Visualizing Visualization

Kevin R. Tyle, University at Albany, SUNY

Unidata Russell L. DeSouza Award Seminar

It started with a Big Splash …

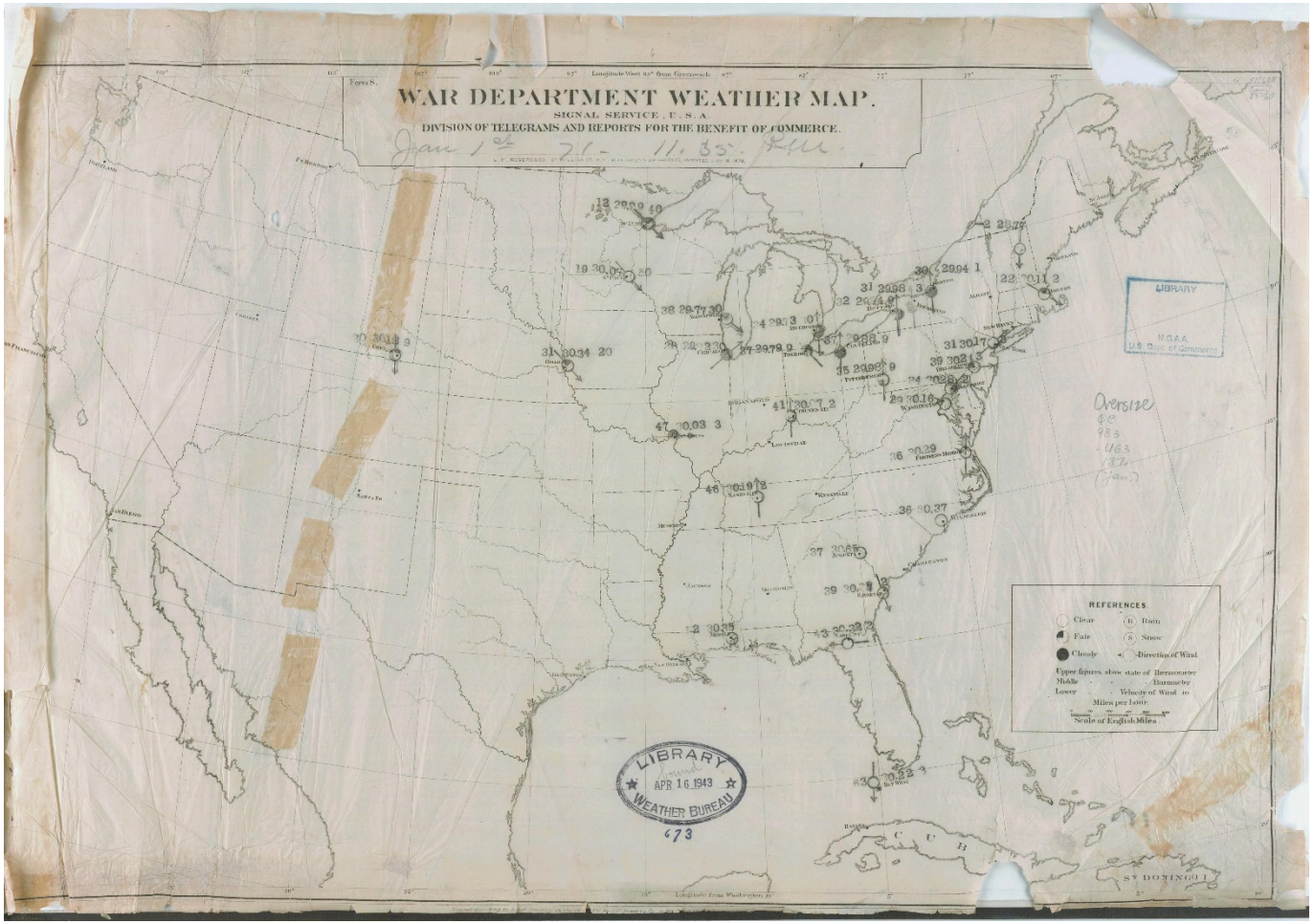
(Apollo 11 Splashdown, 7/24/1969)

Outline

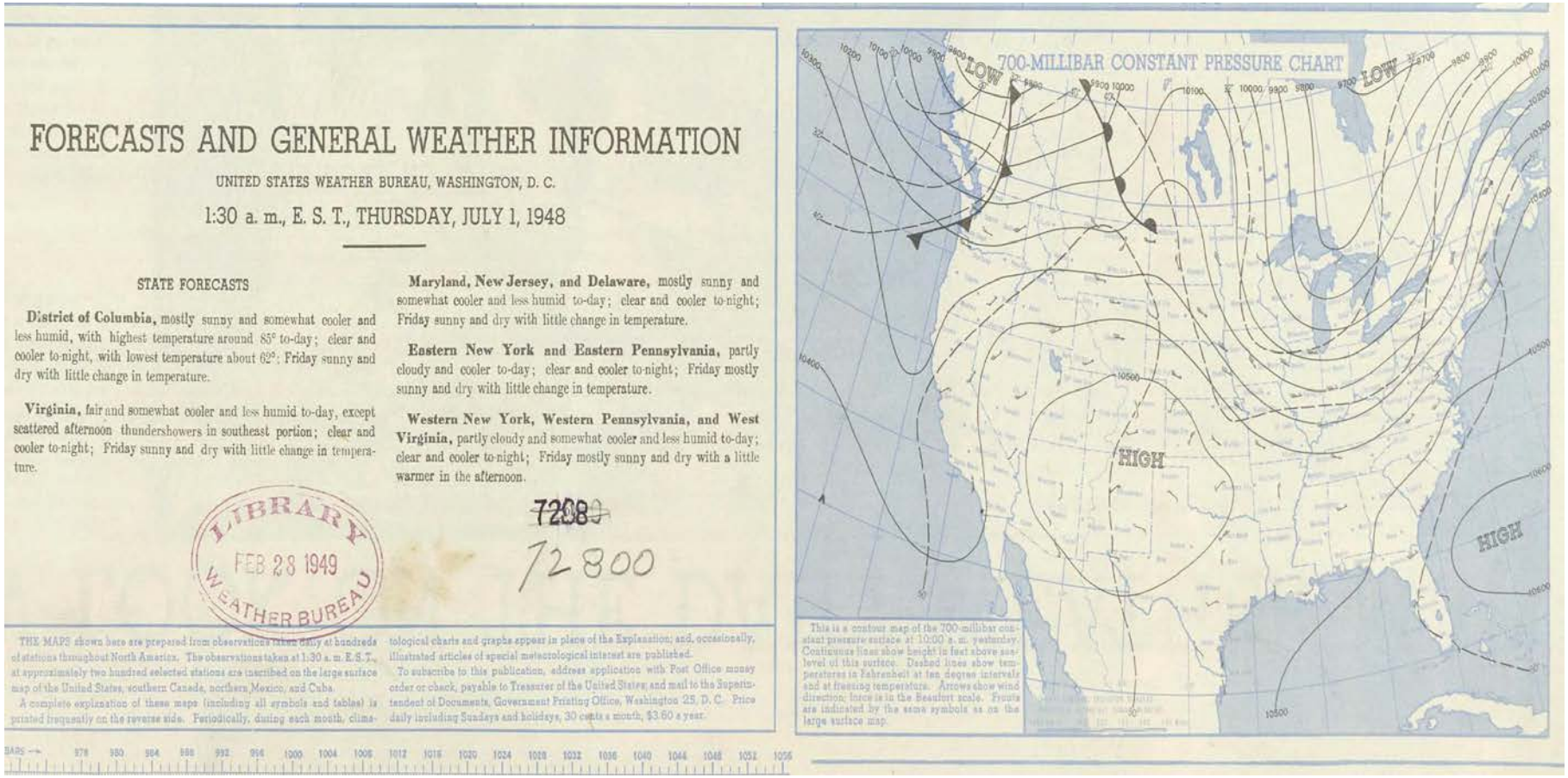
1) Visualization Way Back When
2) Visualization in the “Modern” Era
3) Interactivity in Applications
4) Interactivity in the Browser
5) WxAtlas
6) Visualizing the Future
7) Acknowledgments

Visualization Way Back When

1st US Wx Bureau Synoptic Map



"1st" Upper Air Map



FORECASTS AND GENERAL WEATHER INFORMATION

UNITED STATES WEATHER BUREAU, WASHINGTON, D. C.

1:30 a. m., E. S. T., THURSDAY, JULY 1, 1948

STATE FORECASTS

District of Columbia, mostly sunny and somewhat cooler and less humid, with highest temperature around 85° to-day; clear and cooler to-night, with lowest temperature about 62°; Friday sunny and dry with little change in temperature.

Virginia, fair and somewhat cooler and less humid to-day, except scattered afternoon thundershowers in southeast portion; clear and cooler to-night; Friday sunny and dry with little change in temperature.

Maryland, New Jersey, and Delaware, mostly sunny and somewhat cooler and less humid to-day; clear and cooler to-night; Friday sunny and dry with little change in temperature.

Eastern New York and Eastern Pennsylvania, partly cloudy and cooler to-day; clear and cooler to-night; Friday mostly sunny and dry with little change in temperature.

Western New York, Western Pennsylvania, and West Virginia, partly cloudy and somewhat cooler and less humid to-day; clear and cooler to-night; Friday mostly sunny and dry with a little warmer in the afternoon.

LIBRARY FEB 28 1949 WEATHER BUREAU

7208
72800

THE MAPS shown here are prepared from observations taken daily at hundreds of stations throughout North America. The observations taken at 1:30 a. m. E.S.T., at approximately two hundred selected stations are inscribed on the large surface map of the United States, southern Canada, northern Mexico, and Cuba.

A complete explanation of these maps (including all symbols and tables) is printed frequently on the reverse side. Periodically, during each month, climatological charts and graphs appear in place of the Explanation; and, occasionally, illustrated articles of special meteorological interest are published.

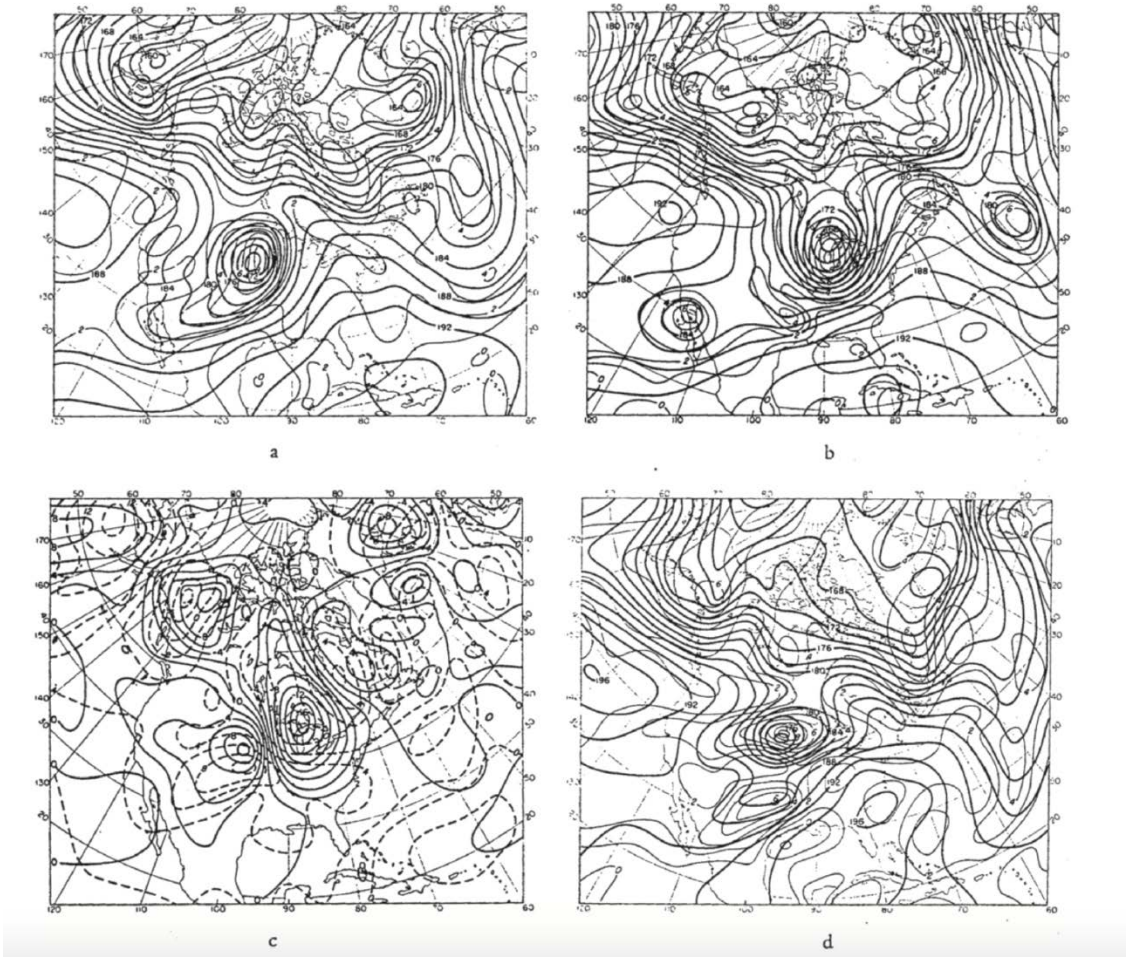
To subscribe to this publication, address application with Post Office money order or check, payable to Treasurer of the United States; and mail to the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Price daily including Sundays and holidays, 30 cents a month, $3.60 a year.

700-MILLIBAR CONSTANT PRESSURE CHART

LOW LOW HIGH HIGH

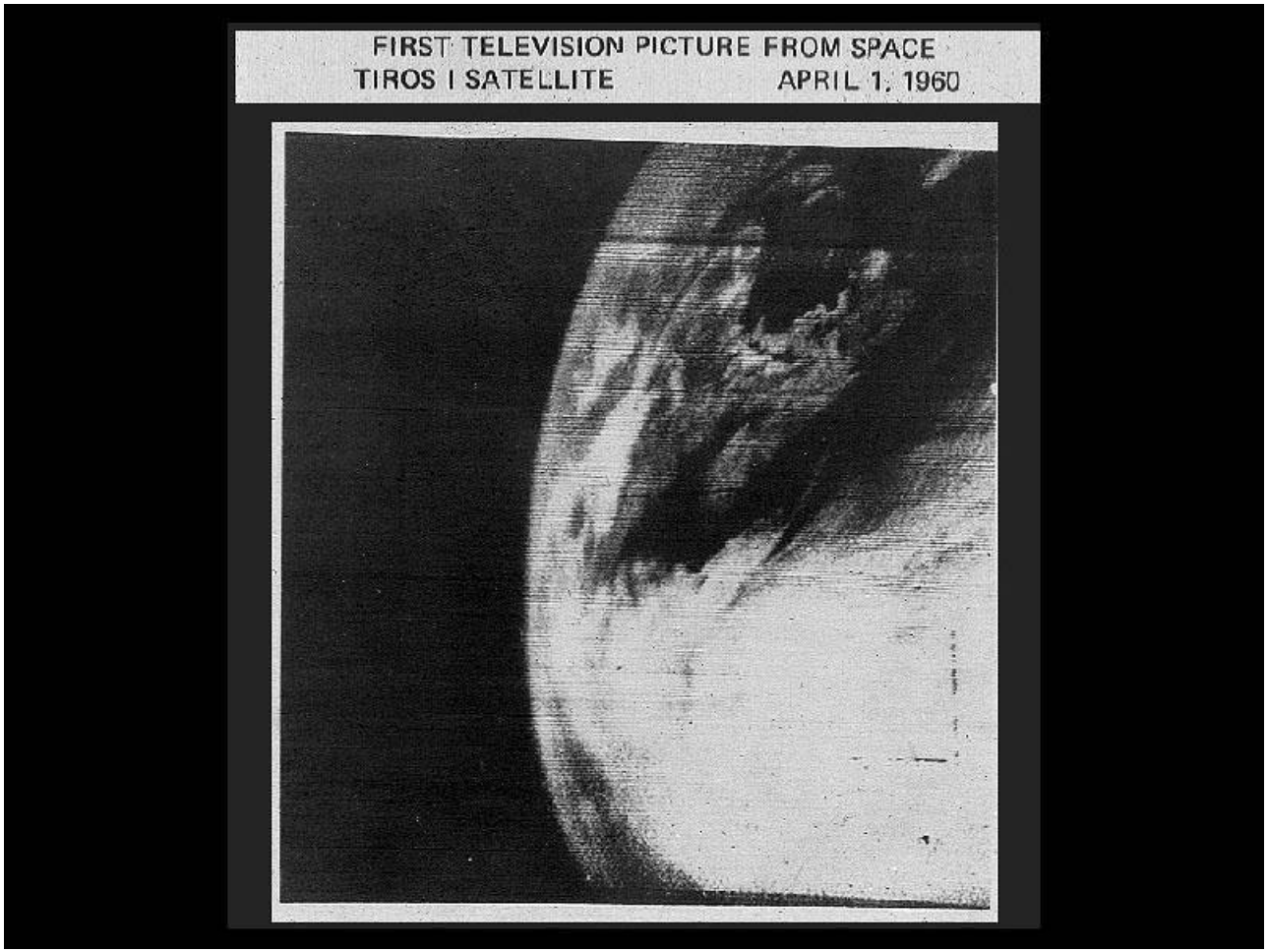
This is a contour map of the 700-millibar constant pressure surface at 10:00 a. m. yesterday. Continuous lines show height in feet above sea-level of this surface. Dashed lines show temperatures in Fahrenheit at ten degree intervals and at freezing temperature. Arrows show wind direction; force is in the Beaufort scale. Fronts are indicated by the same symbols as on the large surface map.

