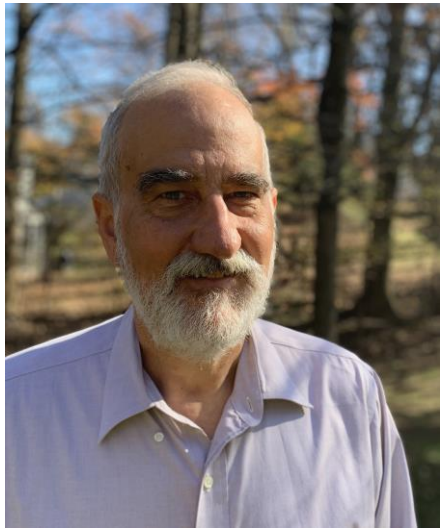
The National Weather Service Whole Story Uncertainty and Probabilities Viewer



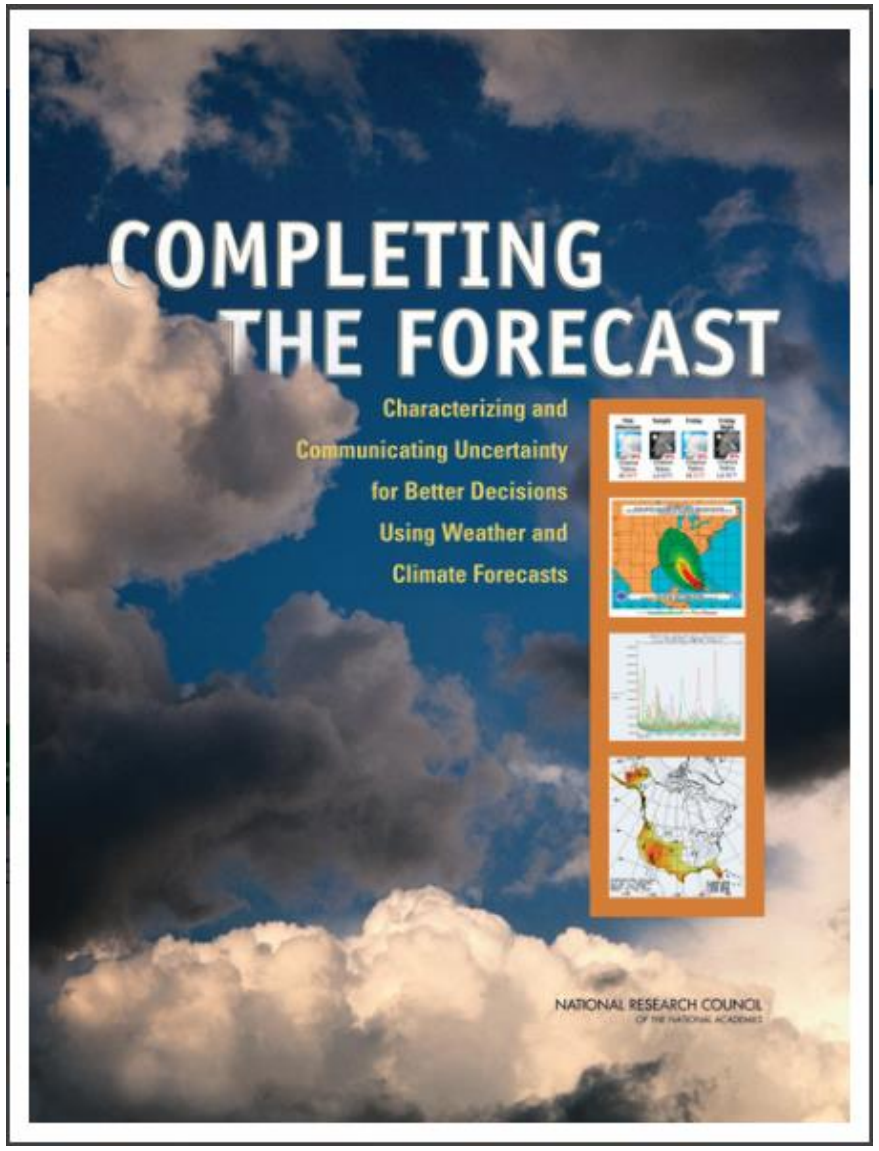
David P. Ruth

Meteorological Development Laboratory
Office of Science and Technology Integration
National Weather Service, NOAA
Silver Spring, Maryland, USA

