

Jobsheet

WRF Simulated GOES-R IR/WV Products

ANSWER KEY

Question 1: In the 6.95 μm (water vapor) synthetic imagery, identify any upper-level jet streaks in the west between 1200-1800 UTC that may impact the forecast region. Do the brightness temperatures appear warmer or colder than GOES water vapor imagery?

The dark region of warmer brightness temperatures roughly corresponds to an upper-level jet over southern Arizona and New Mexico moving towards Texas in the 1200-1800 UTC time period. The GOES-R 6.95 μm synthetic imagery brightness temperatures are warmer (in clear skies) than the GOES (6.5 μm) water vapor imagery. This is primarily because the weighting function for the longer wavelength band peaks lower (and therefore warmer) in the atmosphere.

Question 2: Compare the upper-level jet streak between the synthetic and the GOES water vapor imagery between 1200-1800 UTC. Are there any apparent differences in terms of location and timing of the jet-streak?

The jet streak in the synthetic water vapor imagery appears slightly further east (faster) compared to GOES water vapor imagery.

Question 3: Compare the MCS in north central Kansas between the synthetic IR imagery and the GOES IR imagery. Identify any differences in location and/or timing and what the future impact might be from the associated outflow boundary.

MCS location is slightly further north, but it's there and does a decent job of representing it. The areal extent of the anvil cirrus in the synthetic imagery is considerably less than GOES, this is a known bias. Given the occurrence of an MCS, an important question would be where the MCS outflow boundary will setup by the afternoon? This should focus your attention on GOES imagery for later, where you would expect to be tracking an outflow boundary. It is difficult

to identify in the synthetic imagery since there is forecast low-level clouds where the outflow boundary would exist.

Question 4: Compare the synthetic IR imagery with the GOES IR imagery to assess the coverage of low-level clouds across Kansas and Oklahoma. What differences exist?

The synthetic imagery depicts clearing ahead of the dryline in the warm sector in Oklahoma with extensive low-level clouds across much of Kansas. By 1600 UTC, low-level clouds in Kansas are a little too far south. The clearing pattern in western Oklahoma is well represented.

Question 5: Assess the cloud coverage across Kansas by comparing the synthetic IR imagery with the GOES IR and visible imagery. What can we conclude about the model CAPE forecast in Kansas?

Between 1700-1900 UTC we see considerable clearing in Kansas in the GOES IR and visible, whereas the model (synthetic imagery) kept low-level clouds there longer. Because of this, model forecast CAPE values in this region are likely underdone.

Question 6: Inspect the synthetic IR imagery over Oklahoma. Compare it with the GOES IR and visible imagery. What can we conclude regarding the position of the dryline? What can we conclude about the timing of convective initiation?

By 1800 UTC, the forecast dryline position (delineated by the boundary between warmer brightness temperatures in the hot/dry airmass and the cooler brightness temperatures in the warm/moist airmass) is slightly further east than observed. The model forecasts clear skies in the warm sector ahead of the dryline in Oklahoma. On GOES IR imagery, the colder brightness temperatures in southwest Oklahoma suggest extensive cloud cover there, with clearing skies to the north in northwest Oklahoma. However, inspection of GOES visible imagery shows partly cloudy skies in southwest Oklahoma with clearing skies in northwest Oklahoma. This illustrates why GOES visible (with its higher resolution compared to IR) should be utilized to verify observed trends versus the synthetic imagery forecast. The model has no real signs of towering

cumulus at this time, whereas the GOES visible imagery showed towering cumulus. This suggests the model may be too slow for convective initiation and too far east. This may be correlated with question 2 regarding the jet streak appearing further east in the model compared to GOES which would also support the convection being too far east.

Question 7: Comparing the products, are there any differences in the timing/spatial extent of model output versus the observed GOES products? If so, can you identify any contributing factors to this?

The model retained low-level clouds across much of central Kansas for too long. GOES IR and visible imagery showed this area cleared out much earlier than forecast, so that there was likely considerably more CAPE observed compared to the model forecast. This larger area of clearing allowed for earlier and ultimately more widespread convection along the boundary.