1st US Operational NWP Map

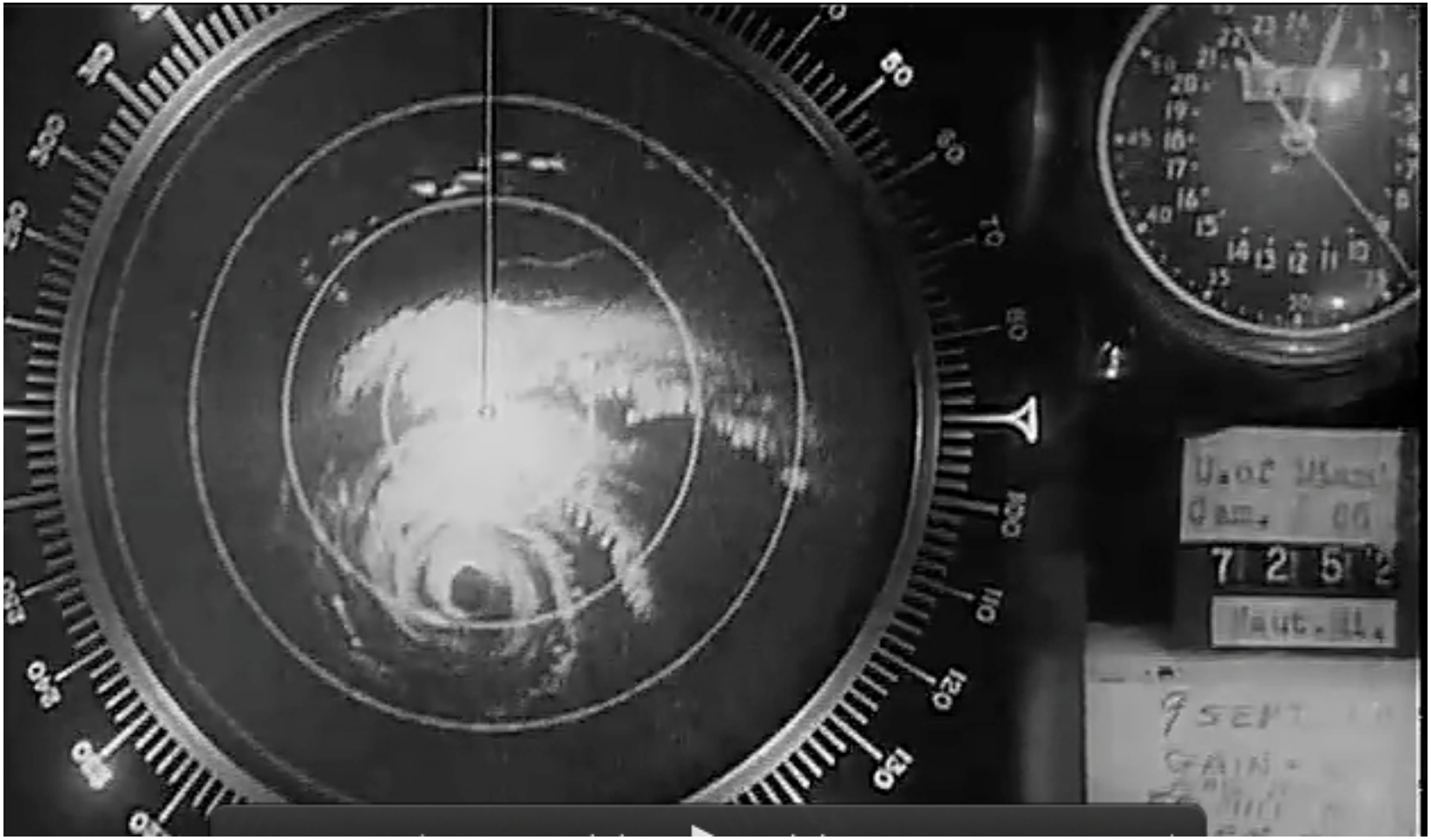


Forecasts for 5 January 1949 (P. Lynch, BAMS 2008)

1st Satellite Image



Radar Imagery (WSR-57)



Hurricane Donna (1960)

That 70s (Animation) Show

6 May 1975 Severe Weather Exercise.

Included in the package are:

a) one overlay grid with state boundaries and marks for use in registration;
b) overlays for 1800 and 2100 with analysis of various features;
c) 1 km resolution visible pictures at 30 minute intervals from 1800 GMT to 2134 GMT

Needed to be supplied:
a) masking tape;
b) grease pencil, (optional).

General instructions: Seeing changes between pictures at different times

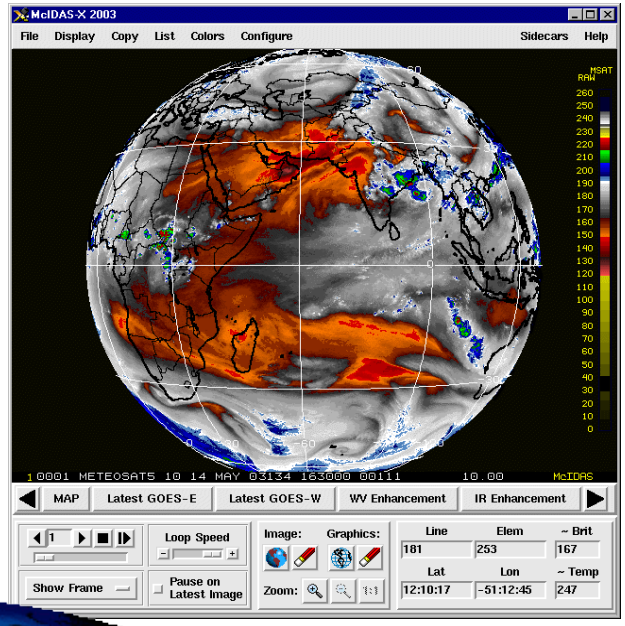
The exercise may be done using all of the pictures, or only a portion of the pictures with the remainder being added at a later time. The same general steps are followed regardless of the number of pictures being used. They are:

a) tape down the top and bottom of the 1800 GMT picture;
b) register the grid to the 1800 GMT picture using the registration marks, tape down the left hand edge of the overlay grid. The edge should be taped so that the grid may be folded back away from the picture(s) beneath it.
c) take the next picture in sequence and place it beneath the overlay grid, aligning its registration marks to those on the overlay grid. Being careful not to move the picture, fold back the grid and tape down the top edge of the picture. Replace grid and check the registration.
d) fold the grid back away from the pictures. Holding the bottom edge of the top picture, raise and then lower it in a sort of fanning motion (so that the bottom picture comes into view and then is covered again by the top picture). By doing this, one may observe the changes which have occurred between the two pictures. Practice this fanning at various speeds.
e) repeat step c with the remainder of the pictures. Each time a new picture is added to the sequence, 'fan it' to observe changes between it and the previous picture. Note that this picture may be compared with any previous picture merely by holding more than one picture while 'fanning.'

UAlbany Synoptic Lab Assignment (1970s)

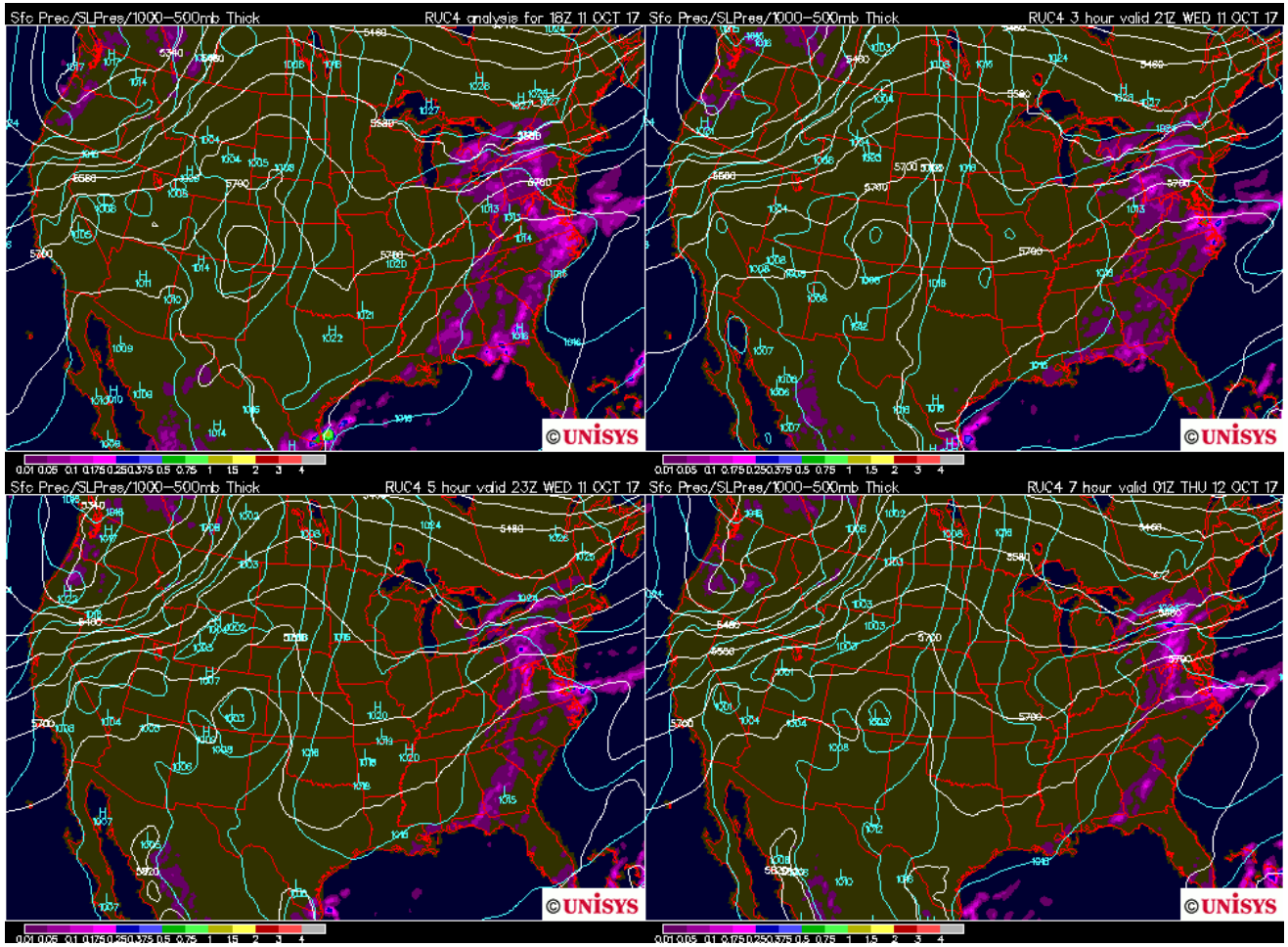
Visualization in the “Modern” Era

McIDAS

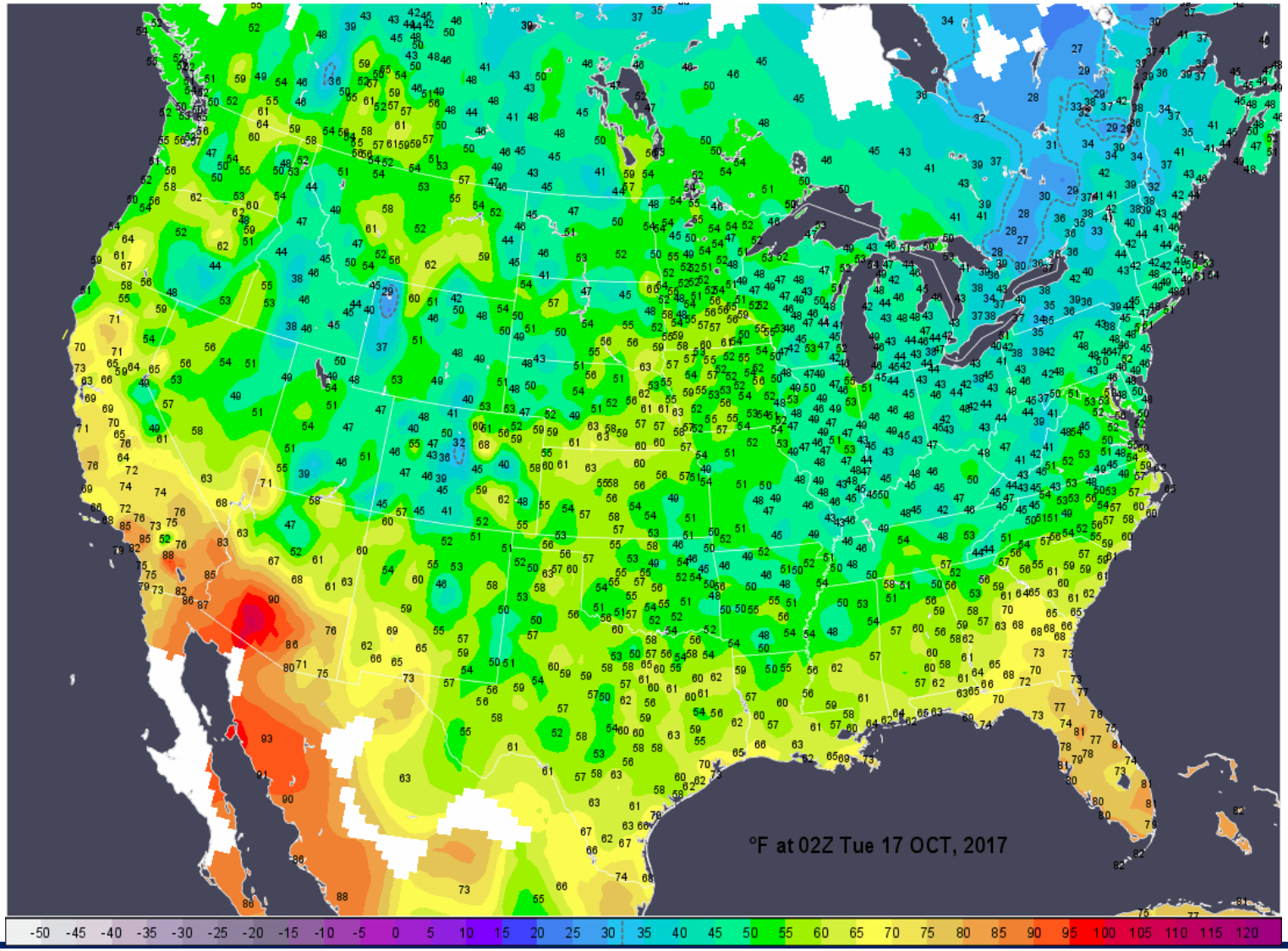

McIDAS-X 2003
File Display Copy List Colors Configure Sidecars Help
MAP Latest GOES-E Latest GOES-W WV Enhancement IR Enhancement
Loop Speed
Show Frame
Pause on Latest Image
Image: Graphics:
Zoom:
Line Elem ~ Brit
Lat Lon ~ Temp


