



NWS Probabilistic Products

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18th Century Forecasting

- “The probability of a fair day to that of a wet one is as ten to one.” - J. Dalton, circa 1793
- Reference: The Early History of Probability Forecasts, Allan Murphy, *Weather and Forecasting*, 1997.

Scientific Progress

- Advances over the last few decades
 - Chaos theory
 - Ensemble modeling made possible by computing advances
- Provides a framework for understanding forecast uncertainty

Doswell (*Wea. Forecasting*, Dec. 2004)

- Human weather forecasters have demonstrated a degree of reliability in the task (of making probability-based forecasts) that is considered remarkable to nonmeteorologists (e.g., Fischhoff 1982)
- Considerable variability of calibration is possible among individual forecasters

Area Forecast Discussions

- It is increasingly common for NWS forecasters to informally communicate confidence within the AFD.

Tour of NWS Products

- National Centers
- River Forecast Centers
- Weather Forecast Offices

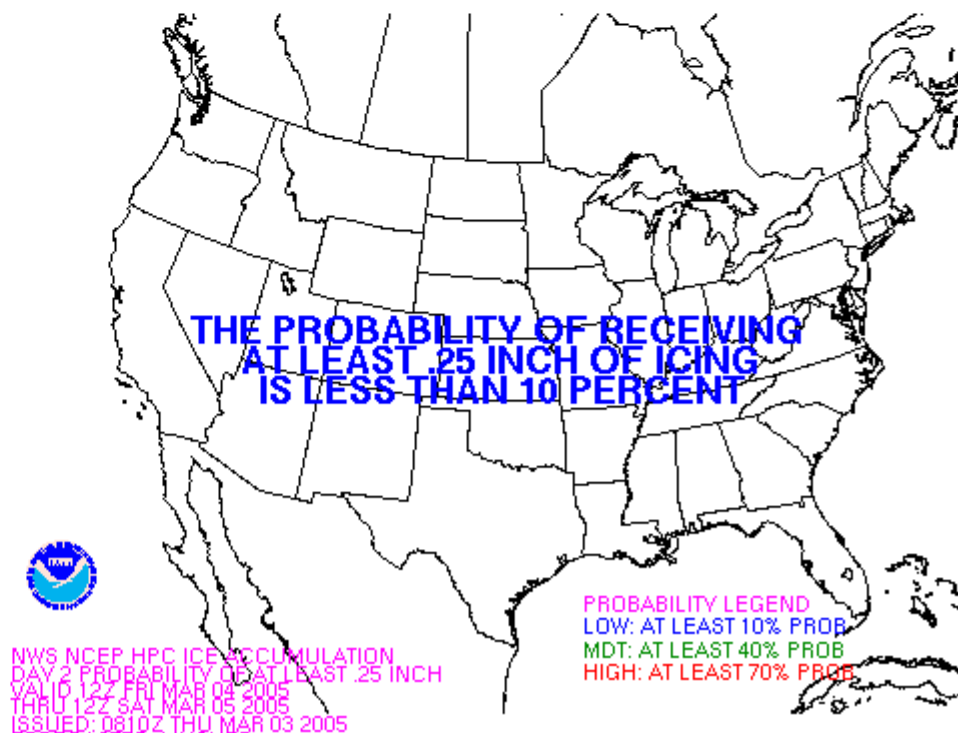
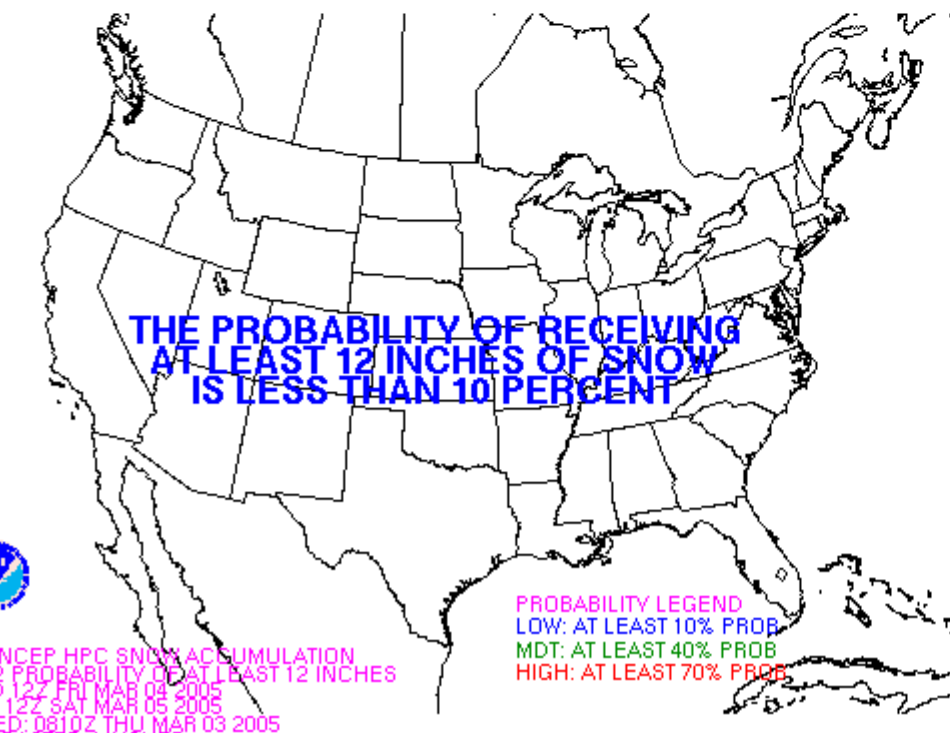
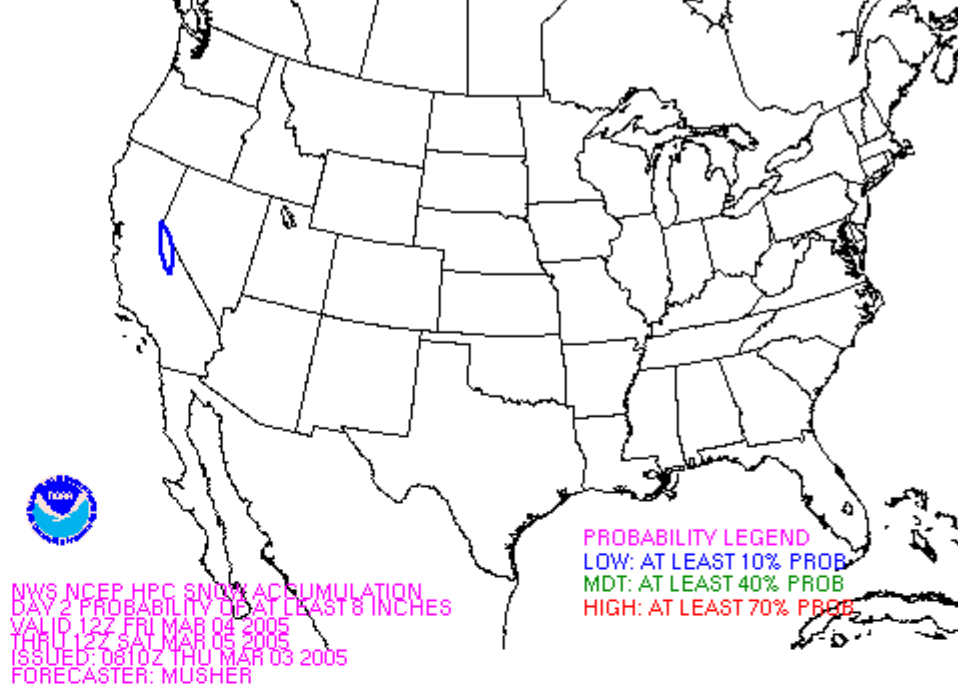
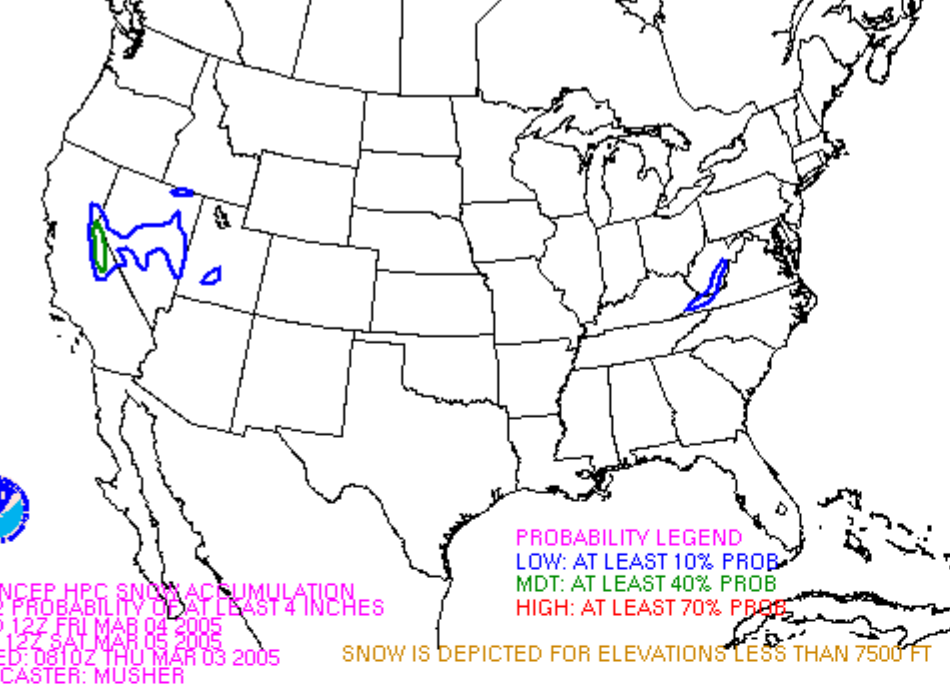
- Not every product is listed here