Dana C. Strom

UEF 2022 – Visualising Meteorological Data

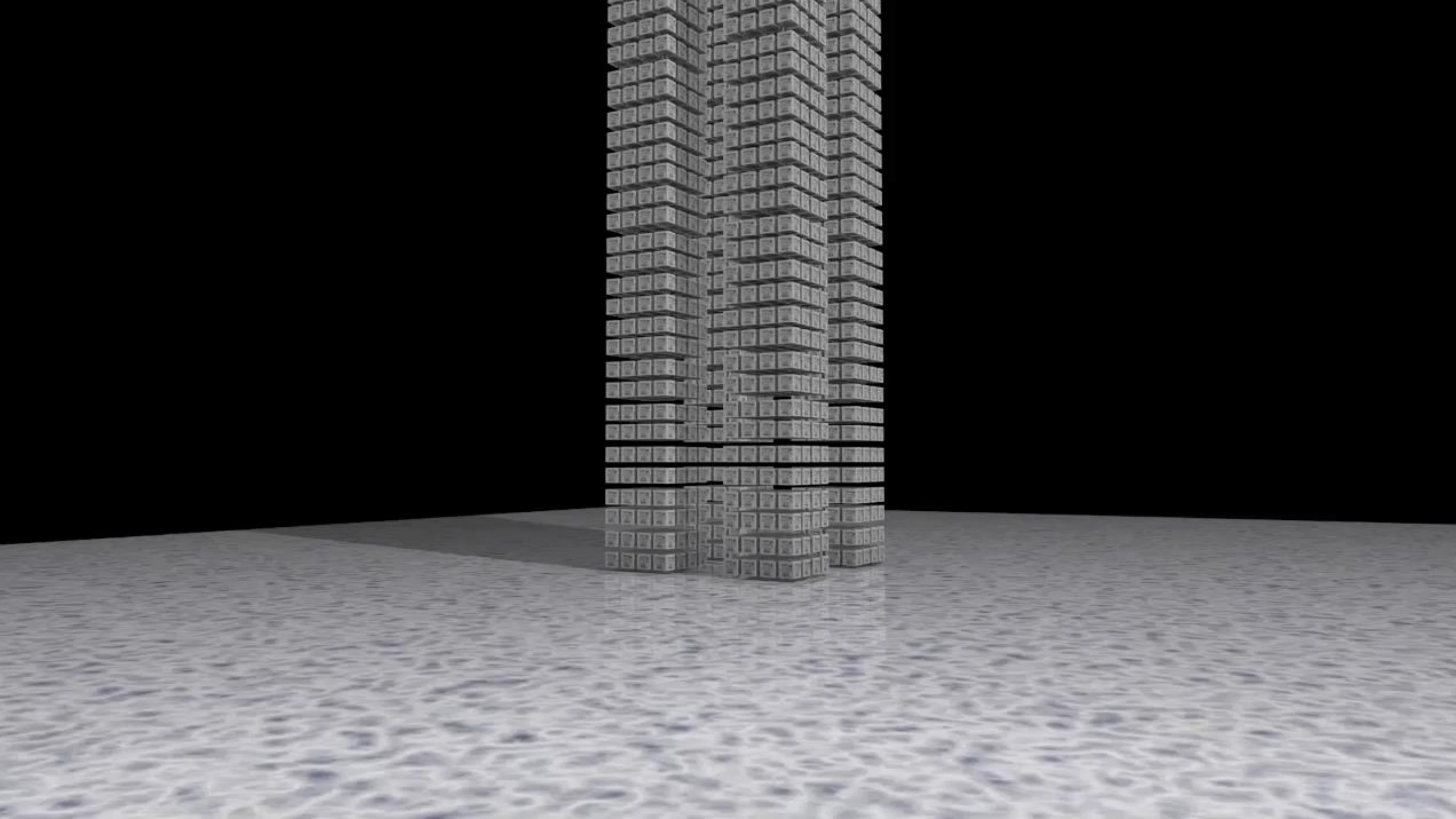
June 9, 2022



Uncertainty is a fundamental characteristic of weather prediction.