McIDAS
V

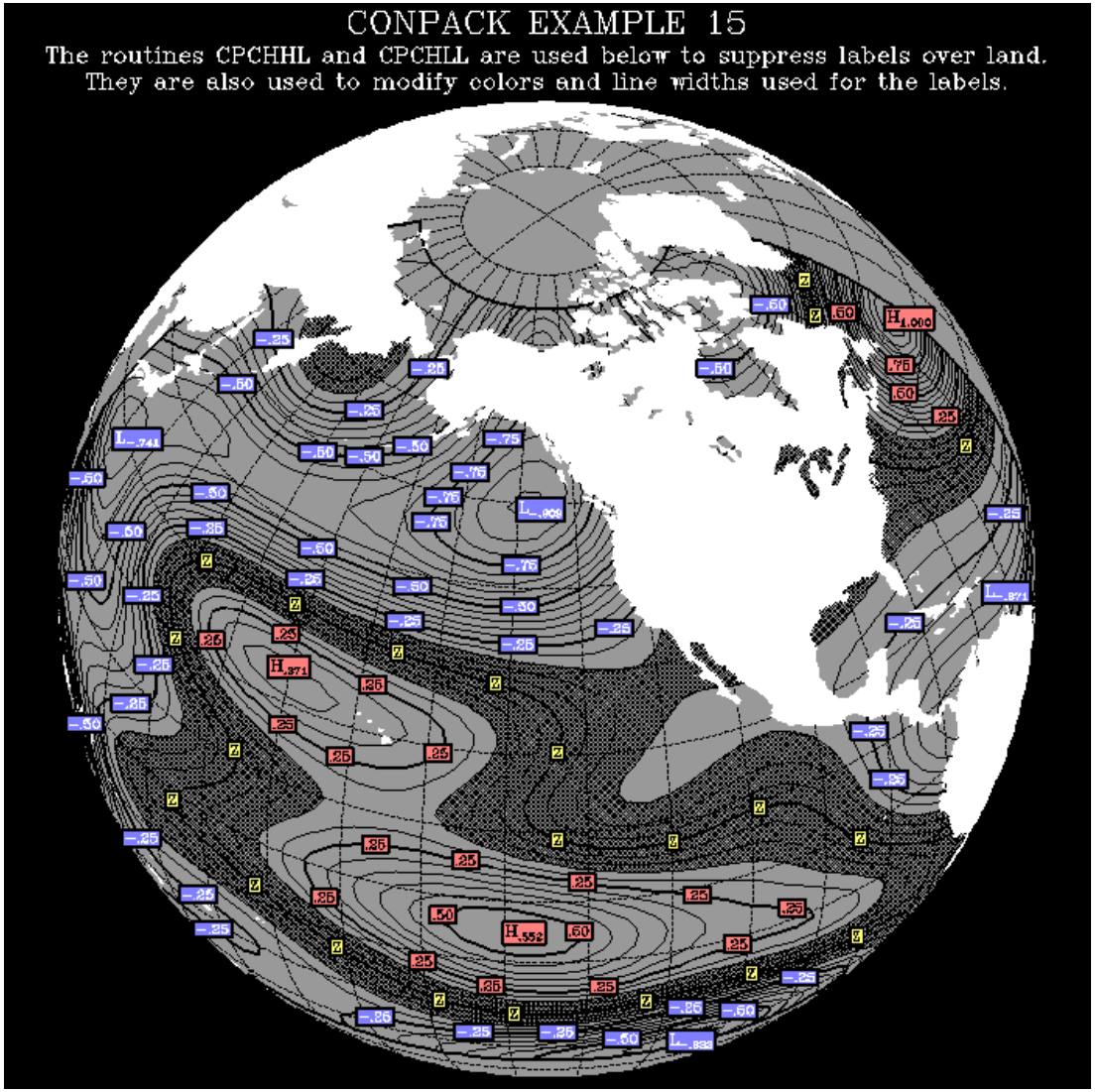
WXP


Sfc Prec/SLPres/1000–500mb Thick
RUC4 analysis for 18Z 11 OCT 17
Sfc Prec/SLPres/1000–500mb Thick
RUC4 3 hour valid 21Z WED 11 OCT 17
Sfc Prec/SLPres/1000–500mb Thick
RUC4 5 hour valid 23Z WED 11 OCT 17
Sfc Prec/SLPres/1000–500mb Thick
RUC4 7 hour valid 01Z THU 12 OCT 17
©UNISYS

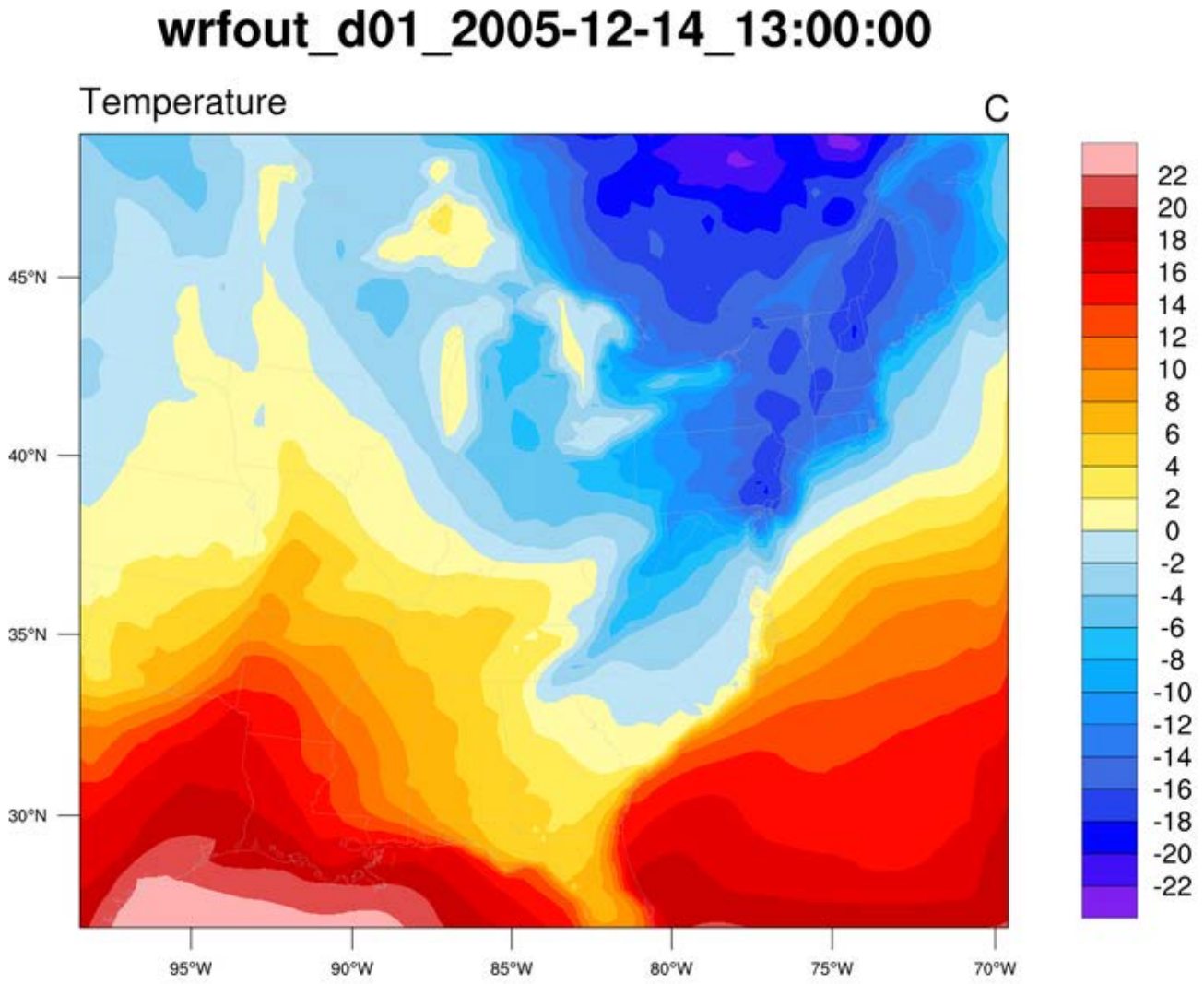
GrADS


°F at 02Z Tue 17 OCT, 2017
-50 -45 -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120

NCAR Graphics



NCL


wrfout_d01_2005-12-14_13:00:00
Temperature
C
45°N
40°N
35°N
30°N
95°W
90°W
85°W
80°W
75°W
70°W
22
20
18
16
14
12
10
8
6
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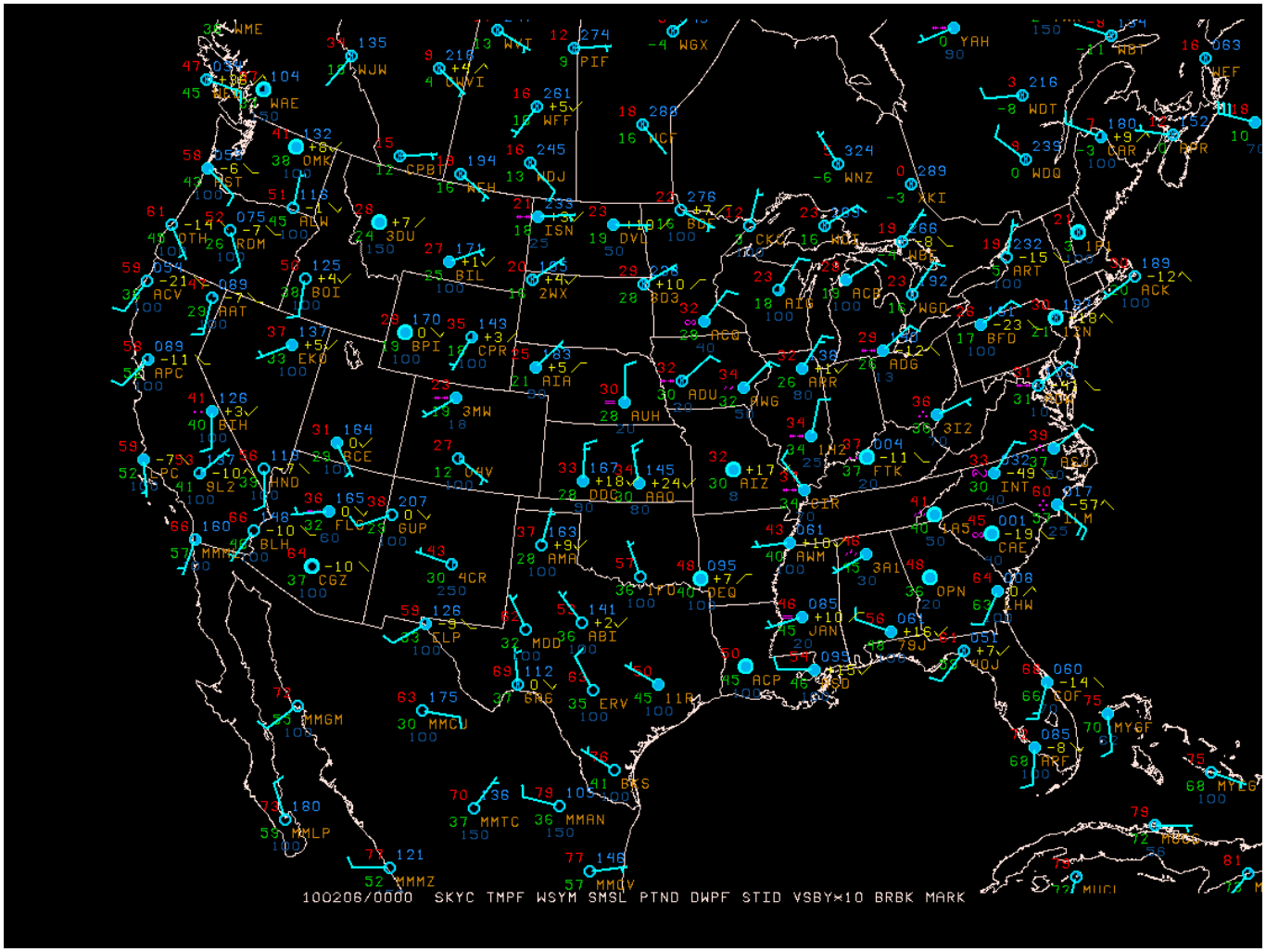
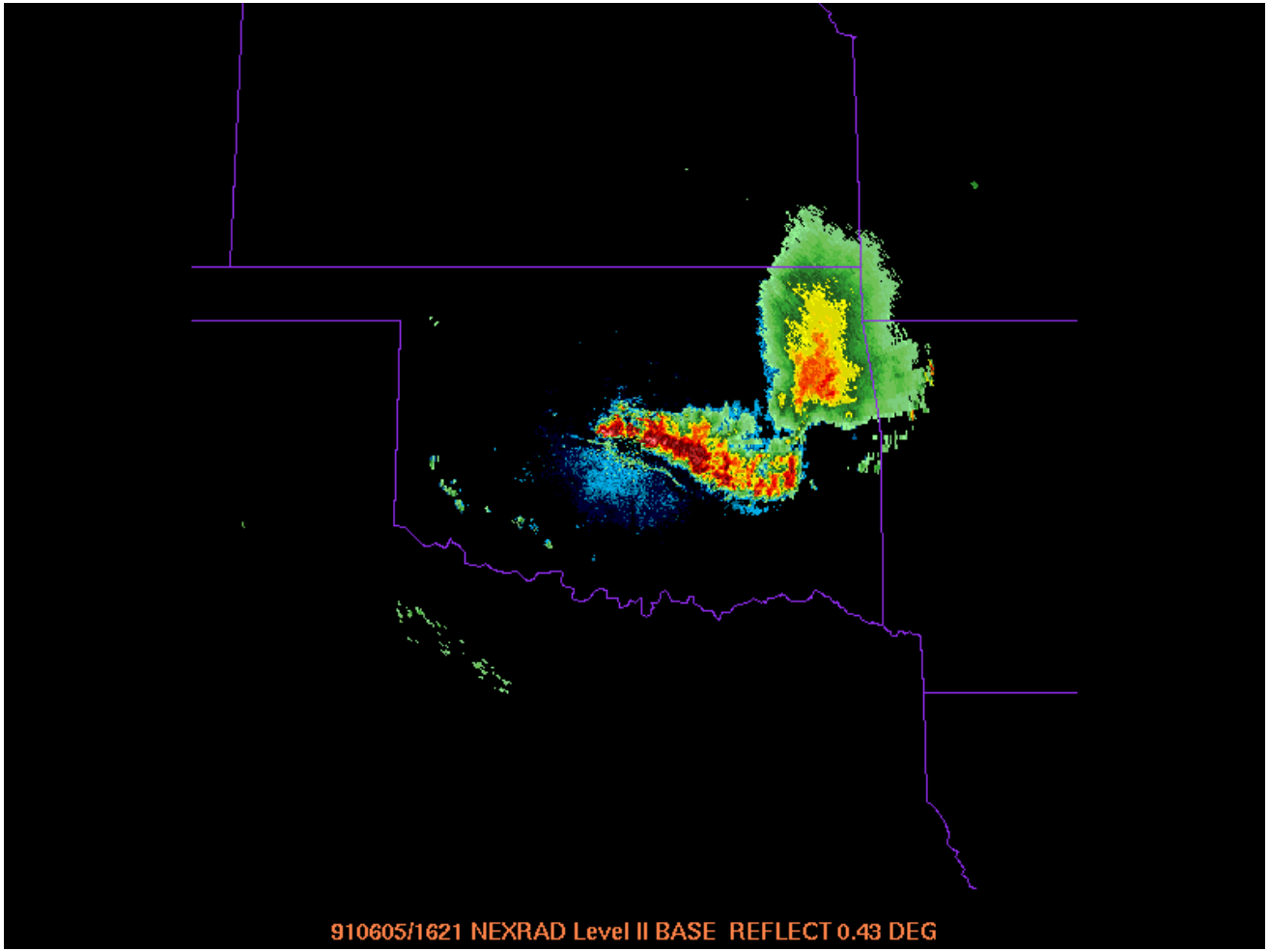
-18
-20
-22

