

Forecast Models are not perfect. Always remember to check the time the map was issued/produced and when it is valid. Check the legend for values and units.

This guide is designed for students who may be producing a forecast for the first time or are unfamiliar with the products on the ISU WxChallenge page.

Any questions, corrections, or suggestions can be directed to ajsorge@gmail.com

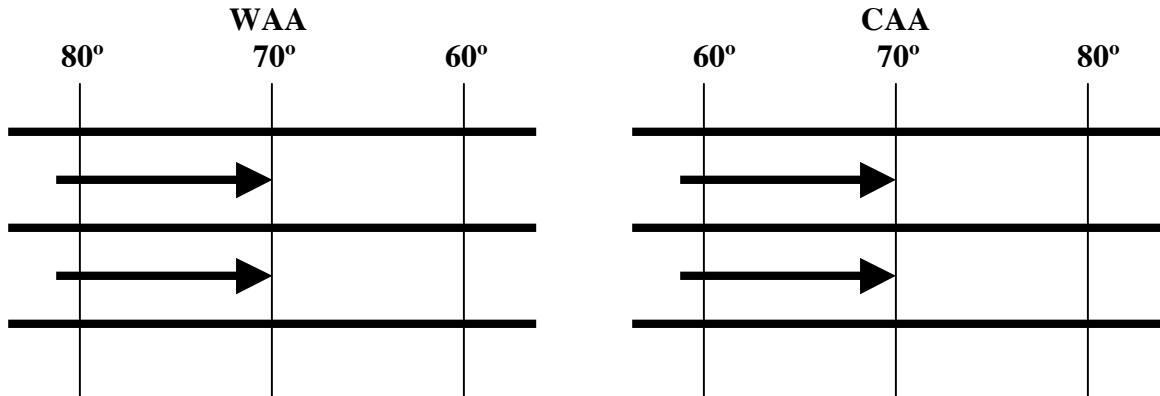
Model Guidance

MOS Guidance: Model Output Statistics (MOS) are forecasts for specific points that provide a wide range of variable from temperatures to visibility. Using MOS with your growing understanding and knowledge of the atmosphere can produce a quality forecast. If you are unfamiliar with MOS, this can help you understand all the acronyms.
<http://weather.cod.edu/notes/fous.html>

12Z WRF/NAM Images/Loop, 18Z WRF/NAM Images/Loop: 12Z (7AM CDT or 6AM CST) and 18Z (1PM CDT or 12PM CST) NAM/WRF (North American Mesoscale/Weather Research and Forecasting model) is a high-resolution model. This means that it can pick up on more details than a global model.

- **200mb/300mb Wind:** These levels are excellent for getting an idea of where the jet stream is located. This can give you an idea of where major weather systems will track. During warmer months, 200mb is used and in colder months 300mb is used to find the jet stream.
- **500mb Vorticity:** Vorticity in its simplest, non-mathematical form is a spin in the atmosphere. An X marks where there is a maximum cyclonic (counter-clockwise) vorticity and an N marks where there is a maximum of anticyclonic (clockwise) vorticity.
- **700mb RH (Relative Humidity):** This map can give you an idea of where there will be clouds and/or precipitation. In general, RH above 70% means there will be cloud cover, 80% clouds with rain possible, and 90% means rain is likely.

- **850mb Temperature:** 850mb can provide an idea where you have temperature advections. Warm air advection (WAA) is found where winds cross isotherms (lines of equal temperature) and advect warmer air into a region of cooler air. In the same manner, cold air advection (CAA) is found where winds cross isotherms and advect colder air into a region where there is warmer air. See illustrations below and remember some places (i.e. mountains, Denver, CO) that 850mb is actually below ground (850 ≈ 1500m).