NWS National Centers

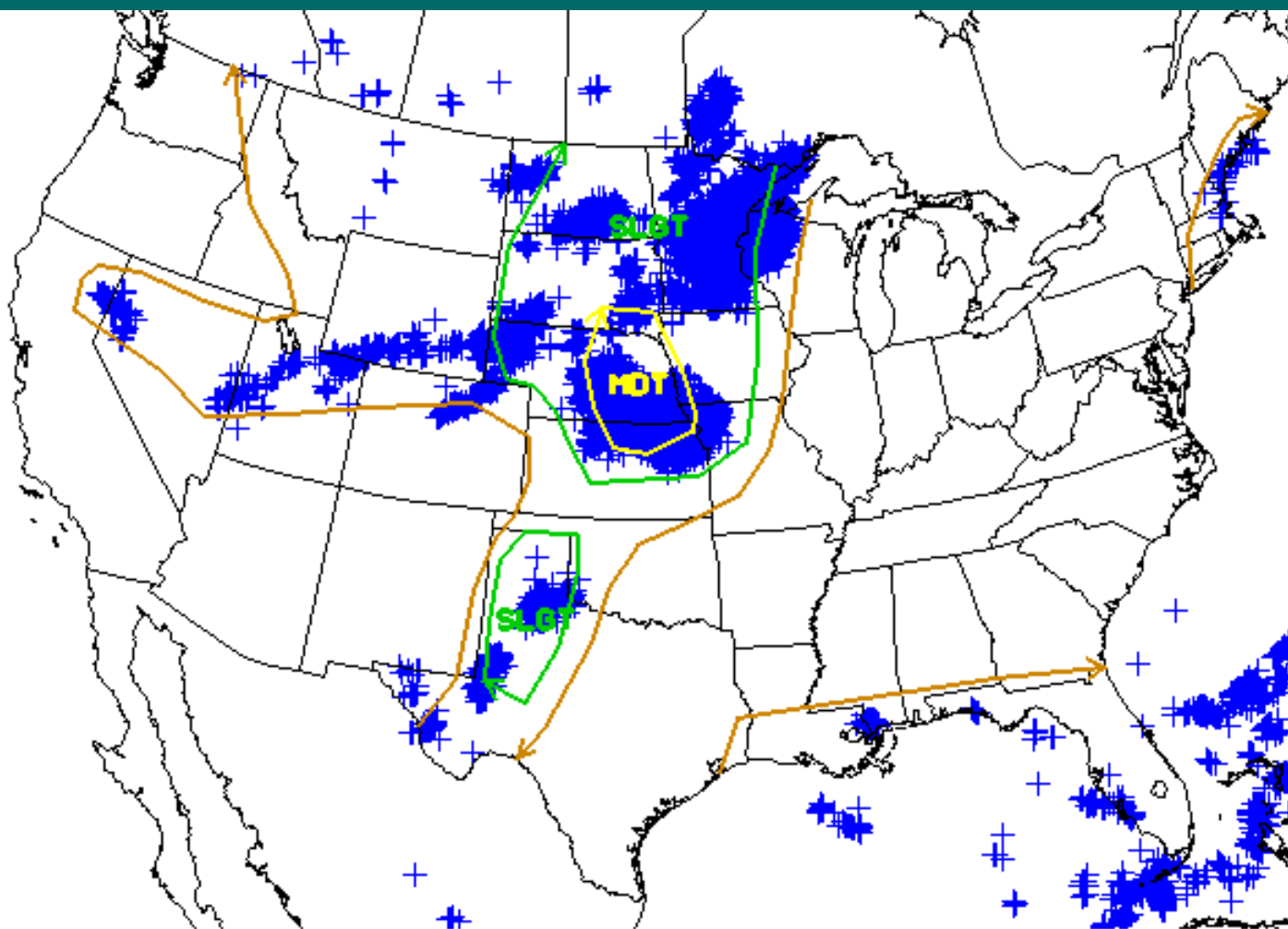
- National Centers of Environmental Prediction (NCEP)
- There are 9 Centers.
- The Environmental Modeling Center (EMC) has provided operational ensemble output since at least 1993.
- I'll show examples from 2 others.