GEMPAK

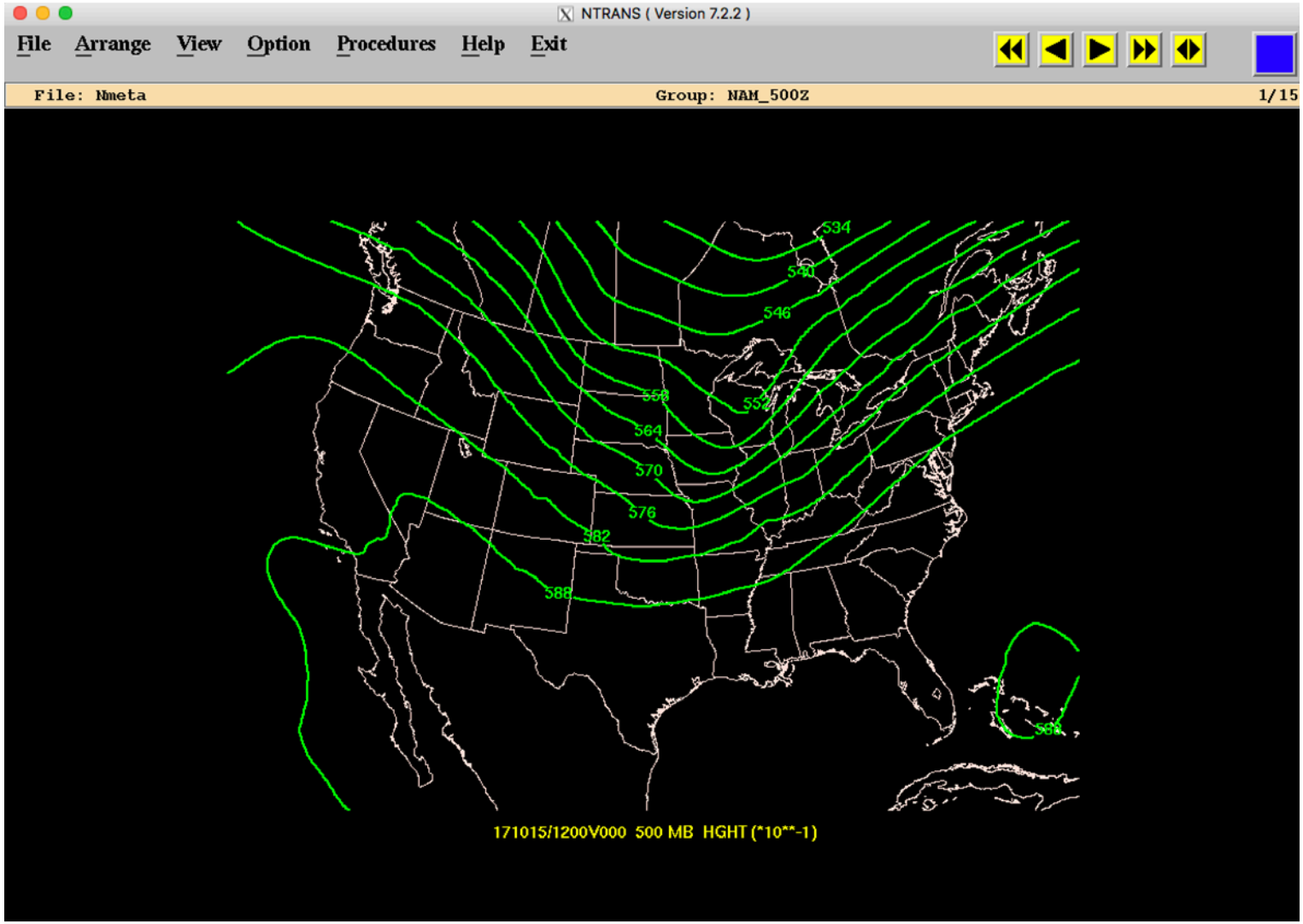

100206/0000 SKYC TMPF WSYM SMSL PTND DWPF STID VSBY×10 BRBK MARK

Radar Imagery (WSR-88D)

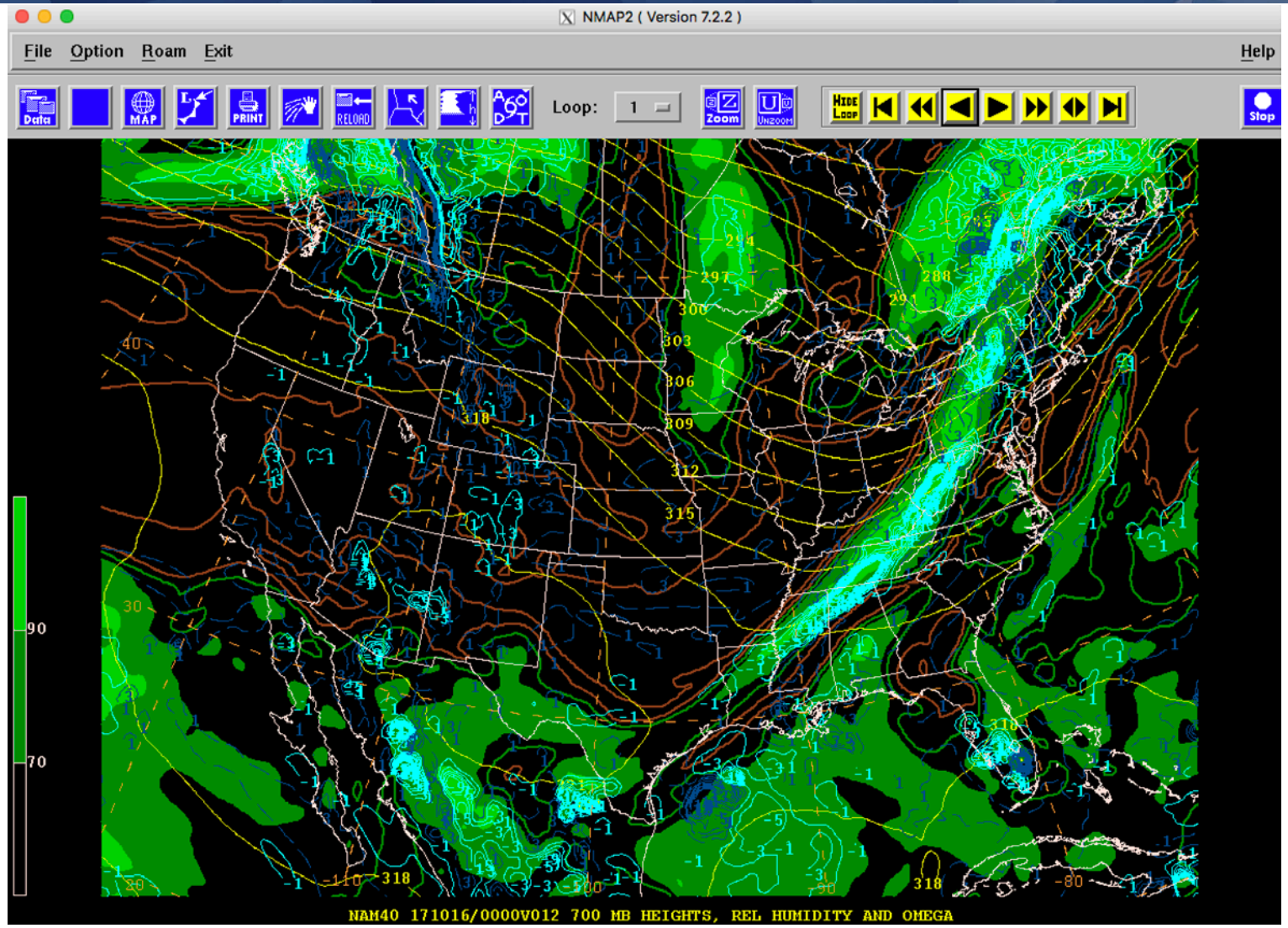


Stepping I”N”to I”N”teractivity: N-AWIPS

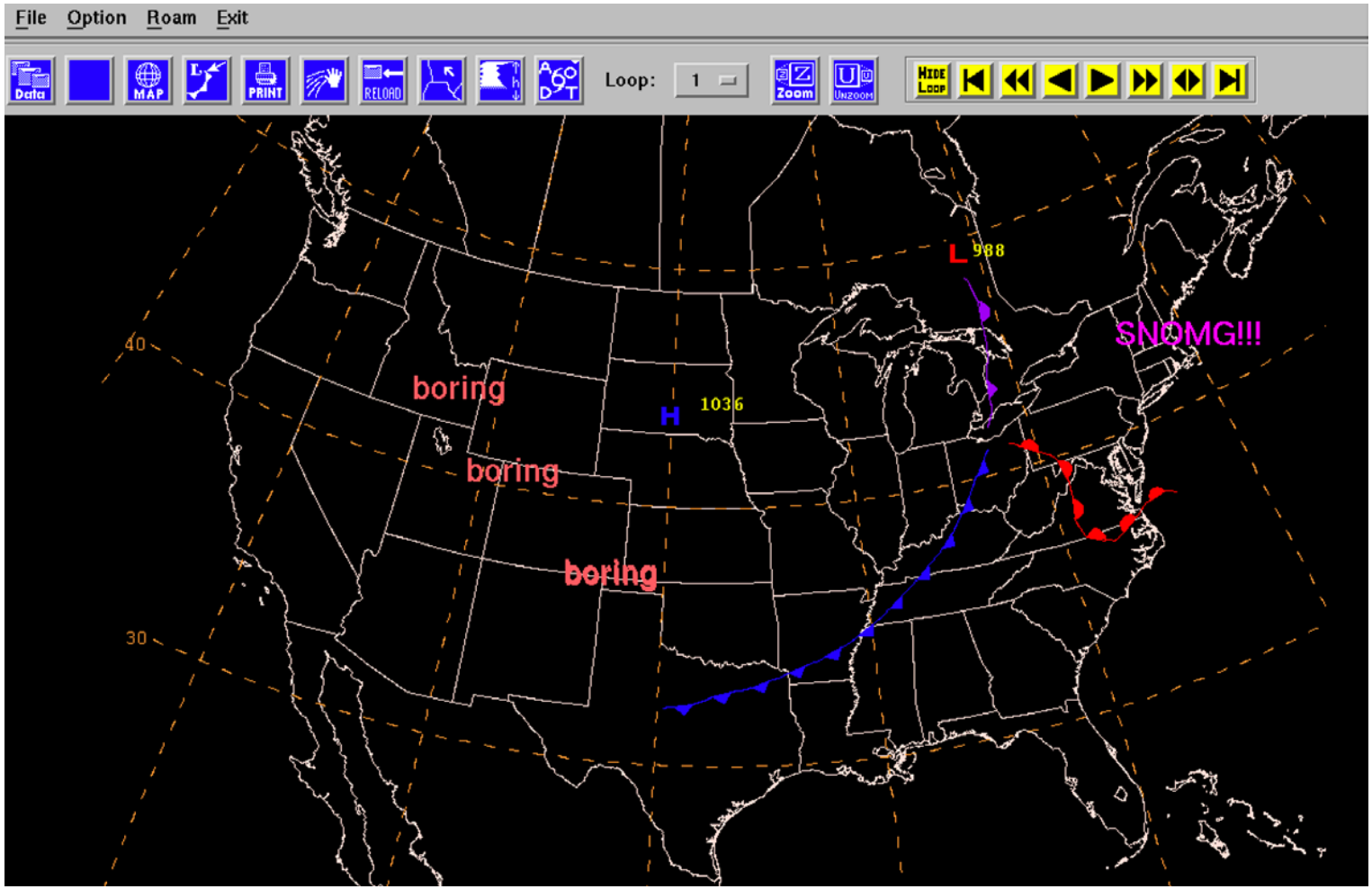
NTRANS


NTRANS (Version 7.2.2)
File
Arrange
View
Option
Procedures
Help
Exit
File: Nmeta
Group: NAM_500Z
1/15
534
540
546
552
558
564
570
576
582
588
171015/1200V000 500 MB HGHT (*10**-1)

NMAP(2)


NMAP2 (Version 7.2.2)
File Option Roam Exit
Help
Data
MAP
PRINT
RELOAD
Loop:
1
Zoom
UNZOOM
HIDE LOOP
Stop
90
70
NAM40 171016/0000V012 700 MB HEIGHTS, REL HUMIDITY AND OMEGA

NMAP(2)


