

Talking points for marine and polar mesolows

1. Title
2. Learning objective
3. Introduction
4. As proxy data for GOES-R, we'll be making use of imagery from the Himawari satellite. We'll start with the familiar visible imagery at 0.64 microns looking north of Japan in the northwest Pacific. For the development of mesolows, the first thing you should look for are indications of cold air advecting over relatively warm water. We see clear indications of that off the Kamchatka peninsula and other regions as well (point east of Kamchatka and north of Japan). Since we have verified that we have significant cold air advection over relatively warm water, we can conclude that the 2 conspicuous circulations over the water are mesolows which have developed due to latent and sensible heat fluxes from the relatively warm sea surface. Since wind observations are typically sparse over water (outside of perhaps scatterometer winds from a polar orbiting satellite), remember to use cloud relative motion as depicted in the visible imagery. Note the fast moving clouds on the mesolow further south, particularly south and west of the center of circulation. In the same mesolow, also note the deeper convective clouds on the north and west flank of the circulation, indicating where localized heavy precipitation exists.
5. We move on to the 0.86 micron band, sometimes referred to as the veggie band. This band shows greater contrast between land and water, therefore coastlines become less ambiguous and small islands are much easier to see. This band can be useful for ice cover as we see portions of the scene have ice cover, this would act to reduce or eliminate latent and sensible heat fluxes which would tend to weaken or dissipate any mesolow that moves across ice cover.
6. Next we look at the 1.6 micron band. This band is useful for delineating clouds from ice or snow cover. Snow and ice surfaces are strongly absorbing at this wavelength so the reflectance is low (thus darker in this color table), however cloud reflectance is high, this contrast helps delineate clouds from snow or ice cover.
7. Now we look at the familiar 10.4 micron IR imagery. The mesolow typically consists of low-level clouds and perhaps some colder clouds associated with convective cloud tops. Identification of convective cloud tops with this channel may help identify where the heavier precipitation exists.
8. This is the low level water vapor band at 7.3 microns. Of the 3 water vapor bands, this will be the most useful since its weighting function peaks lowest in altitude. Note that the 2 mesolows still appear in this channel, although not as readily as the IR band at 10.4 microns or visible imagery.
9. We move on to a different case, same geographic region but now we're looking about a month later than the previous event. We're later in the winter, therefore ice cover is more widespread. Note the widespread cumulus lines indicative of cold advection over relatively warm water. Snowfall is likely occurring in many of these bands, particularly the more pronounced bands. Cloud motion near the center of the mesolow is quite conspicuous, meaning that wind speeds

are likely strong. Note the convective band on the west and southern flank of the mesolow, this would likely be an area of heavy localized snowfall. Notice the much smaller scale mesolows north of Japan (point out both of them). Anticipating their landfall would be important as it brings in a period of heavy snow and strong winds. Finally, notice that the extensive ice cover field is quite reflective, meaning it has a similar look to the clouds (except the clouds move of course). Focus in on this region (shadow highlight east of Sakhalin island), can you discriminate between clouds and ice cover?

10. Over the same region of interest I just highlighted, it's now much easier to discriminate between clouds and ice cover by using the 1.6 micron imagery. For analyzing the cloud field, it's useful to look at the 1.6 micron imagery since clouds remain highly reflective, yet ice cover does not therefore this band delineates clouds from ice or snow on the ground quite nicely. This is useful application when attempting to identify cloud streamers over an ice field of unknown fractional coverage. The existence of cloud streamers indicate there is sufficient open water for significant sensible and latent heat fluxes. These fluxes may either result directly in precipitating convection, or, may build the boundary layer depth and contribute enough heat and moisture to more readily develop precipitating convective clouds farther downstream or even interacting with a mesolow.
11. We move on to the IR band at 10.4 microns. Note the colder convective cloud tops south of the circulation. It would've been difficult to discern this from the visible bands alone since the background consists of low-level cumulus lines making it all blend in. However in this channel the colder cloud tops show up clearly.
12. Time for an Interactive exercise. This is a 4 panel loop of the mesolow event we were just looking at. Here we have 3 water vapor bands and 1 visible bands, which band are we looking at in each panel?
13. Now we discuss our question from the previous slide. When looking at the 3 water vapor bands, keep in mind the weighting function profile as well as the expected level for the feature of interest. In this case, the mesolow and associated low-level clouds are the feature of interest. We would expect the upper level water vapor band to not show the mesolow or associated low clouds, the mid level water vapor band would only show it in a subtle way, and it would show up the best in the low level water vapor band. The lower left panel must be the upper level water vapor band at 6.2 microns since the mesolow does not show up. The mesolow shows up best in the upper right panel so that is the low level water vapor band at 7.3 microns, leaving us with the mid level water vapor band at 7.0 microns in the upper left panel. The only question in the lower right panel is which visible band are we looking at? Recall there was an extensive region of ice cover north and northwest of the mesolow, ice cover would be bright in the 0.64 or 0.86 micron band, while in the 1.6 micron band it would be much less bright due to higher absorption at this wavelength and thus less reflective so in this case we're looking at the 1.6 micron band, which I also showed earlier to point out cloud versus ice or snow cover delineation.
14. GOES-R aids in mesolow identification because of its greater spatial and temporal resolution compared to current GOES. The IR and visible bands will continue to play a prominent role in mesolow identification, however there will be new visible bands on GOES-R that aid in mesolow identification. This includes the 0.86 micron veggie band which increases contrast between

water and land, better identifying coastlines and islands. Also, the 1.6 micron band can easily discriminate between clouds and snow or ice cover, this is particularly important for mesoscale identification against a typical winter background and cloud streamers over ice fields of unknown fractional coverage. Finally, be sure to make use of the 4 panel display to display multiple satellite bands in tandem for the most complete diagnosis, similar to multiple fields of dual-pol radar display.