HPC

- Hydrometeorological Prediction Center issues graphs with probabilities for
 - Winter Weather
 - Excessive Rainfall
 - Medium-Range Pops



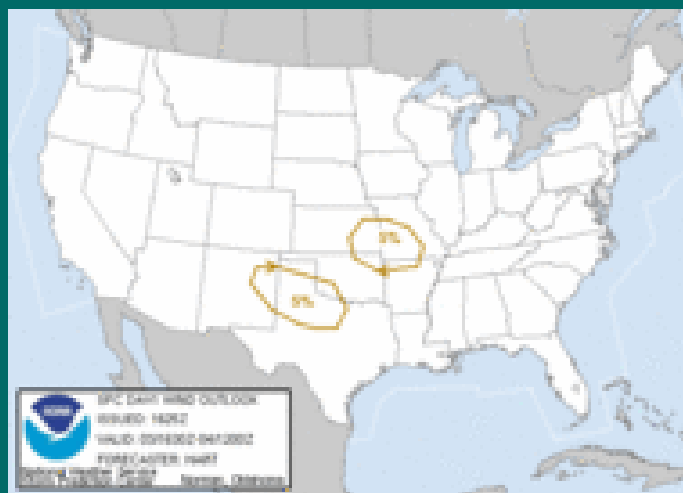
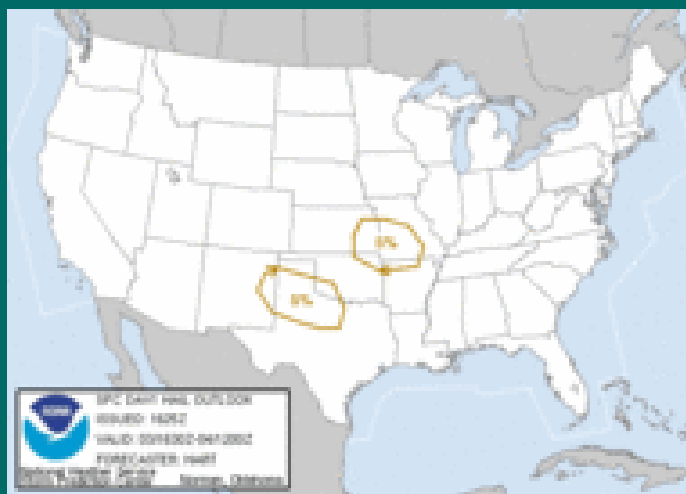




20030623 01Z DAY1 and 20030623/01Z to 20030623/12Z LIGHTNING
(134068 total strikes)

18.75 inches in circumference
7 inches in diameter
June 22, 2003 Aurora, Nebraska





The Hydrometeorological Prediction Center issues probabilities for excessive rainfall, winter weather and medium range POPs.

See http://www.hpc.ncep.noaa.gov/qpf/excess_rain.shtml

And http://www.hpc.ncep.noaa.gov/wwd/winter_wx.shtml

And http://www.hpc.ncep.noaa.gov/medr/pop_12hr.shtml#hr12

The Tropical Prediction center issues hurricane track guidance in probabilistic form.

See <http://www.nhc.noaa.gov/archive/2004/prb/al112004.prblty.009.shtml>

The Storm Prediction Center convective outlook is a categorical forecast that specifies the perceived level of threat via the descriptive wording: Slight, Moderate, and High Risk. SPC also issues probabilistic graphics for tornadoes and severe hail and wind.