File Option Roam Exit
Data
MAP
PRINT
RELOAD
Loop: 1
Zoom
Unzoom
Hide Loop
L 988
H 1036
SNOMG!!!
boring
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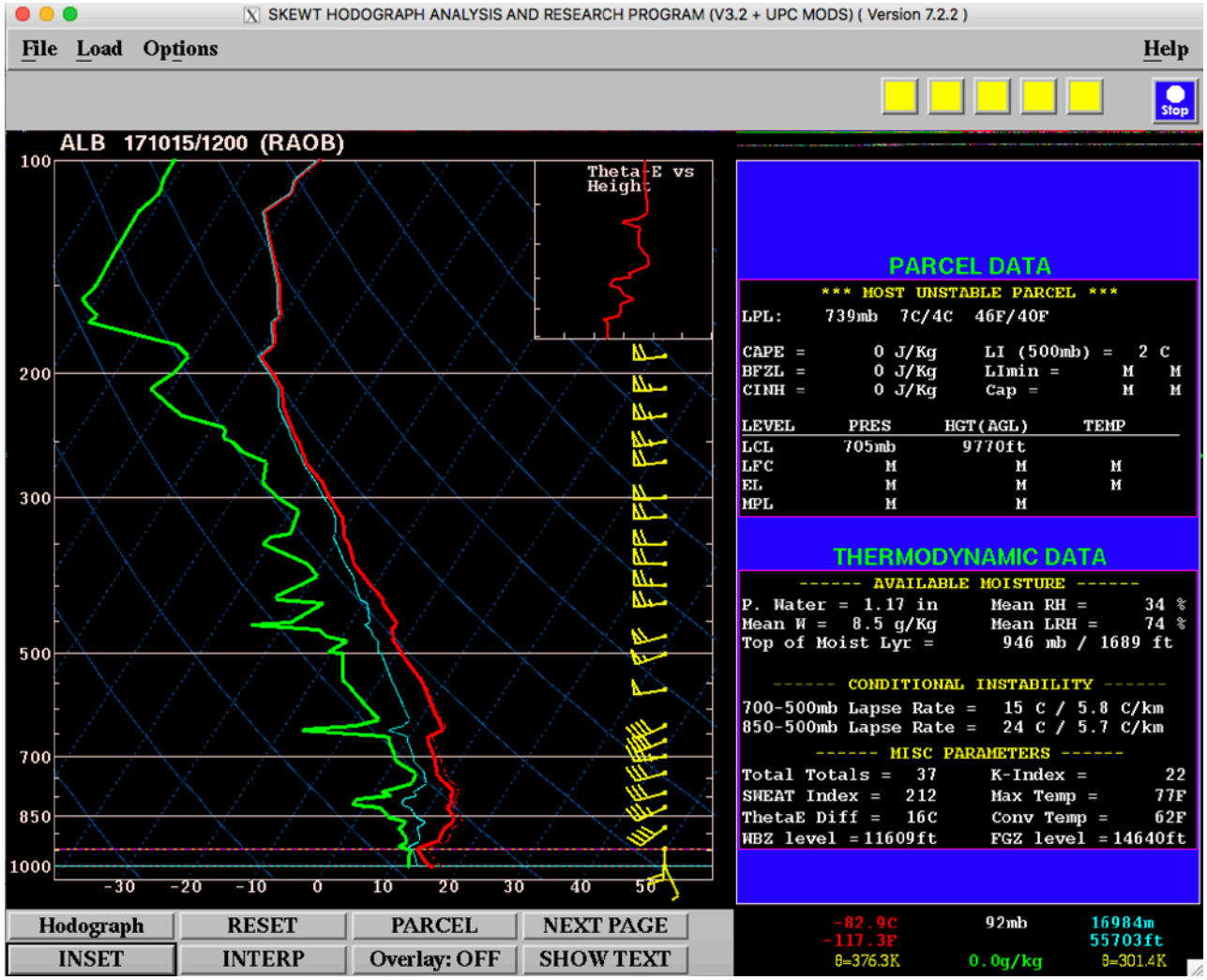
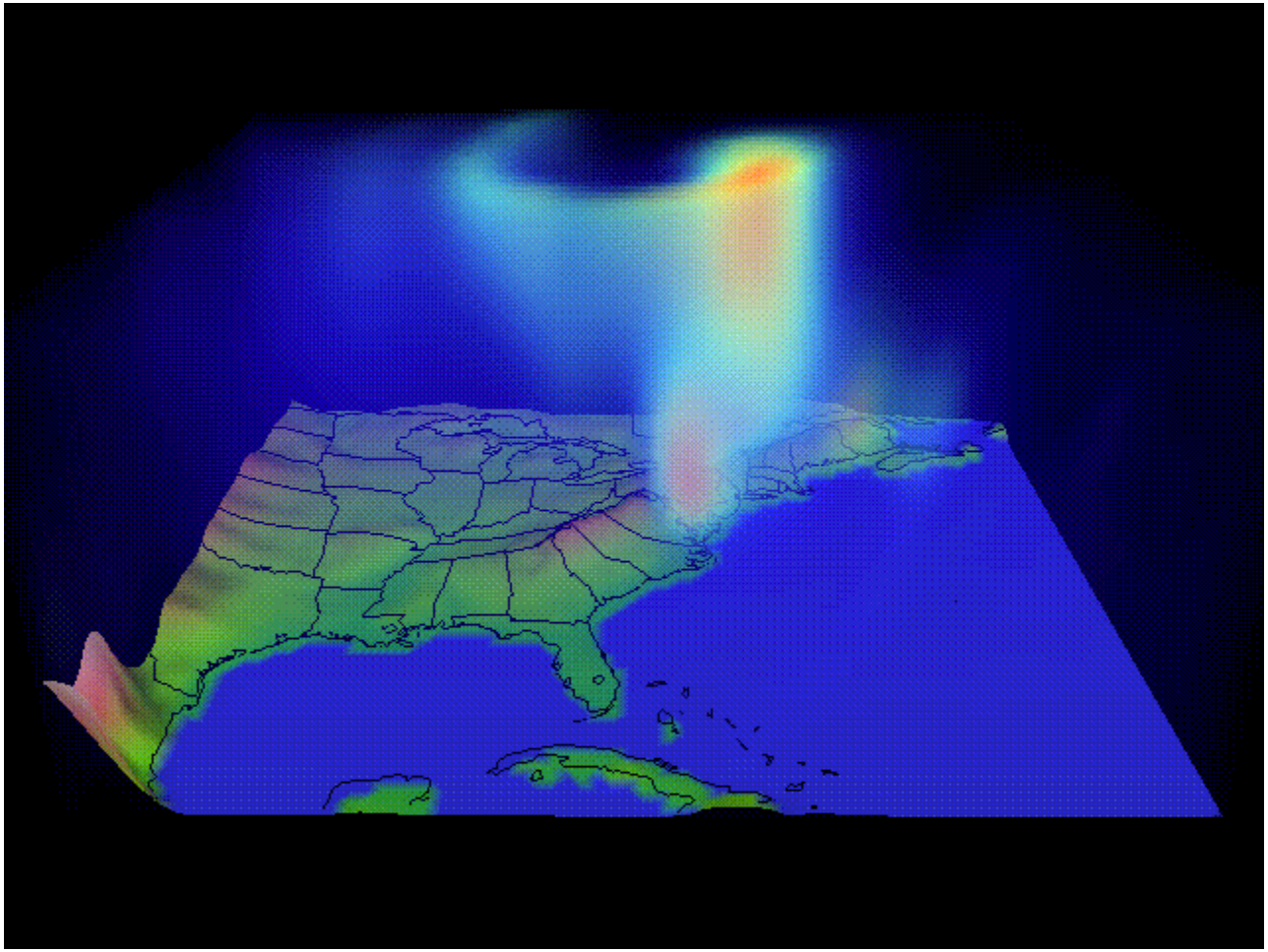
boring
40
30

