

## **Talking Points – Atmospheric River Module**

(if none are listed then all the information is on the slide)

**Slide 1: Title**

**Slide 2: Learning Objectives .**

**Slide 3: What is an Atmospheric River?**

**Slide 4: Diagnosing an Atmospheric River now**

**Slide 5: Atmospheric River example using CIRA TPW**

Note that this was a significant precipitation event along the West Coast. Images are shown at 6-h intervals to get a longer loop.

**Slide 6: Diagnosing an Atmospheric River in the GOES-R era**

**Slide 7: The LAP TPW product**

Things to note:

- 1) Unlike the NOAA/NESDID Blended TPW product, this product CANNOT see through clouds (hence the cloud mask). The retrievals that ARE made in “cloudy” areas are generally in areas of thin cirrus.
- 2) So this product combines satellite derived PW with model (GFS) analyzed PW

**Slide 8: Example of the LAP algorithm product as it would appear on AWIPS**

This is how the LAP TPW product will appear on AWIPS using the "rainbow" color table.

**Slide 9: Loop of the LAP product for our case.**

Note of course that this is NOT from AWIPS.

This is LAP TPW over the tropical to subtropical mid Pacific Ocean using Himawari to create the product.

Loop goes from 00z/11 Feb to 18z/12 Feb at 6-hour intervals (Note that in the GOES-R era this product would be available at high frequency)

**Slide 10: Same loop with features annotated**

- 1) The thin plume of higher PW extending from sw to ne is associated with an advancing trough and its associated cold front (low is way off to the NE). Note the very dry air behind this frontal zone.

- 2) Our developing AR is marked by the northward advancing plume of higher PW air from the south (in the blue oval).
- 3) There is a dry slot of air between these two features, but over time the moisture from the south gets drawn up into the eastward advancing frontal zone and when this moves onto the West Coast this is when the heavy precipitation hits.
- 4) Next we will see how these features look with the 3 WV channels

**Slide 11: Loop of WV imagery for Himawari band 9, at 6.94 microns)**

This channel is closest to what we now have in GOES. Recall from the GOES-R Water Vapor module that the weighting function for this channel generally lies between ~400 to 600 mb, slightly lower than what we now have on GOES, so a little lower than the current GOES water vapor channel.

The loop shown here (and in the next two slides) covers the same time period as the LAP TPW loop just shown, with an image every 6 hours, and also covers the same area of the Pacific Ocean.

What do we see in this loop? The most obvious feature is the plume of moisture that moves at first northwards and then off the northeast, corresponding to the high TPW plume that we saw in the LAP imagery. On the other hand, the zone of drier air between this feature and the frontal zone does not stand out very well in this channel of the WV imagery. We also do not readily see the moisture associated with the frontal zone itself except off to the northeast portion of the image towards the end of the loop.

**Slide 12: Loop of WV imagery for Himawari band 8, at 7.35 microns)**

This channel senses the lowest in the atmosphere, with a relatively broad weighting function that peaks near 700 mb. Initially there is very dry air shown by the warm brightness temperatures extending from west to east across the domain. Over the course of the loop this area of dry air decreases as the frontal zone pushes south and east and our plume of moisture associated with the developing AR moves initially to the northwest and then in a narrower plume to the northeast ahead of the frontal zone. The moisture associated with the frontal zone itself shows up better in this low level water vapor imagery, though it is still not as obvious as the AR plume.

**Slide 13: Loop of WV imagery for Himawari band 10, at 6.2 microns)**

Lastly, we have the high level water vapor channel, with a weighting function that peaks generally in the 300-400 mb level, somewhat higher than the current GOES water vapor channel.

We note a plume of colder brightness temperatures extending off to the northeast with time, coincident with our AR moisture plume reaching to higher levels. Since

we see the plume of moisture in all 3 WV channels we can imply that it extends through a deep layer of the atmosphere (though we cannot tell how much TPW is present from this imagery).

**Slide 14: 4-panel loop of WV imagery for Himawari for all 3 bands, plus the IR band at 10.41 microns**

One could look at all 3 WV channels at the same time using the 4-panel capability on AWIPS2. In this loop, again covering the same time period as in the loops shown previously, we have placed an IR image in the lower right panel.

Here we see the value of the water vapor imagery to diagnose our developing AR – we certainly do not get the sense of northward moisture transport from the tropics from the IR imagery alone.

Another point to note with the IR imagery is that the clouds associated with the frontal zone have fairly warm brightness temperatures, indicating that at this point only shallow convection is found with the cold front. This explains why we could not see the frontal moisture in the mid and high level water vapor bands.

**Slide 15: 4-panel of WV imagery for Himawari for all 3 bands, plus the IR band at 10.41 microns, for 00z/12 Feb only**

Now let's look at one time only, 00z on 12 Feb; about midway through the loops we just examined. Certainly from IR imagery alone we would not have much of an indication of our moisture plume moving out of the tropics. We do however see the band of cloudiness along the cold front extending from sw-ne, with a large field of cumuliform cloudiness or cellular convection behind the front in the colder, unstable air. Note that the lower level WV imagery also depicts some of this cloudiness (for example just to the right of the color table bar). The fact that this channel sees lower into the atmosphere and has higher resolution than the current GOES WV channel allows us to see these types of features.

**Slide 15: 4-panel of WV imagery for Himawari for all 3 bands, plus the visible band at 0.64 microns, for 00z/12 Feb only**

Now let's look at one time only, 00z on 12 Feb; about midway through the loops we just examined, but this time we have put a visible image in the lower right panel. The visible image nicely depicts the frontal zone and the cellular convection behind it, but not much about our developing Atmospheric River.

In terms of our developing AR plume, the more westward bulging of the tropical moisture is most clearly seen in the lower level water vapor imagery, with a fairly sharp edge marked by the light green arrows. The yellow arrow in each of the WV images marks the plume of moisture with our developing AR that is extending off to the northeast. Note how it is bringing moisture northwards into what otherwise is a

very dry atmosphere, as noted by the warmer brightness temperatures in all 3 WV images to the east of the yellow arrow.

**Slide 17: Summary**

In summary, the new water vapor channels and LAP TPW product will aid in identifying Atmospheric Rivers in the GOES-R era.