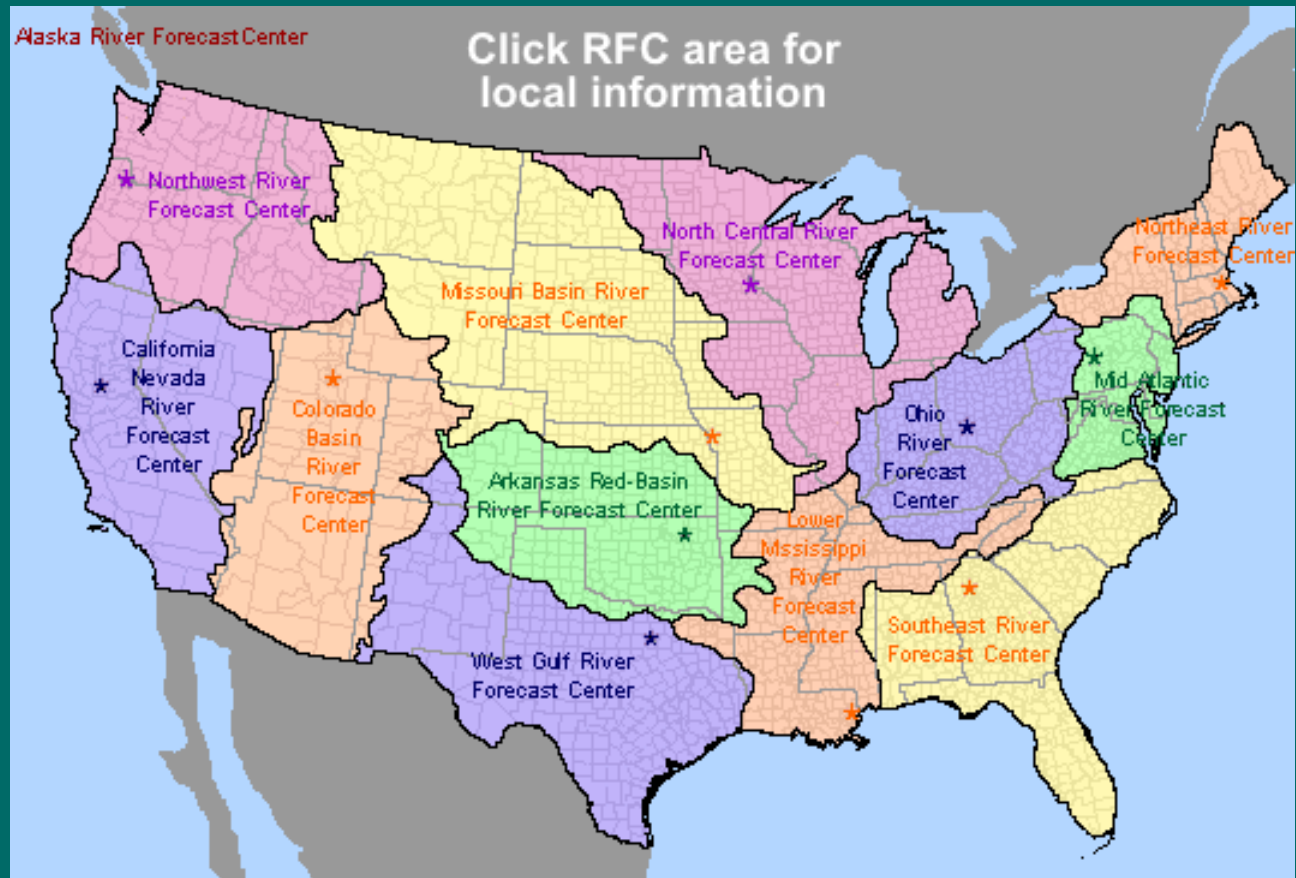
See for example <http://www.spc.noaa.gov/products/outlook/day1otlk.html>

And <http://www.spc.noaa.gov/products/outlook/probinfo.html>

The Environmental Modeling Center has provided operational ensemble output since 1993

See <http://wwwt.emc.ncep.noaa.gov/gmb/ens/>

River Forecast Centers



Hydrologic Outlooks

- Advanced Hydrologic Prediction Services (AHPS)
 - products tend to be probabilistic
 - historic precipitation, temperature and streamflow
 - current river and basin conditions
 - short-term meteorologic outlook.
 - The core of the AHPS system is the Ensemble Streamflow Prediction program, which is part of NWSRFS (National Weather Service River Forecast System).

Many, if not all NOAA/NWS River Forecast Centers (RFCs) provide probabilistic forecasts. Here are just two:

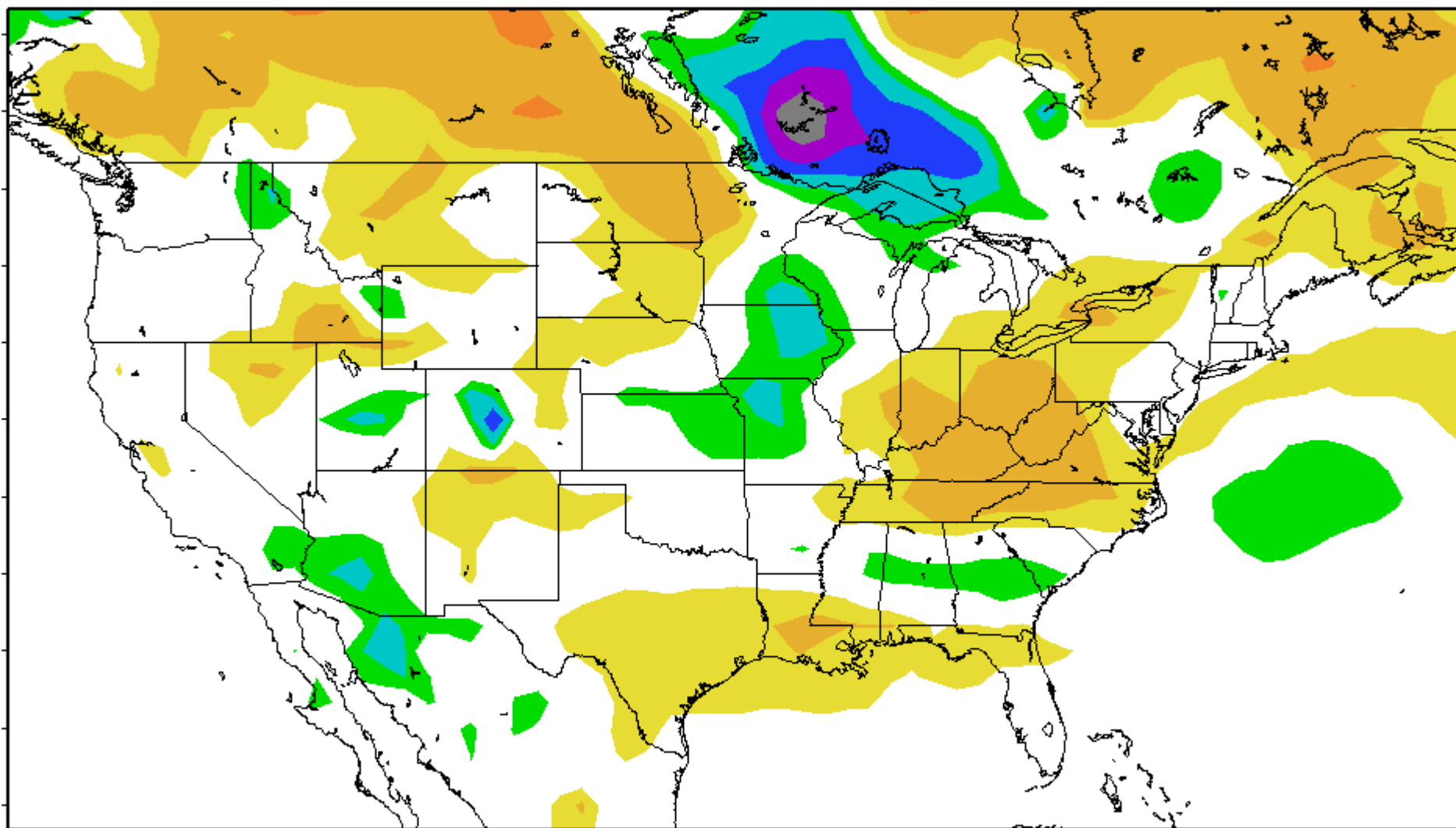
NWRFC: Short-term probabilistic stream flow hydrographs using output from the SUNY-Stony Brook ensemble.