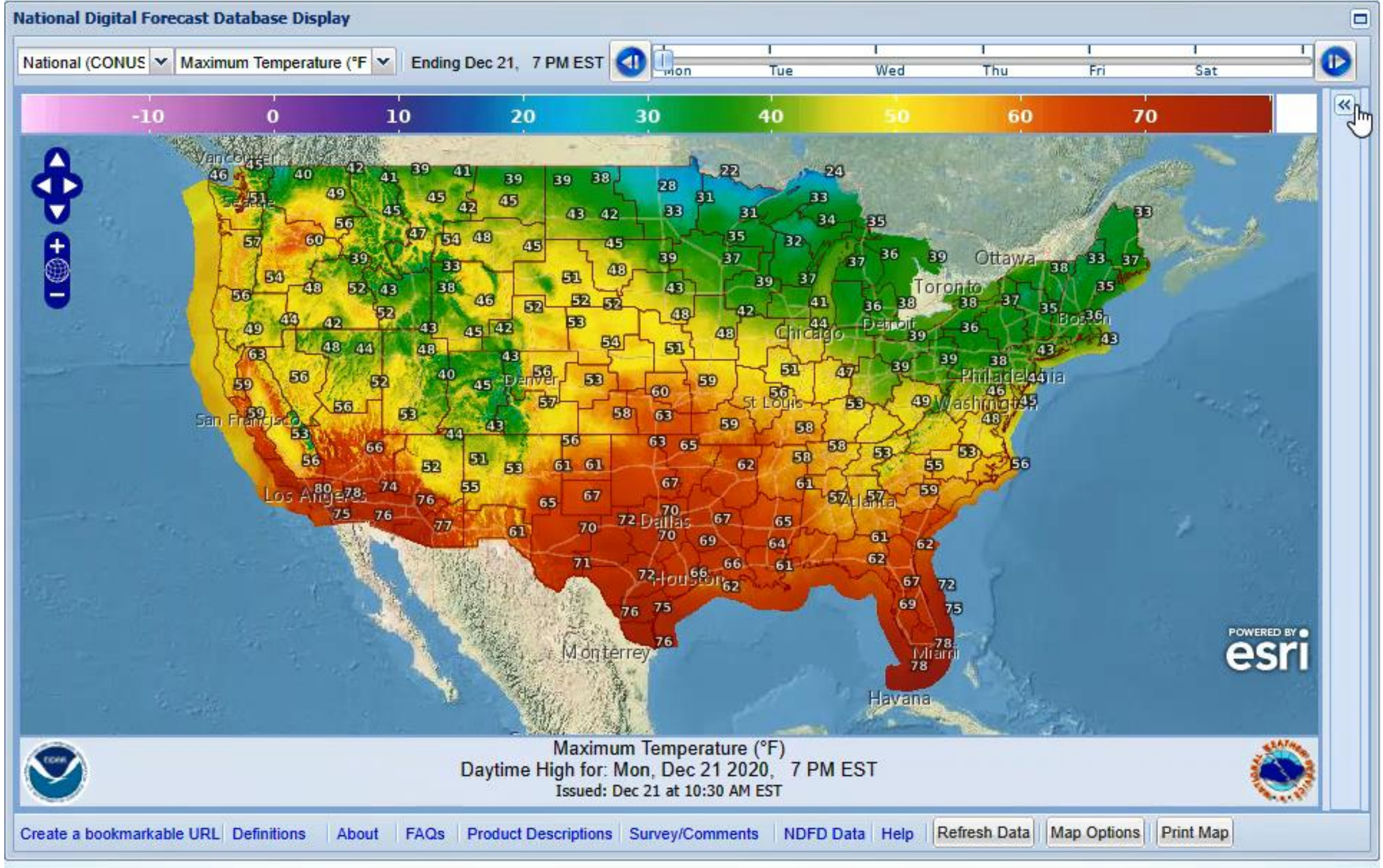
No forecast is complete without a description of its uncertainty.