NSHARP

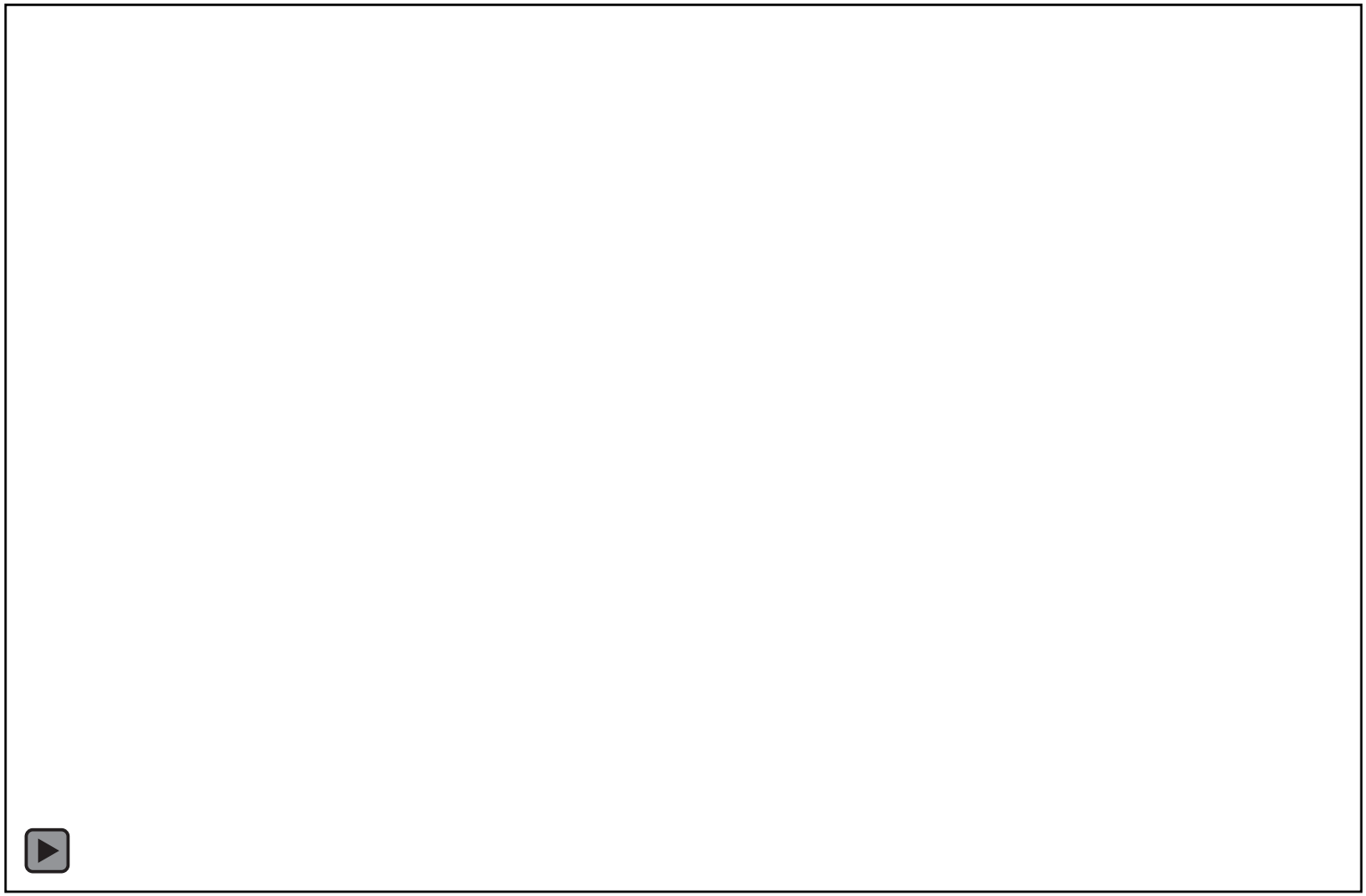


3-D Visualization: Vis5D, IDV

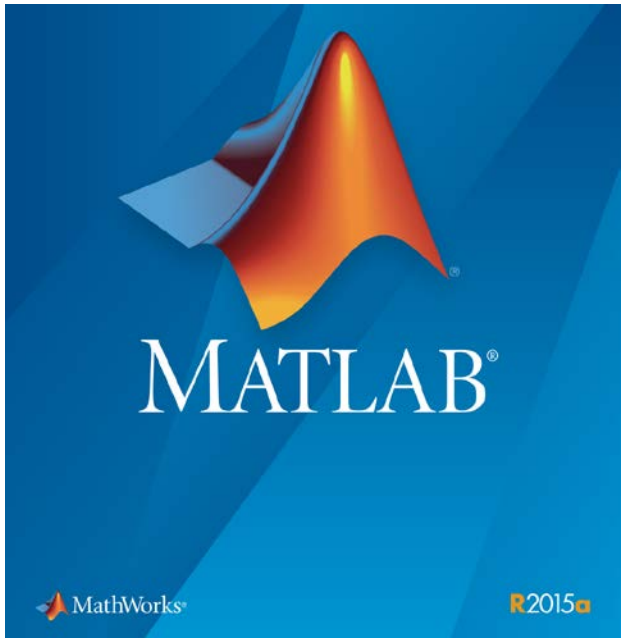
Vis5D



IDV



Others



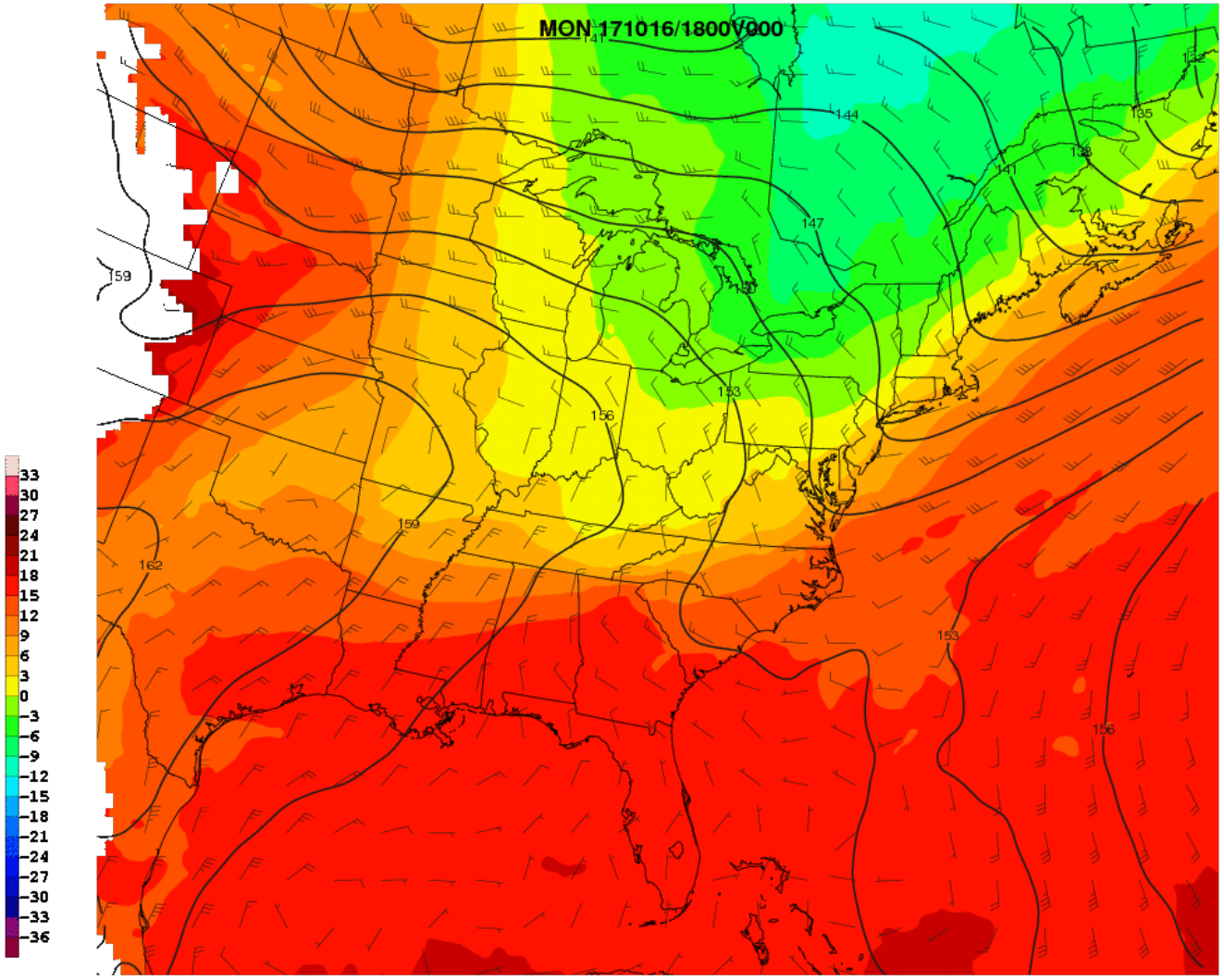
IDL

VAPOR
Visualization & Analysis Platform

AWIPS

Visualization Products: Static Graphics

GEMPAK


MON 171016/1800V000
33
30
27
24
21
18
15
12
9
6
3
0
-3
-6
-9
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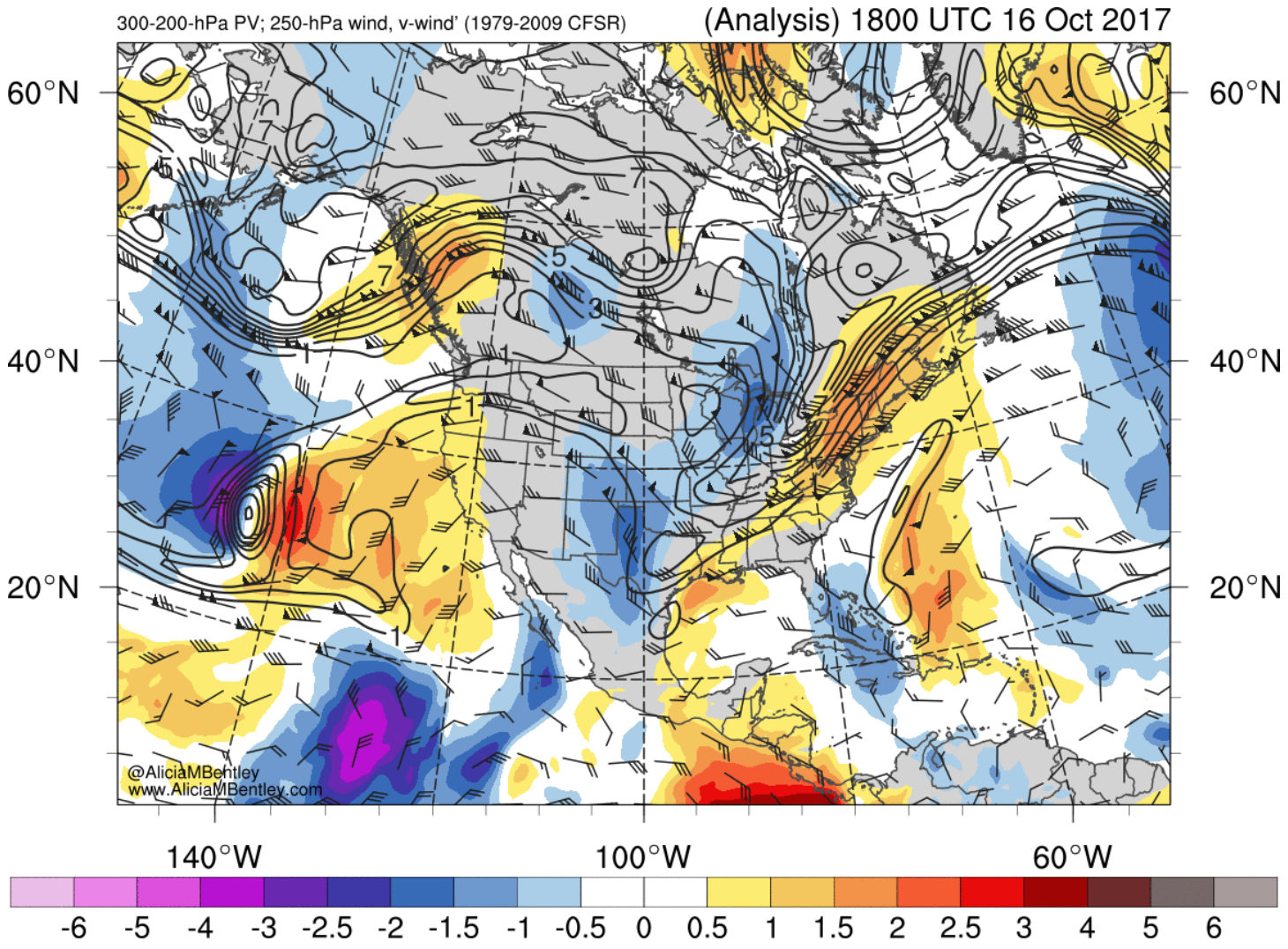
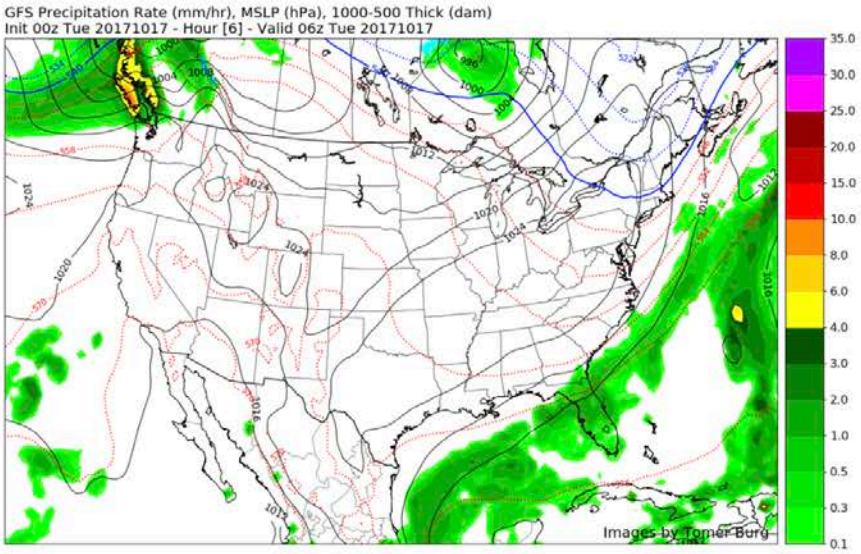
-15
-18
-21
-24
-27
-30
-33
-36

NCL

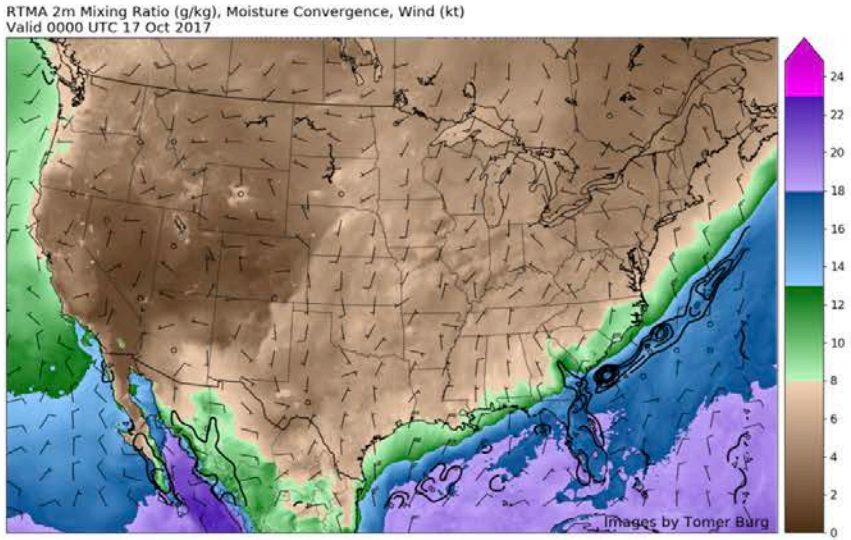


Python

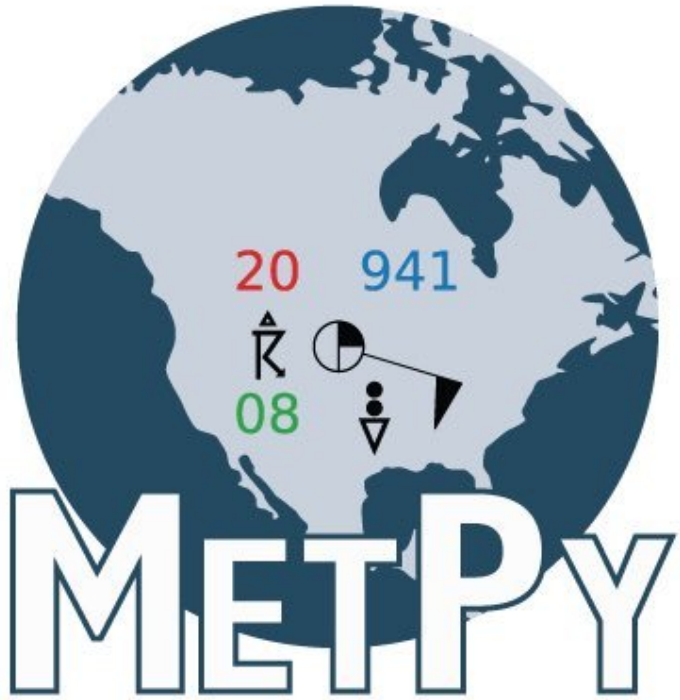
Real Time Model Guidance (GFS & NAM)

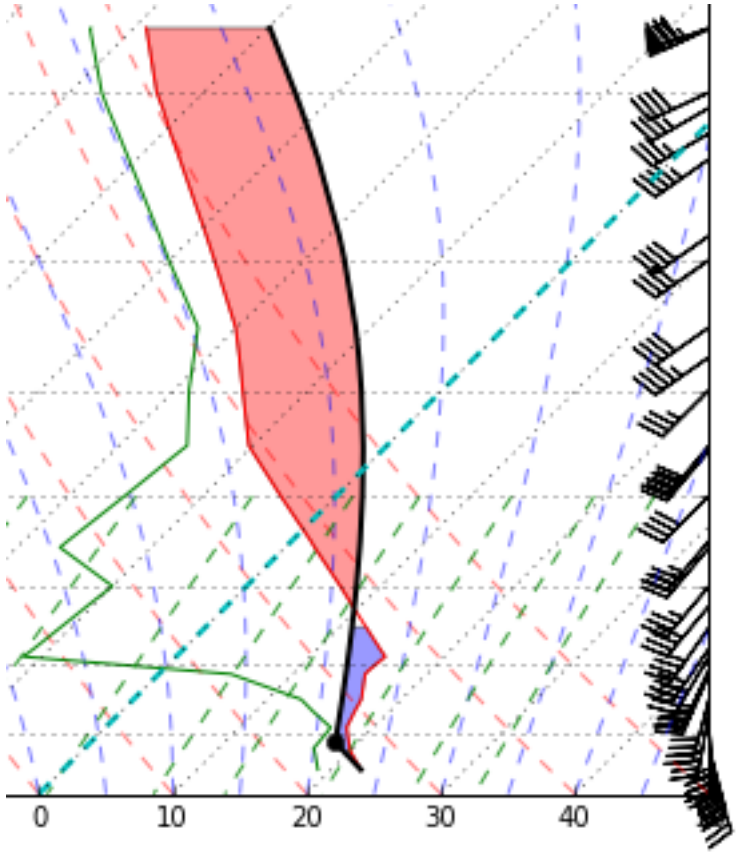


Real Time Mesoscale Analysis (RTMA)