- **Total Precipitation in 6, 12, 24, 36, 48, or 60hrs:** These maps can give a forecaster an idea of how much precipitation will fall in a given time period.
- **850mb Temp/MSLP, 6 hr Precip:** This composite map provides the forecaster with an idea of what type of precipitation will fall along with the surface features (fronts, low and high pressure). Temperatures below 0°C at 850mb can mean that snow will fall at the surface (there are exceptions such as warm air near the ground that may change the snow).
- **Simulated Reflectivity:** This is the model trying to do its best to simulate what the radar will look like at a certain time. So far, it does okay with the types of storms, but position and movement have not verified well in the past.
- **MSLP 850-700mb:** Thickness in the mid-levels of the atmosphere.
- **MSLP 1000-850mb:** Thickness in the lower level also known as the planetary boundary layer.
- **MSLP 1000-500mb:** Thickness in the 1000-500mb layer. The 540 line is a good rule of thumb for when you may expect snow. (i.e. if the 540 line is over or south of Ames, snow is possible). The caveat is that in transition between fall to winter and winter to spring this rule may not hold true because of warm mid or lower levels.
- **Total Precipitation of Period:** Select a forecast hour and you will see a map of forecast precipitation totals. Make sure to check the color key.

12Z GFS Images/Loop, 18Z GFS Images/Loop: 12Z or 18Z images and loops from GFS model. The GFS (Global Forecast Systems) is a global model that produces forecasts out to 16 days.

- **Surface Graphics**

- **10m Wind/6 hour Precipitation:** Provides the forecaster with an idea of winds at 10m/40ft above the ground as well as precipitation.
- **850mb Temp/MSLP/6 hr Precip:** This composite map provides the forecaster with an idea of what type of precipitation will fall along with the surface features (fronts, low and high pressure). Temperatures below 0°C at 850mb can mean that snow will fall at the surface (there are exceptions such as warm air near the ground that may change the snow).
- **Total Precipitation in 6, 12, 24, 36, 48, 60 or for the Period:** Similar to the NAM/WRF, gives you the total amount of precipitation over your chosen time period. Again, look at the color legend.

- **Upper Air Graphics**

- **MSLP 850-700mb:** Thickness in the mid-levels of the atmosphere.
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of equal temperature) and advect warmer air into a region of cooler air. In the same manner, cold air advection (CAA) is found where winds cross isotherms and advect colder air into a region where there is warmer air. See illustrations below.

- **850mb Vorticity:** Similar to 500mb vorticity, but now showing areas of cyclonic and anticyclonic vorticity near the top of the boundary layer.

NCEP Model Output for WxChallenge: A site I've never used before, but turns out to have quite a few cool tools, similar to BUFKIT. I won't cover every variable as I did for the NAM/GFS.

- **Time-Height Cross Sections:** These are similar to BUFKIT cross sections, although you can't overlay layers. (i.e. Omega (upward motion) and Potential Temperature can provide an idea of where banded snow may occur). Provides a 2-d slice of the atmosphere, which can be useful for determining precipitation type among other things.
- **Near Surface Time Series:** Nice plots of the temperature/dewpoint trend as well as whether any precipitation and what type of precipitation may occur.
- **Convective Time Series:**
 - **CAPE (Convective Available Potential Energy) and CIN (Convective InHibition)** provide an idea of if and when you may have precipitation. High values of CAPE means there is a lot of energy for the atmosphere to tap into. However, high values of CIN, which can inhibit precipitation, may not allow precipitation to form.
 - **LI (Lifted Index) and K Index:** These are two severe weather parameters. Basically, the more negative the value, the better the chance of severe storms.
 - **PWAT (Precipitable WATER):** The amount of moisture/water in a column of atmosphere. This can provide guidance on how much precipitation may fall.
- **Model Comparison**
 - **Temperature Comparison:** Model comparison of temperatures are plotted so that you can easily pick out outliers. It is a bit messy though.
 - **Precipitation Comparison:** Model comparison of precipitation are plotted in bar graph form.

National Weather Service Products

NWS Area Forecast Discussion: Allows you to understand what the NWS forecasters are thinking will happen along with how confident they are in their forecasts. There tends to be lots of acronyms and jargon, but I have found this site helpful.

