Predicting Fog on the Oregon Coast

Advection fog at the coast forms when warmer more humid air coming from the land or sea is cooled and moistened by the layer of air above the sea.

Along with the surface air cooling, moistening begins at the base of the dry air mass as it moves over the ocean during the preconditioning stage. Like the cooling, moistening occurs initially at the surface and slowly mixes upward via mechanical turbulence. The moistened layer contains hygroscopic nuclei, such as tiny particles of salt or pollutants, and deepens gradually.

This moistening is indicated by rising dew point temperatures. When forecasting fog formation, it can be helpful to closely monitor the surface dew point temperature over the sea. Fog formation may be imminent when the dew point approaches the sea surface temperature.

A general rule of thumb used by some forecasters: Fog formation is unlikely when the dew point in the lowest layer is significantly lower than the sea surface temperature.

The moistened air parcels in the low levels slowly become convectively buoyant due to the decreased density of the moist air. The small-scale "vapor-driven" convection enhances moistening of the lower boundary layer.

Therefore here is my recipe,

1) See the relative humidity forecast from the MM5 for the coastline you would like to fly at:

http://www.atmos.washington.edu/~ovens/loops/wxloop.cgi?mm5d3_rhsfc+///3

Note how the relative humidity over the ocean varies with the coastline. Sometimes it onshore and sometimes it forms a sharp dividing line just off the coast. This and the beach sea temperature and near shore water temperature difference will determine if a fog bank develops or if the fog will be on shore. Mountain catabatic wind often forms beach morning fog. Most of time this dissipates in the afternoon sun if the marine air is not too humid. Of course, cooler on shore wind can feed the relatively warmer near shore waters at anytime and bring in the fog, so note the progression of RH over time and possibly incoming fog. Use the color code legend at the bottom of the map to translate into a real number R.H.

2) Calculate the dew point of the greater RH values (and lower ones if they are high too) using the calculator at

http://einstein.atmos.colostate.edu/~mcnoldy/humid.html and NOAA forecasted air temperature.

3) Check the ocean temperature using the appropriate buoy at http://www.wrh.noaa.gov/pqr/buoys.php or use http://www.terrafin.com/sstview/samples/freeoregon.htm (sometimes this is obscured by high clouds or fog!)

4) Fog formation is unlikely when the dew point in the lowest layer is significantly lower than the sea surface temperature.

5) Beware of very hot valley temperatures, northeasterly winds, a trough of low pressure moving through and presence of very cold near shore waters. The coastal fog can be very intense under these conditions as hot and humid inland air is mixing with cold near shore waters. Changing wind directions or increasing wind can turn the fog off and on as land and marine air masses have different RH. Sometimes simply increasing wind promotes mixing of the cold ocean layer with the air mass creating fog. Relief can be found on the lee-side of capes and headlands in these conditions.

References

California and Oregon Humidity and Coastal Fog Jessica D Lundquist and Thomas B Bourcy
Scripps Institute of Oceanography http://tenaya.ucsd.edu/~jessica/fogAMS.pdf