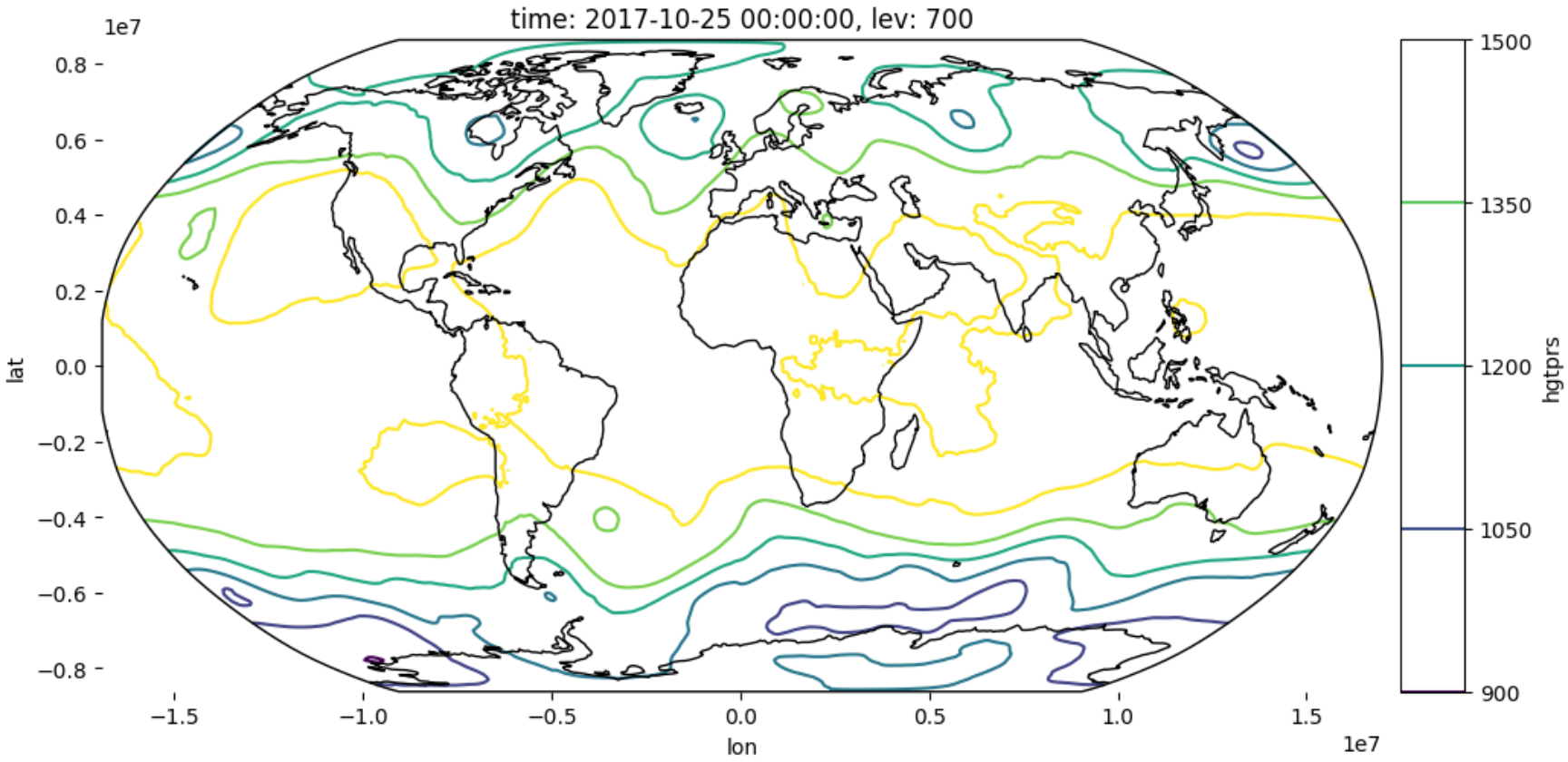
Python



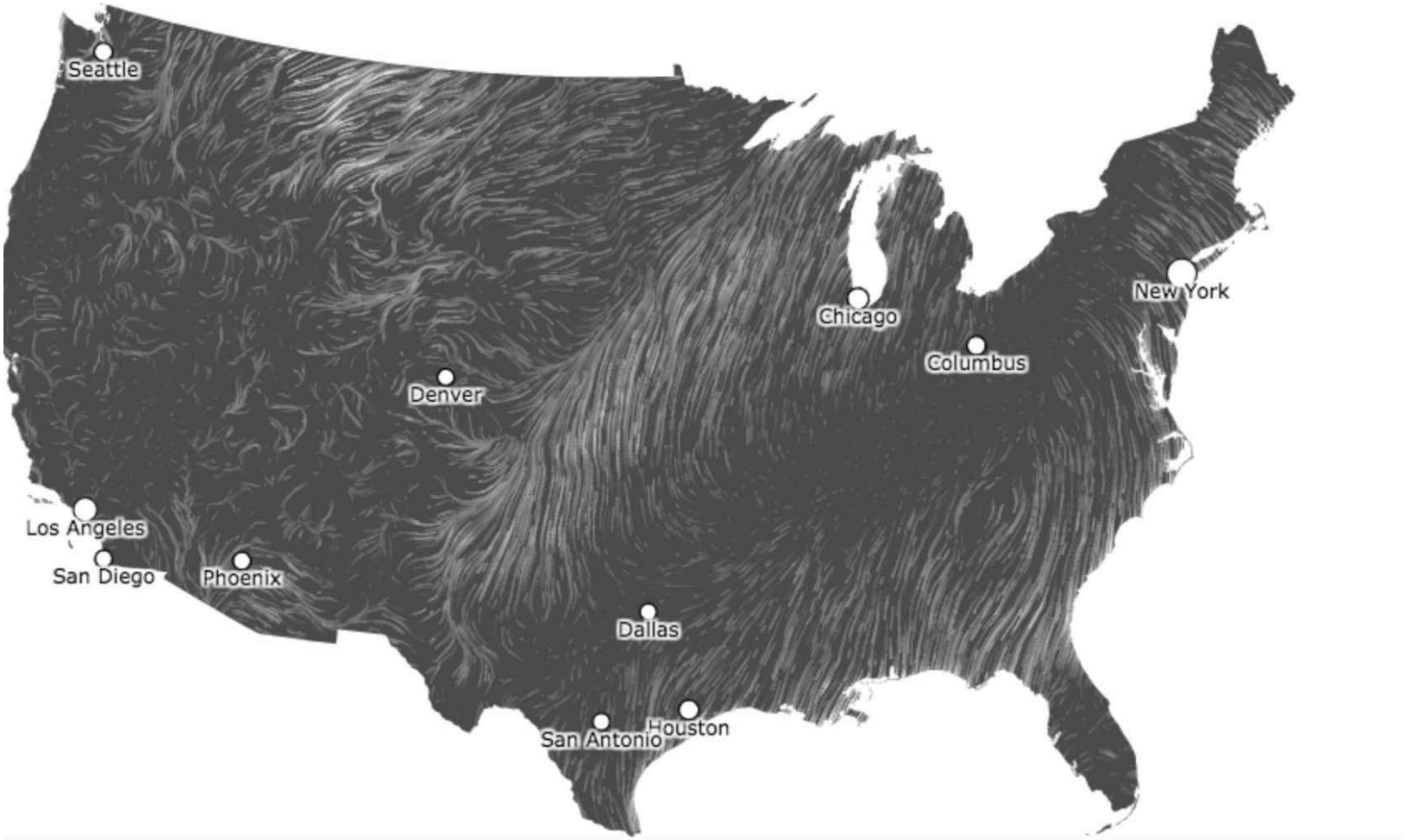


Interactivity in the Browser

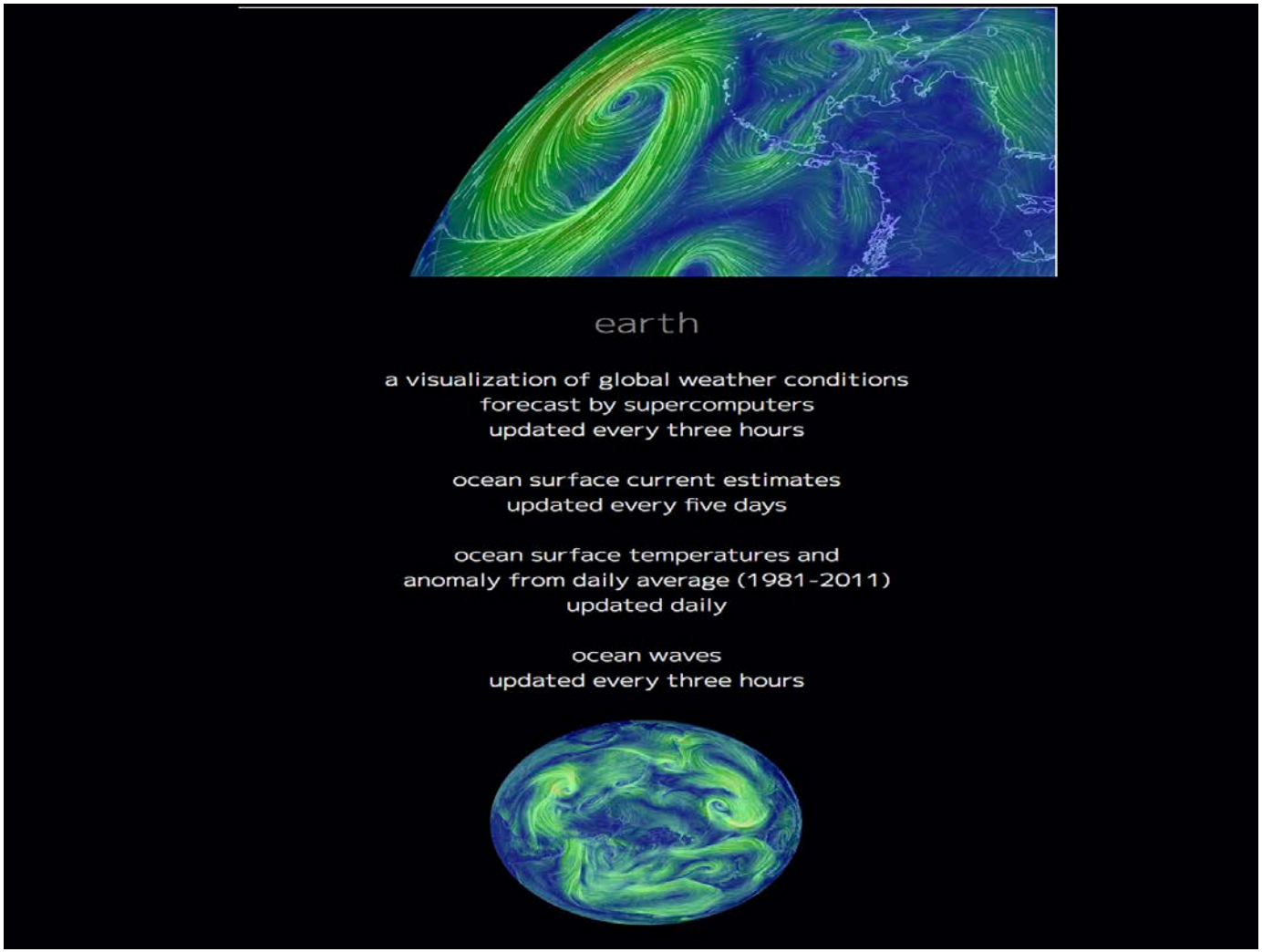
Jupyter / Geoviews



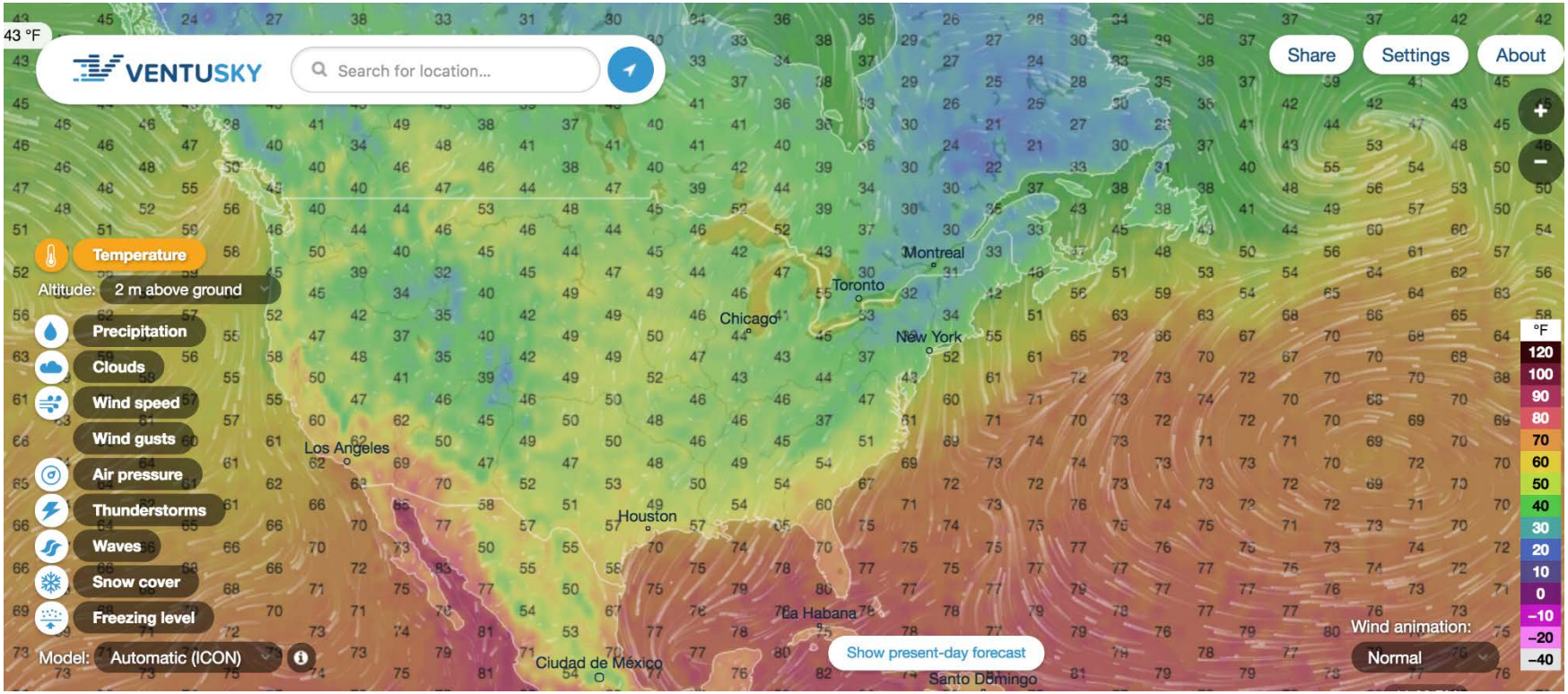
Hint.wind.fm and its Offspring



Earth.nullschool.net

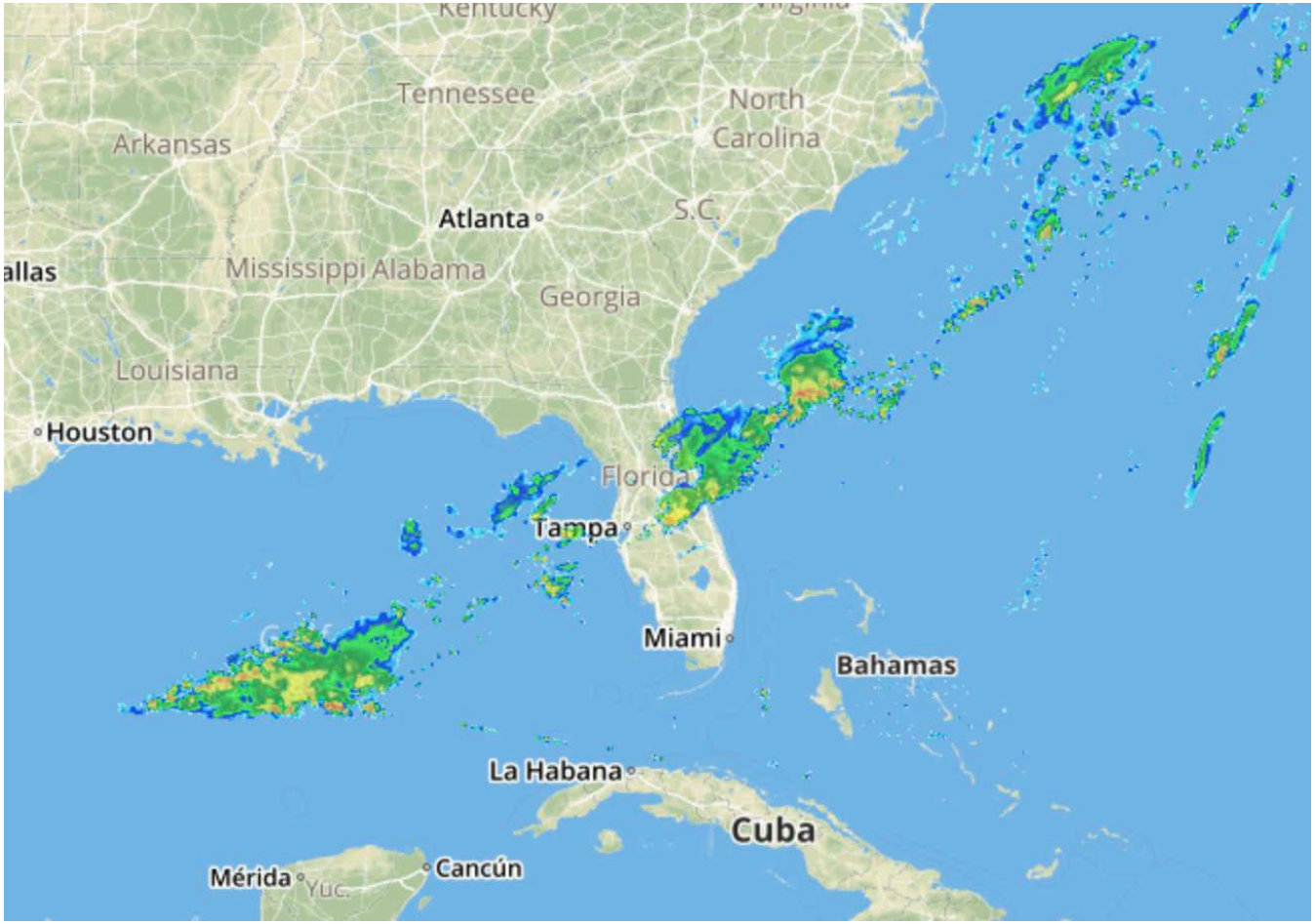


Ventusky

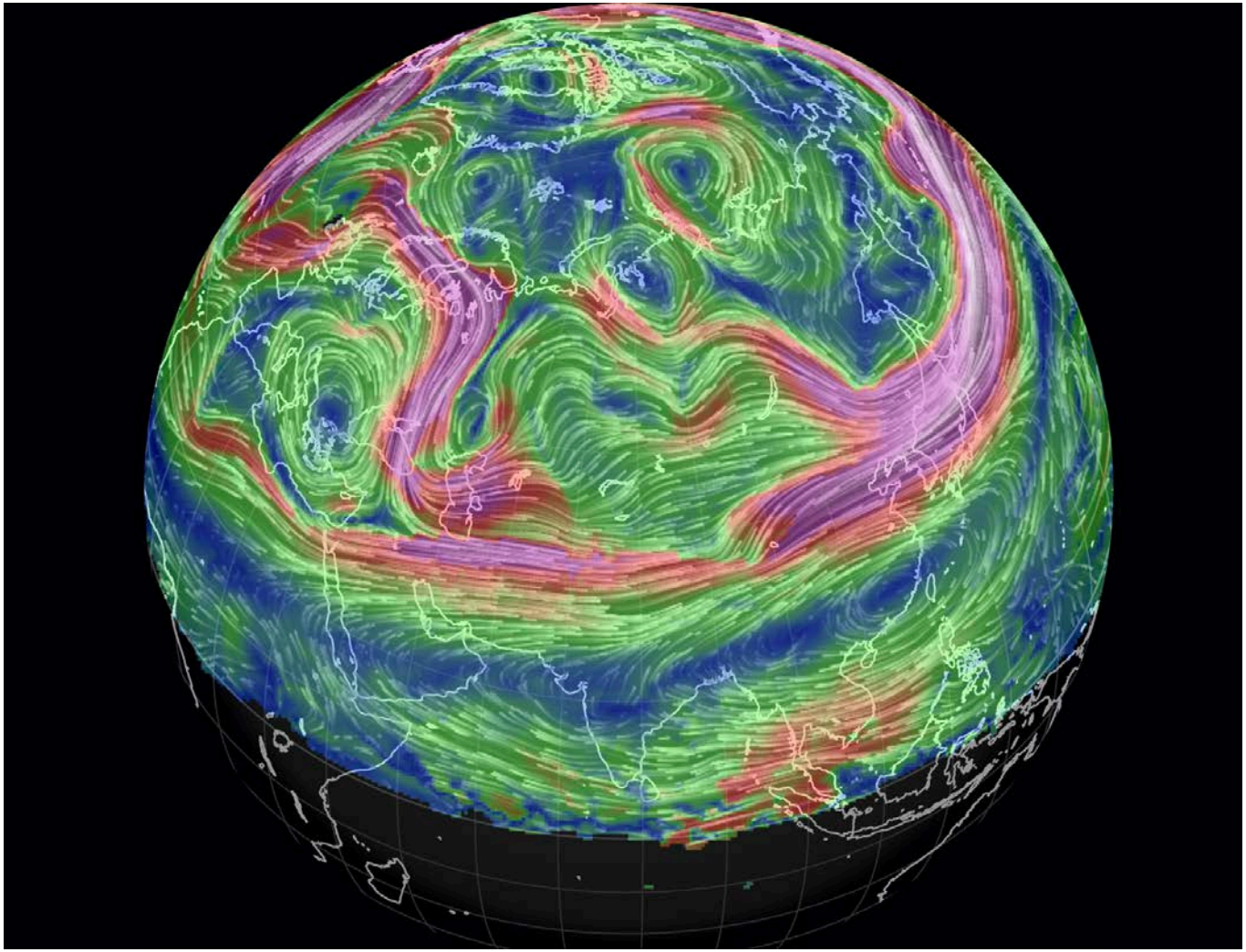

43 °F
VENTUSKY
Search for location...
Share
Settings
About
Temperature
Altitude: 2 m above ground
Precipitation
Clouds
Wind speed
Wind gusts
Air pressure
Thunderstorms
Waves
Snow cover
Freezing level
Model: Automatic (ICON)
Show present-day forecast
Wind animation:
Normal
°F
120
100
90
80
70
60
50
40
30
20
10
0
−10
−20
−40
Montreal
Toronto
Chicago
New York
Los Angeles
Houston
La Habana
Ciudad de México
Santo Domingo