See http://www.erh.noaa.gov/nerfc/mm5_test.shtml

NWRFC: Northwest RFC provides graphs of ensemble stream flow predictions.

See http://www.nwrfc.noaa.gov/ahps/ahps_display.cgi?DWRI1

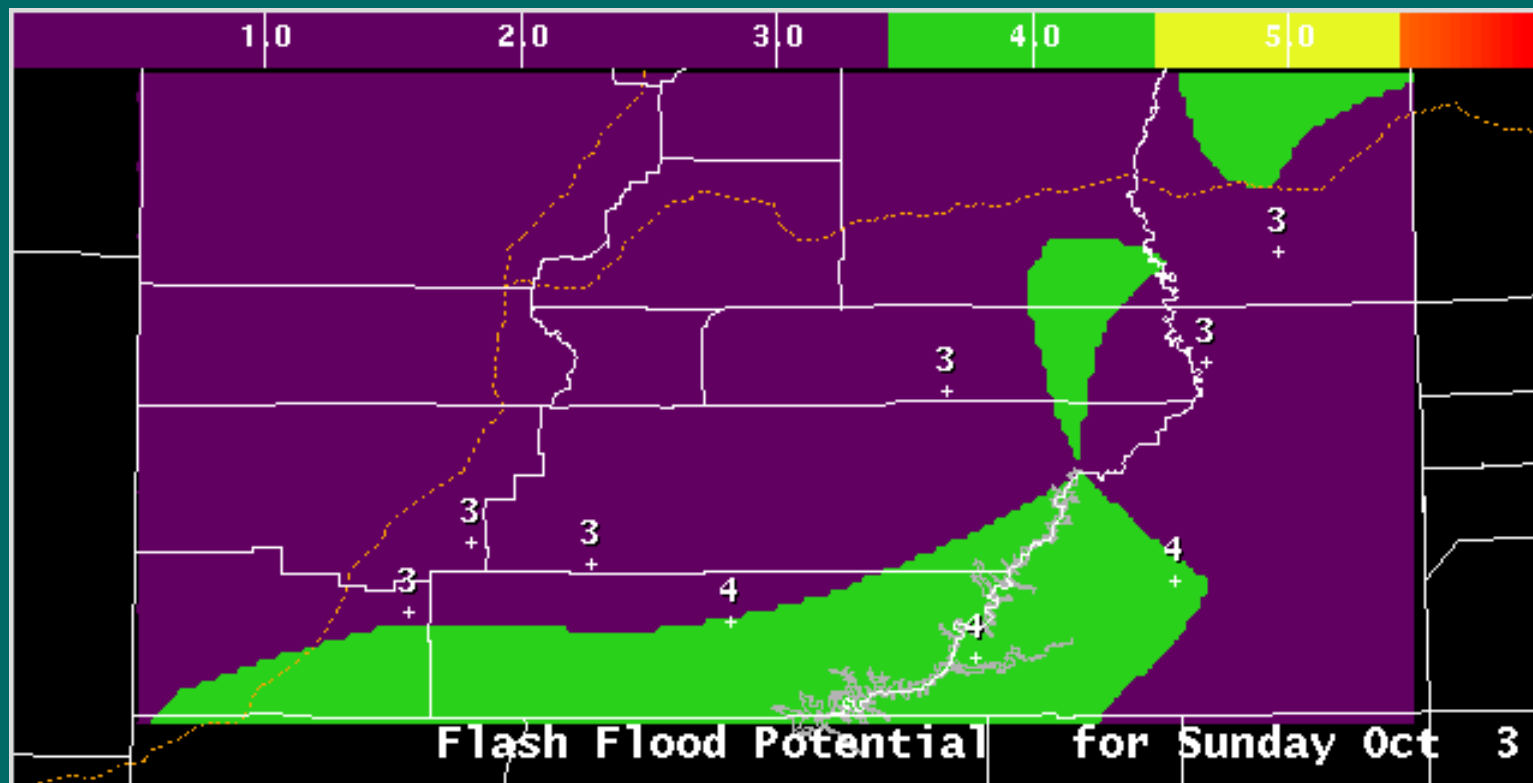
12Z03MAR2005 (Thu) GFS Ensemble tmp2m Experimental
Forecast Confidence 66hr forecast valid 06Z06MAR2005 (Sun)



125W 120W 115W 110W 105W 100W 95W 90W 85W 80W 75W 70W 65W

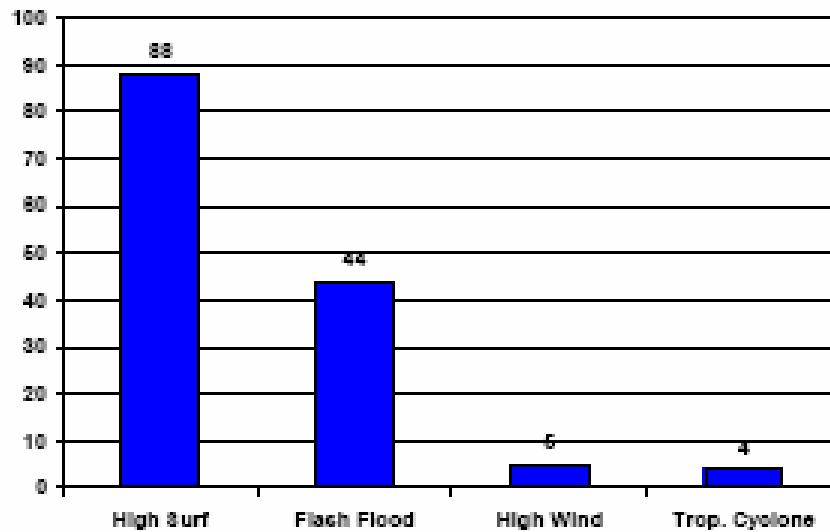
Much Below Normal Below Normal Normal Above Normal Much Above Normal