<http://www.weather.gov/glossary/glossary.php>

NWS Point Forecast Matrix: Similar to MOS, this is the NWS' way of displaying their forecast. There are less acronyms so it is a bit more user friendly for those who don't speak/talk MOS.

Daily Climate Summary: If the weather is pretty bland, a persistence forecast can be a good way to go. Climate data will give you an idea of what the typical temperatures are for the city, but be careful with persistence forecasting.

HPC Quantitive Precipitation Forecast: A graphical view of forecasted precipitation amounts for the entire US.

Upper Air Charts Analysis

These maps are from various mandatory upper levels. This is actual weather data that is obtained by launching weather balloons that sample the atmosphere as they ascend. By using these map, you can get a feel for how well a model is handling the current weather situation. For instance, if the 250mb analysis chart has the jet stream in Canada, but the GFS model had the jet stream across the southern US at the same time, the GFS has not initialized well. This means the GFS does not have a good handle on the current weather scenario and using its model guidance may lead to a bad forecast.

RAP 850mb Rawinsode Data: The current 850mb analysis.

RAP 700mb Rawinsode Data: The current 700mb analysis.

RAP 500mb Rawinsode Data: The current 500mb analysis.

RAP 250mb Rawinsode Data: The current 250mb analysis.

KMHX Skew-T/Stuve/Hodo: Allows the forecaster to see a vertical slice of the atmosphere. This can be useful for severe thunderstorms as well as determining precipitation type during the winter months.

Radar Images

NWS Radar/Loop. Regional NWS Radar/Loop, National Radar Image (NWS)/Loop, COD Radar Image/Loop: A good now-casting tool that can help the forecaster decide if precipitation will begin, continue or leave the forecast city by the time the next forecasting period begins/ends.

Satellite Images

COD 1km Visible Satellite/Loop: During daylight hours, visible satellites take pictures of the clouds. This can help forecasters find where clouds may keep temperature down during the day or hold temperatures up overnight. In addition, fog and snow can also be seen from these images.

ADDS Regional Visible Satellite/Loop: Same idea as the COD 1km Visible Satellite above, except a little wider viewer.

ADDS National Visible Satellite/Loop: A national view of visible satellite.

ADDS Regional Color Infrared/Loop: When the sun goes down, infrared will become your friend. Infrared satellites measure the infrared radiation from the clouds and then using

mathematical equations converts it to a temperature. The warmer the cloud, the lower the height of the cloud. The colder the cloud, the higher the height of the cloud. High clouds can mean that there are thunderstorms or perhaps just some fair weather cirrus clouds.

ADDS Water Vapor (National)/Loop: Provides the forecaster with an idea of where there is water vapor in the *upper atmosphere*. This image/loop is not near the surface. Oranges/Reds mean drier air and magentas/blues/greens mean there is moisture in the upper atmosphere.

Surface Observations

72 Hour Observation History: This provides a three-day history for the forecast city. This can give you trends of how fast the temperature may fall. In addition, it can help give you an idea of how your forecast is varying in real-time.

RAP Regional Surface Map: Surface weather stations can provide valuable and timely information about the current temperature, dewpoint and wind. If you're able to loop a surface plot, you may be able to tell how when a front may get to your forecast city. For example, if a strong cold front will be coming through your forecast city, your high temperature may occur before, at or shortly after the beginning of the period. By knowing when the front will pass through the forecast city, you may be able to have a better forecast than the models.

Dewpoint Contour Map (National): This map gives you an idea of where moisture is at near the surface and thus available to produce precipitation. However, high dewpoints don't mean there will be precipitation.

Wind/Sea Level Pressure Contour Map: Provides current surface map of the US along with wind direction and speed.

COD 3-Hour Pressure Change Map: 3hr pressure change provides an idea of where a low-pressure system may track. The low will follow the track to the lowest pressure falls similar to how a ball in a funnel shaped room will go to the center (lowest) point of the funnel.