D clock in the lower-right corner of D2D.

13. Inside the "Set Time" window, set the D2D clock to **2011 May 25 23:05 UTC** (don't bother changing the seconds) and check the "Freeze Time at This Position" box.

14. Load the RGB Airmass Product by clicking on the **Satellite → CIRA/SPORT GOES Sounder → GOES Sndr RGB Air Mass**.

15. Set the frame count to **13** and let the product loop on the D2D screen. Concentrate on the pattern over the southwestern US, particularly in West Texas and New Mexico.

Objective #3: Develop a feeling of how to interpret the temporal evolution of features displayed in this product through the use of a pre-assembled case study on 24 May 2011.

WES Case Instructions

1. If AWIPS D2D is not currently open, double-click on the Launch AWIPS D2D icon to start up an AWIPS D2D session.

2. Left click on the D2D clock in the lower-right corner of D2D.

3. Inside the "Set Time" window, set the D2D clock to **2011 May 26 0:05** UTC (don't bother changing the seconds) and check the "Freeze Time at This Position" box.

4. The product combinations for this jobsheet are located in an AWIPS procedure folder called **RGB_Airmass**. This can accessed from the D2D menu by selecting **File → Procedures → Open…**, selecting **RGB-Airmass** from the list, and clicking on the OK button. This will open up a new window called **Procedure – RGB_Airmass**

5. Select **Sounder+Model** from the procedure window and click on the **Load** button to open the products into D2D. This will load RGB Airmass, METAR observations, RUC13 300mb wind, and RUC13 700mb relative humidity. Left-clicking on an individual product name in the legend will hide/unhide the product. While this will show all products from 0100 UTC on 24 May to 0000 UTC on 26 May, focus your observation window to 1500 UTC on 24 May to 0000 UTC on 25 May.

   Looking only at the METAR observations with the RGB Airmass Product, notice how the sharp color gradients in the RGB Airmass Product compare with the surface observations. This is particularly evident in the development and intensification of the west Texas dryline.

   Looking only at the 300mb wind with the RGB Airmass Product, notice how the high PV air indicated by the reddish areas corresponds to the location of the polar jet. Also notice how the tendency in red, accounting for the diurnal variations, corresponds well to where you may expect tropopause folding.

   Looking only at the 700mb relative humidity and the RGB Airmass Product, notice how the greener regions on the RGB Airmass Product seem to be associated with greater

moisture and as the greens take on a more red tones the 700 hPa relative humidity is generally lower.

6. Loop the D2D display through the entire data window (up to 0000 UTC on 26 May).

Observe how the product depicts extra-tropical cyclone intensification and how as the cyclone occludes there are almost concentric rings of cooler (blue) air masses and warm high PV air masses (red).