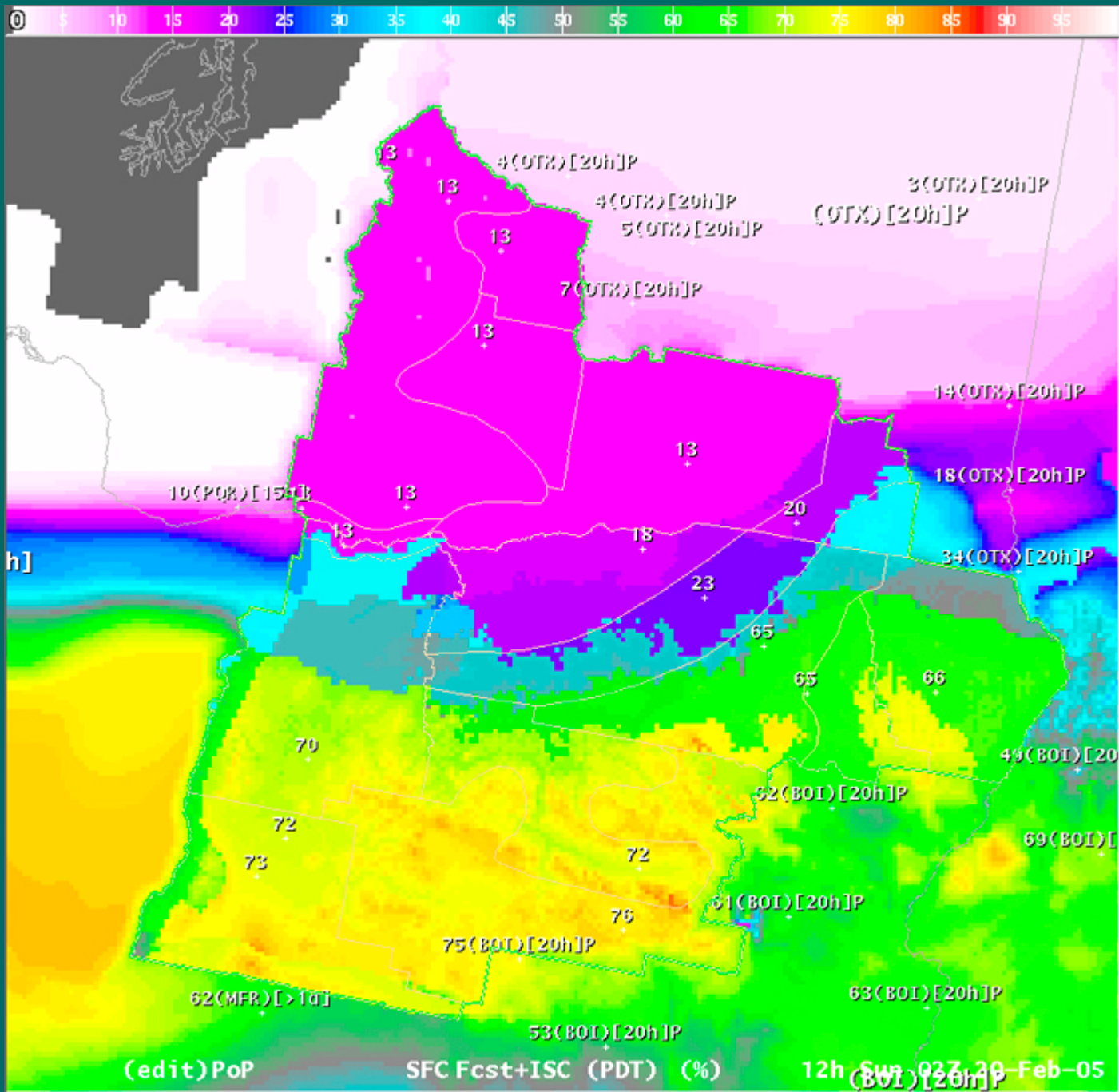


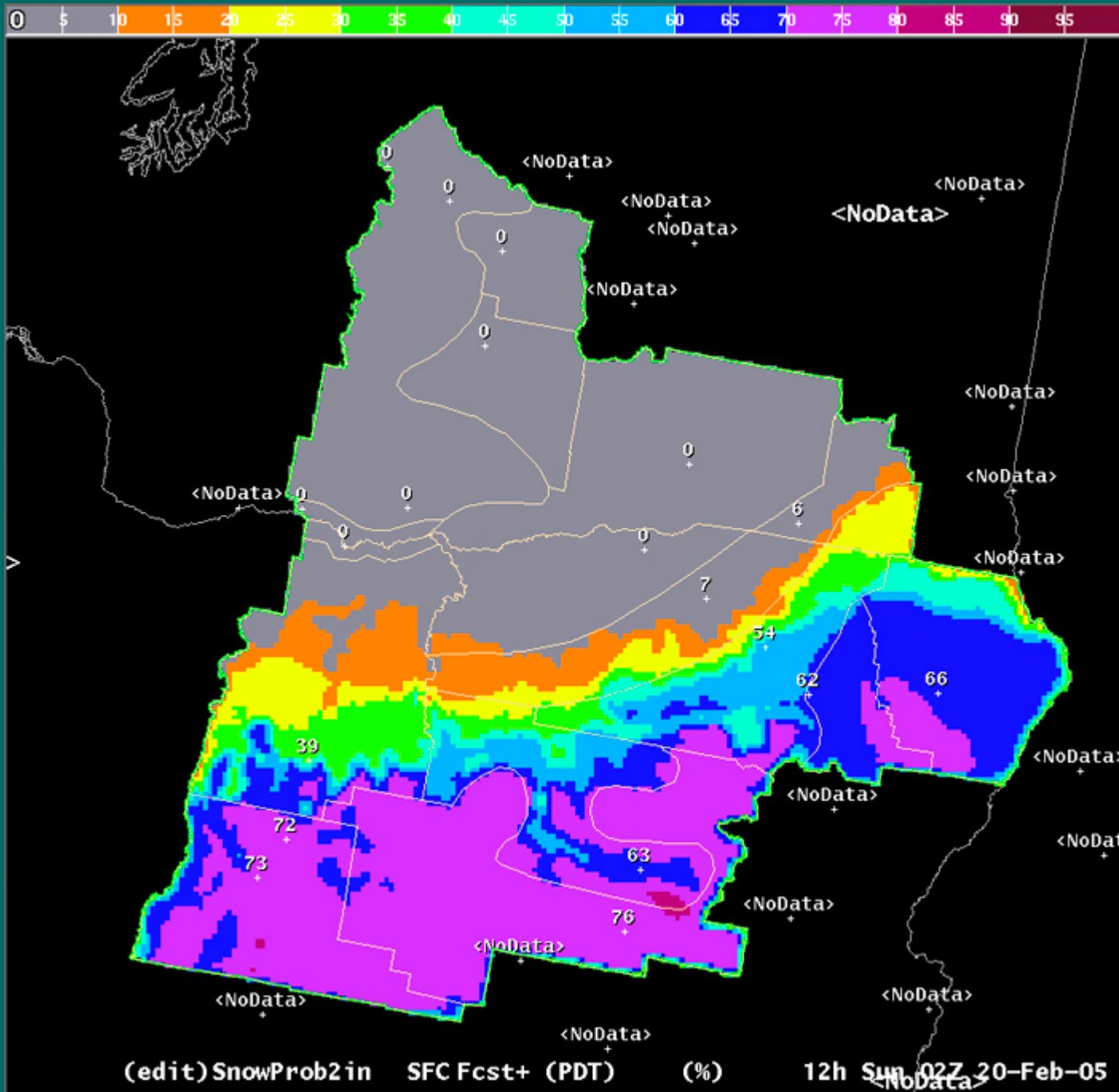
State of Hawaii
Weather Event Deaths
1960 - 2002

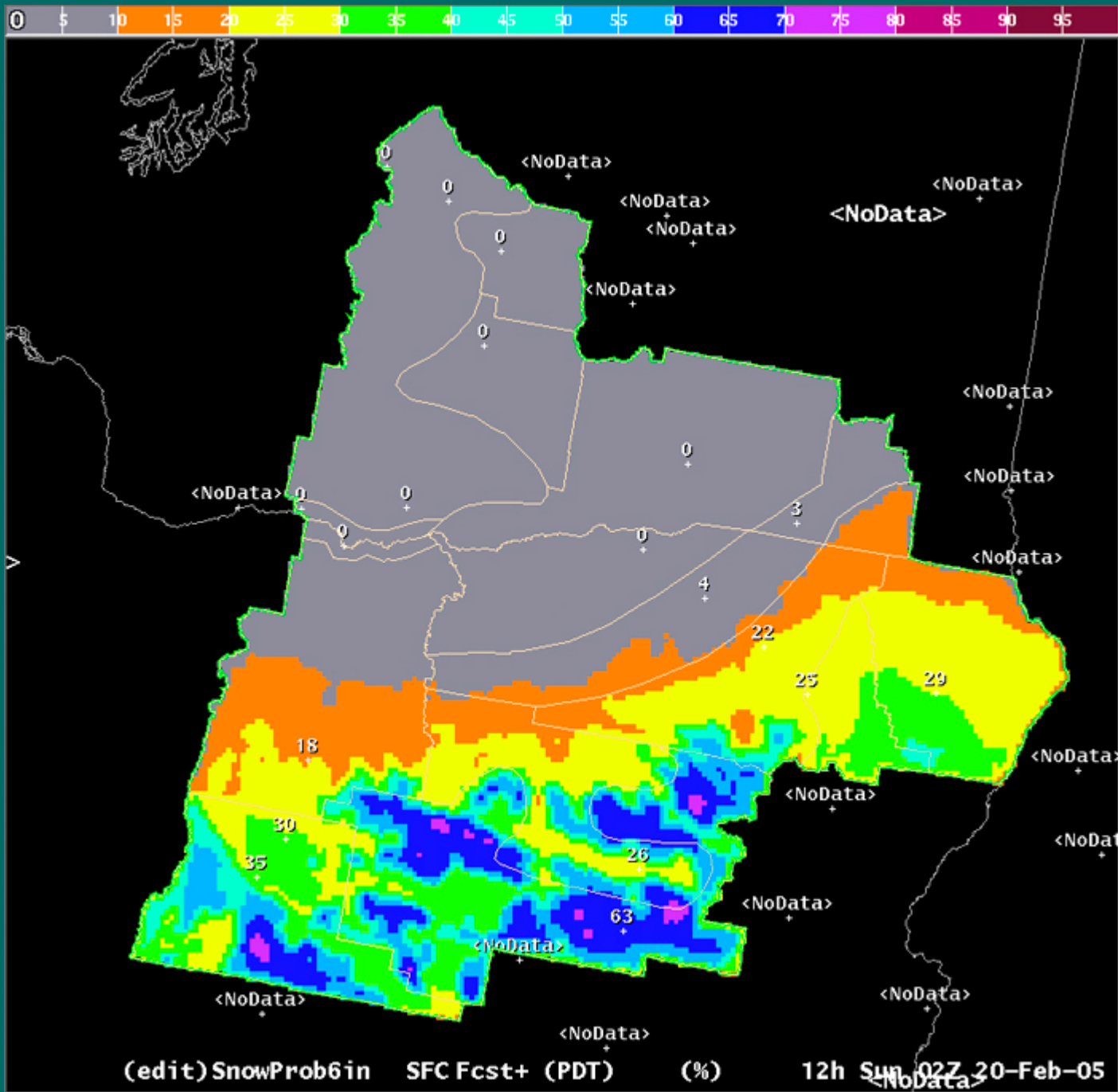


FORECAST	SWL	DMNT	DMNT	HGT		WIND	WIND	SPD
DATE	HGT	DIR	PD	TEND	PROB	SPD	DIR	TEND
THU	8	NW	17	UP	HIGH	8-12	SE	DOWN
03/03	3	E	7	DOWN	MED			
	2	S	11	DOWN	MED			