WMS / OpenLayers / Leaflet

WMS / OpenLayers / Leaflet



”Nullschool” with winds on DT



WxAtlas: Leveraging Databases

WxAtlas

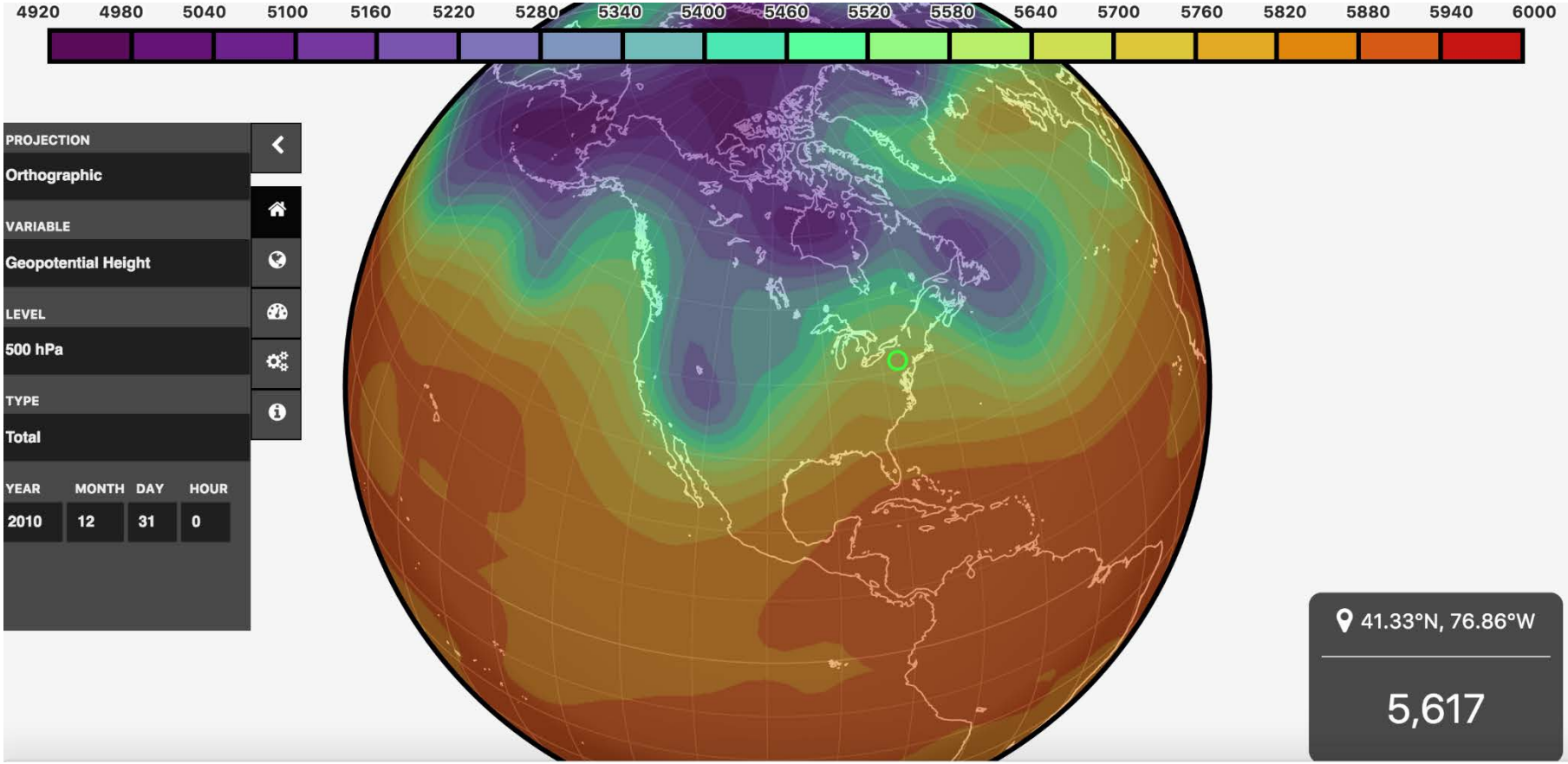

HTML


WebGL


React
A JAVASCRIPT LIBRARY FOR BUILDING USER INTERFACES


PostgreSQL

WxAtlas

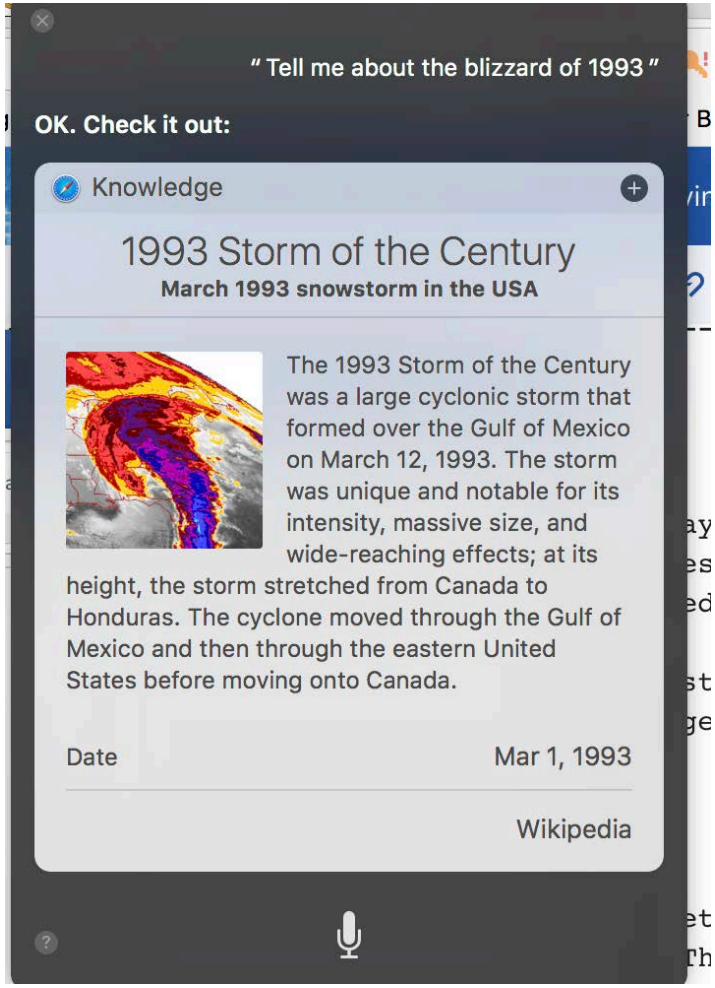


Larry Gloeckler (UAlbany DAES) and AVAIL (UAlbany Geography & Planning)

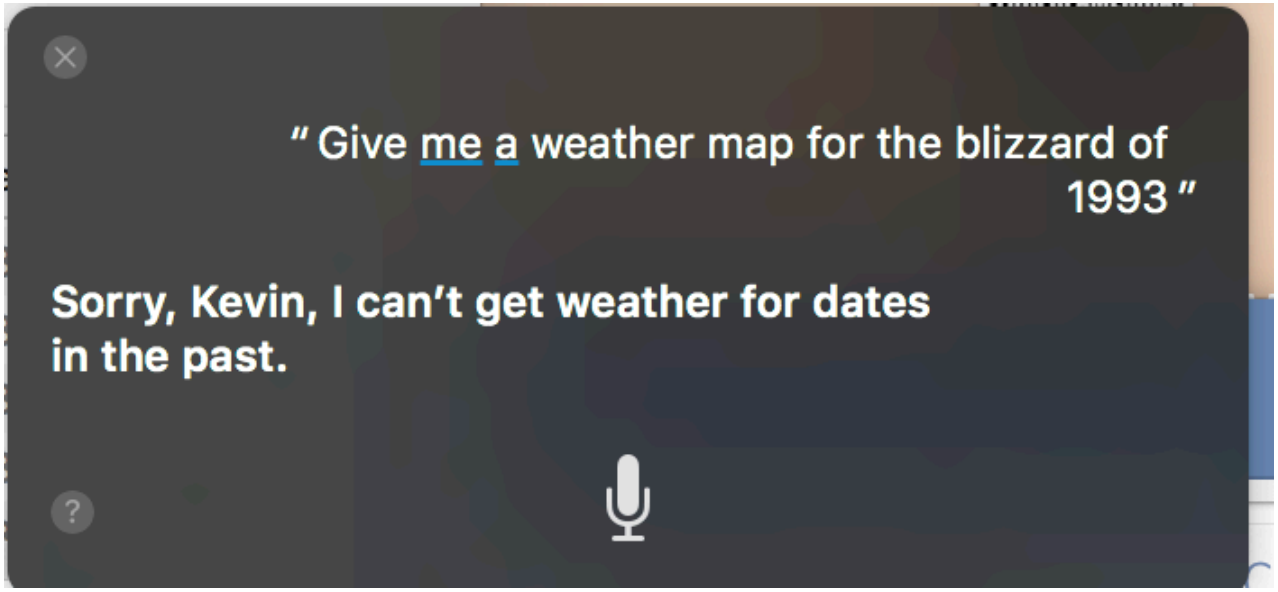
The Future

Alexa / Siri

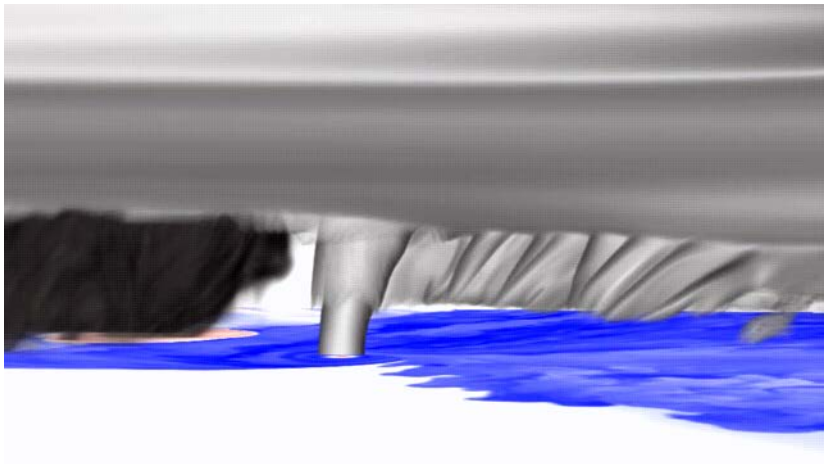
Alexa / Siri


" Tell me about the blizzard of 1993 "
OK. Check it out:
Knowledge
1993 Storm of the Century
March 1993 snowstorm in the USA
The 1993 Storm of the Century was a large cyclonic storm that formed over the Gulf of Mexico on March 12, 1993. The storm was unique and notable for its intensity, massive size, and wide-reaching effects; at its height, the storm stretched from Canada to Honduras. The cyclone moved through the Gulf of Mexico and then through the eastern United States before moving onto Canada.
Date
Mar 1, 1993
Wikipedia

Alexa / Siri


" Give me a weather map for the blizzard of 1993 "
Sorry, Kevin, I can't get weather for dates in the past.

GPU Visualization



Leigh Orf's Tornado Visualization: http://orf.media/

Acknowledgments

Lance Bosart & Dan Keyser

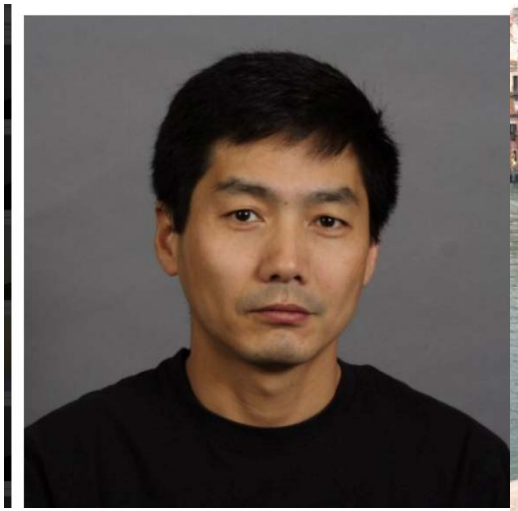
Gary Lackmann

Scott Jacobs

David Knight

Steve Chiswell “Chiz”

Yuan Ho, Don Murray, Jeff McWhirter



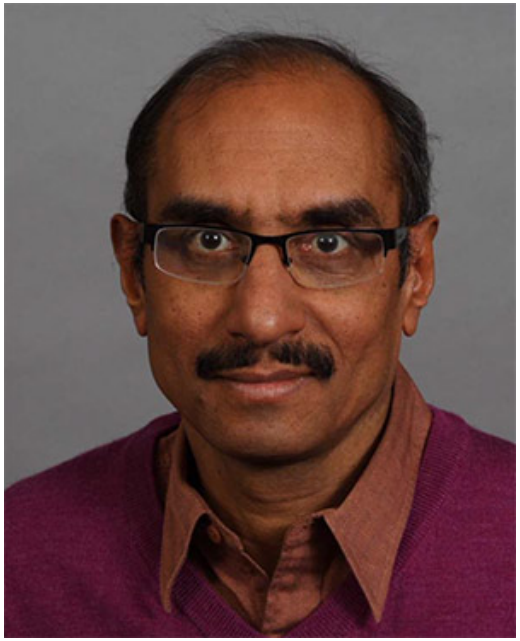
Larry Gloeckler & AVAIL

AVAIL

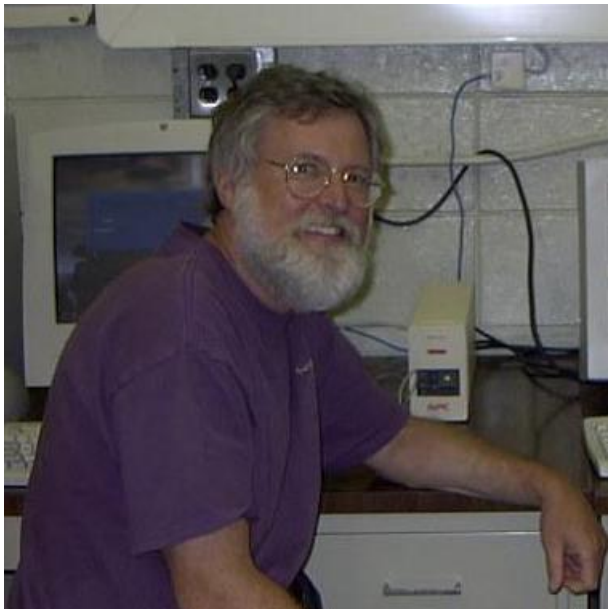
Albany Visualization And Informatics Labs

Ross Lazear

Mohan Ramamurthy



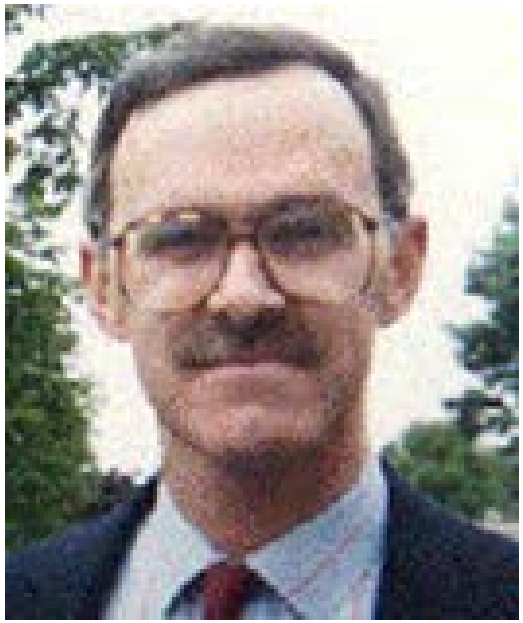
Tom Yoksas



Gilbert Sebenste

Daryl Herzmann

Russell DeSouza



And one final admonition before we adjourn …

And one final admonition before we adjourn …

Always remember to run **gpend**!!

Thank you!!!

Questions?

Extra Slides

okay, so I've looked a little deeper and here's how it breaks down:
~65% raw gridded data - 700GB/1.07TB
~33% indexes - 350GB/1.07TB
the remaining ~2% comprises header tables, coefficient tables, and sequences
so the large majority makes up just raw gridded data
and... "also ... is any of the grid info transmitted in JSON? Or is it all just read in from postgres?"
yes, the data is pulled from the database and serialized to a JSON formatted string
we use the simplejson library to do that, and 'dumps' method
i.e., simplejson.dumps(data)
the serialized JSON string looks like:
{'header': {'lo1': 0, 'la1': 90, 'dx': 2.5, 'dy': 2.5, 'nx': 144, 'ny': 73}, 'data': [long_list_of_all_data_values_to_be_plotted]}
in other words, it's just a JavaScript object of key, value pairs
keys are 'header' and 'data', and values are either another object of key, value pairs, or a list containing the actual data
the data structure is analogous to nested dictionaries in Python
that's how JS handles data
and that's how Cambecc formats his data -- he runs the grib files through the grib2json converter and produces exactly what I showed above