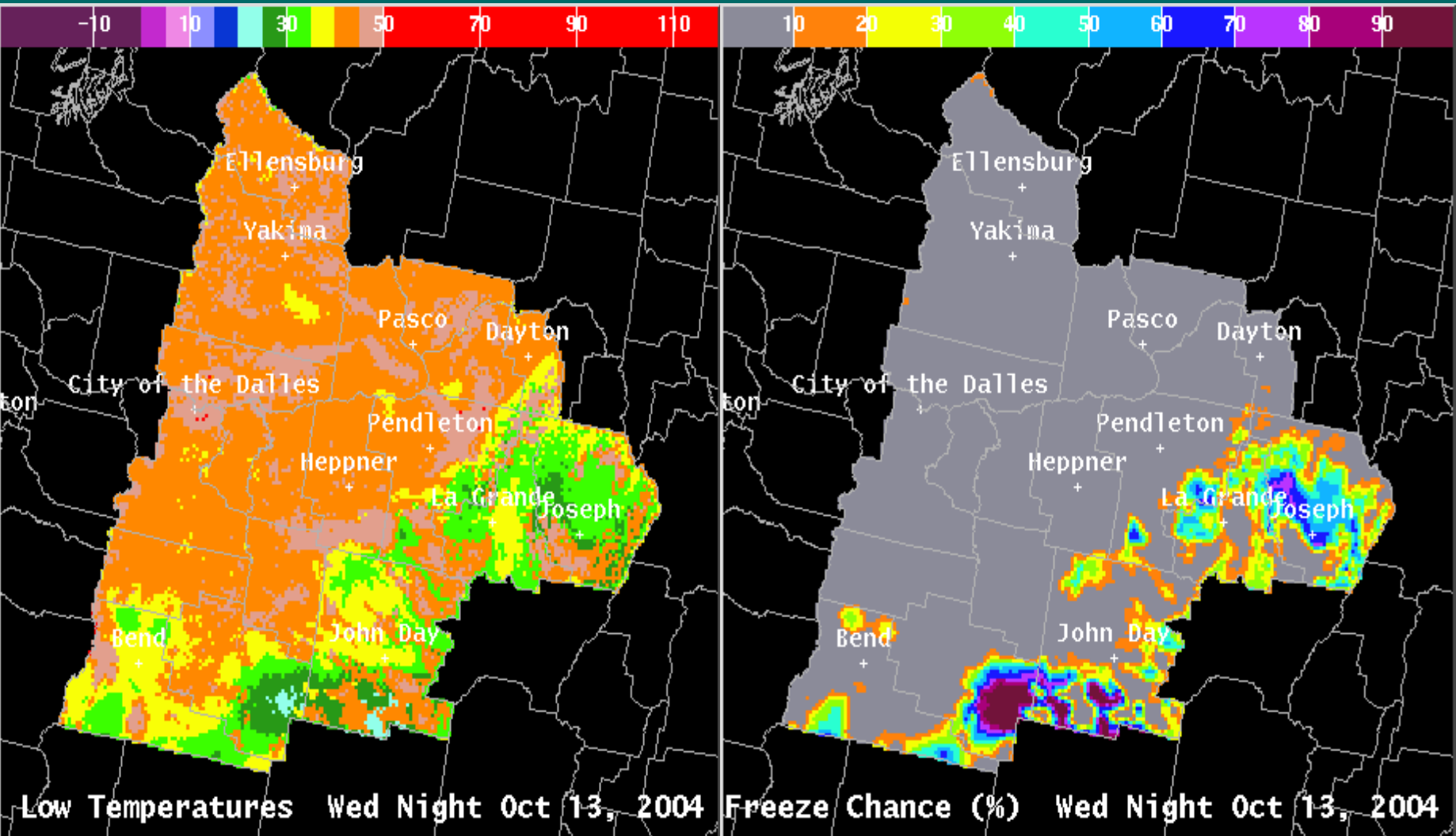








Probability of Freezing Temps



<p>Forecast confidence measures using NCEP medium and short-range ensembles and real-time NWS web-based graphical products. Forecasters fine-tune the uncertainties. See http://moe.met.fsu.edu/confidence/images</p>	<p>Florida State Univ. and WFO Tallahassee</p>	
<p>Swell height forecast includes level of certainty -- HIGH, MED, or LOW. A collaboration of NOAA employee and a long-time surf forecaster. http://www.srh.noaa.gov/data/HFO/SRFHFO</p>	<p>WFO Honolulu</p>	
<p>Probabilities appended to the bottom of winter storm watch bulletin. http://www.erh.noaa.gov/phi if a winter storm warning is in effect.</p>	<p>WFO Mt. Holly (Philadelphia)</p>	
<p>Probability of snowfall range for two metro areas. The range of probable accumulations provides an indirect way of seeing forecaster confidence. http://www.erh.noaa.gov/buf/SpotLES/qpsf1.htm</p>	<p>WFO Buffalo</p>	
<p>Hazardous Probability Grids for the first two 12 hour periods. http://www.srh.noaa.gov/data/ifps/jan/GFE/Hazards.html (Click on the "Hazards" tab)</p>	<p>WFO Jackson, MS</p>	

<p>Snowfall amount probabilities for the Cottonwood Canyons, including a "Most Likely" and "Next Most Likely" snowfall amount for two 12-h periods. http://www.wrh.noaa.gov/slc/projects/mtnwx/cottonwoodForecast.php</p>	<p>WFO Salt Lake City</p>
<p>Flash flood potential during the summer/fall for southern Utah. Zion National Park posts the text version throughout the park to make hikers aware of any potential for flash flooding for that day. http://www.wrh.noaa.gov/slc/projects/ifp/html/ffp.php</p>	<p>WFO Salt Lake City</p>
<p>Graphs of Freeze and Snowfall Amount Probabilities http://www.wrh.noaa.gov/pdt/currentHazards/graphicalHazards.php?tab=1</p>	<p>WFO Pendleton</p>
<p>Graphical HWO (Hazardous Weather Outlook) with categorical threats. http://www.erh.noaa.gov/mhx/LocalHazards.html</p>	<p>WFO Morehead City, NC</p>



Conclusions

- customer feedback and number of web hits indicate products are very popular.
- a digital database permits new graphical products.
- Human role in forecasting forecast confidence needs to be explored and tested.