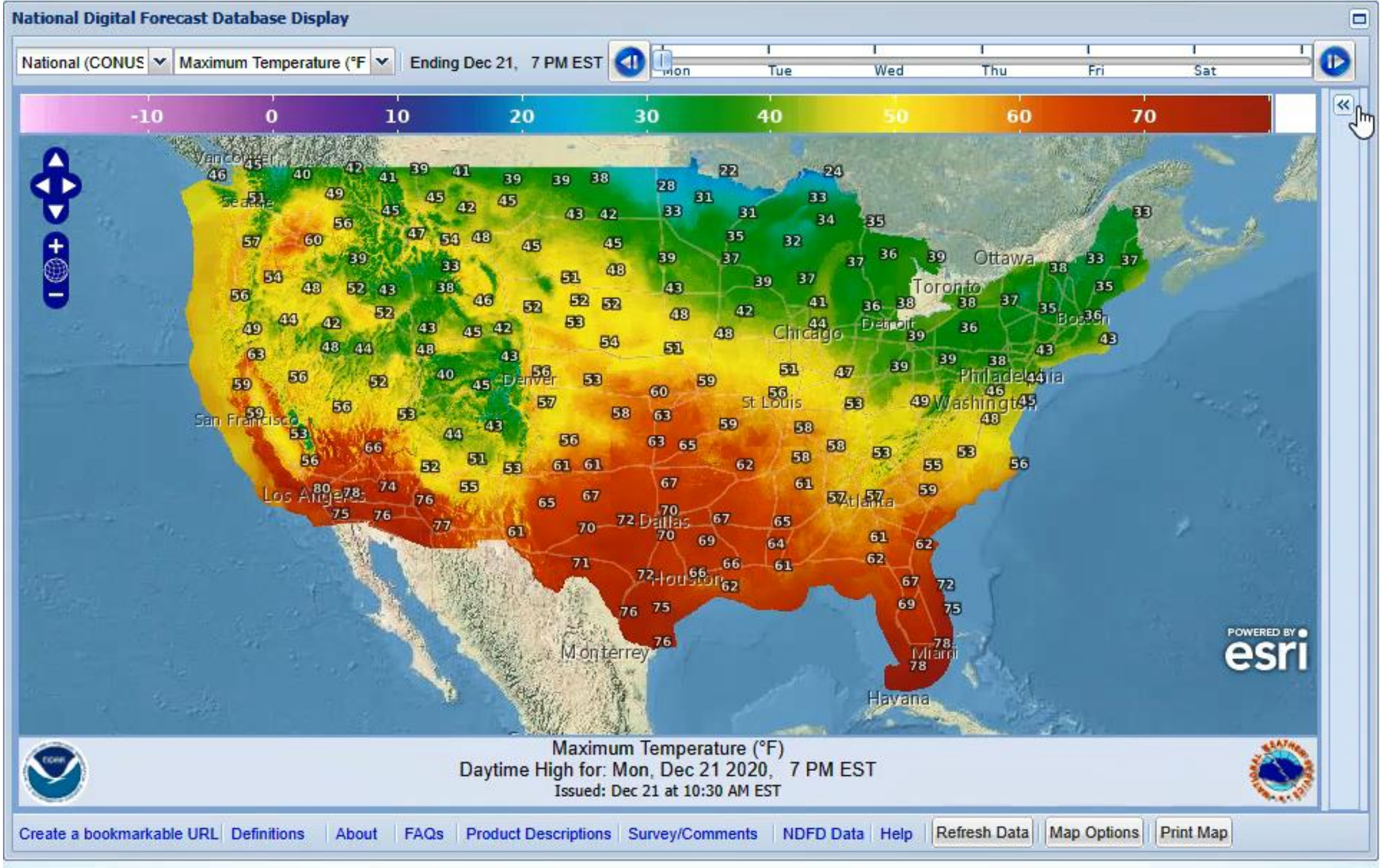
National Research Council - 2006



Single-value deterministic forecast guidance

Whole Story Uncertainty & Probabilities


National Digital Forecast Database Display
National (CONUS
Maximum Temperature (°F
Ending Dec 21, 7 PM EST
Mon
Tue
Wed
Thu
Fri
Sat
-10
0
10
20
30
40
50
60
70
Vancouver
Seattle
Ottawa
Toronto
Chicago
Detroit
Boston
Philadelphia
Washington
Denver
St Louis
San Francisco
Los Angeles
Atlanta
Dallas
Houston
Monterrey
Miami
Havana
POWERED BY esri
Maximum Temperature (°F)
Daytime High for: Mon, Dec 21 2020, 7 PM EST
Issued: Dec 21 at 10:30 AM EST
Create a bookmarkable URL
Definitions
About
FAQs
Product Descriptions
Survey/Comments
NDFD Data
Help
Refresh Data
Map Options
Print Map


National Digital Forecast Database Display
National (CONUS
Maximum Temperature (°F
Ending Dec 21, 7 PM EST
Mon
Tue
Wed
Thu
Fri
Sat
-10
0
10
20
30
40
50
60
70
Vancouver
Seattle
Ottawa
Toronto
Detroit
Chicago
Boston
Philadelphia
Washington
St Louis
Denver
San Francisco
Los Angeles
Dallas
Atlanta
Houston
Monterrey
Miami
Havana
POWERED BY esri
Maximum Temperature (°F)
Daytime High for: Mon, Dec 21 2020, 7 PM EST
Issued: Dec 21 at 10:30 AM EST
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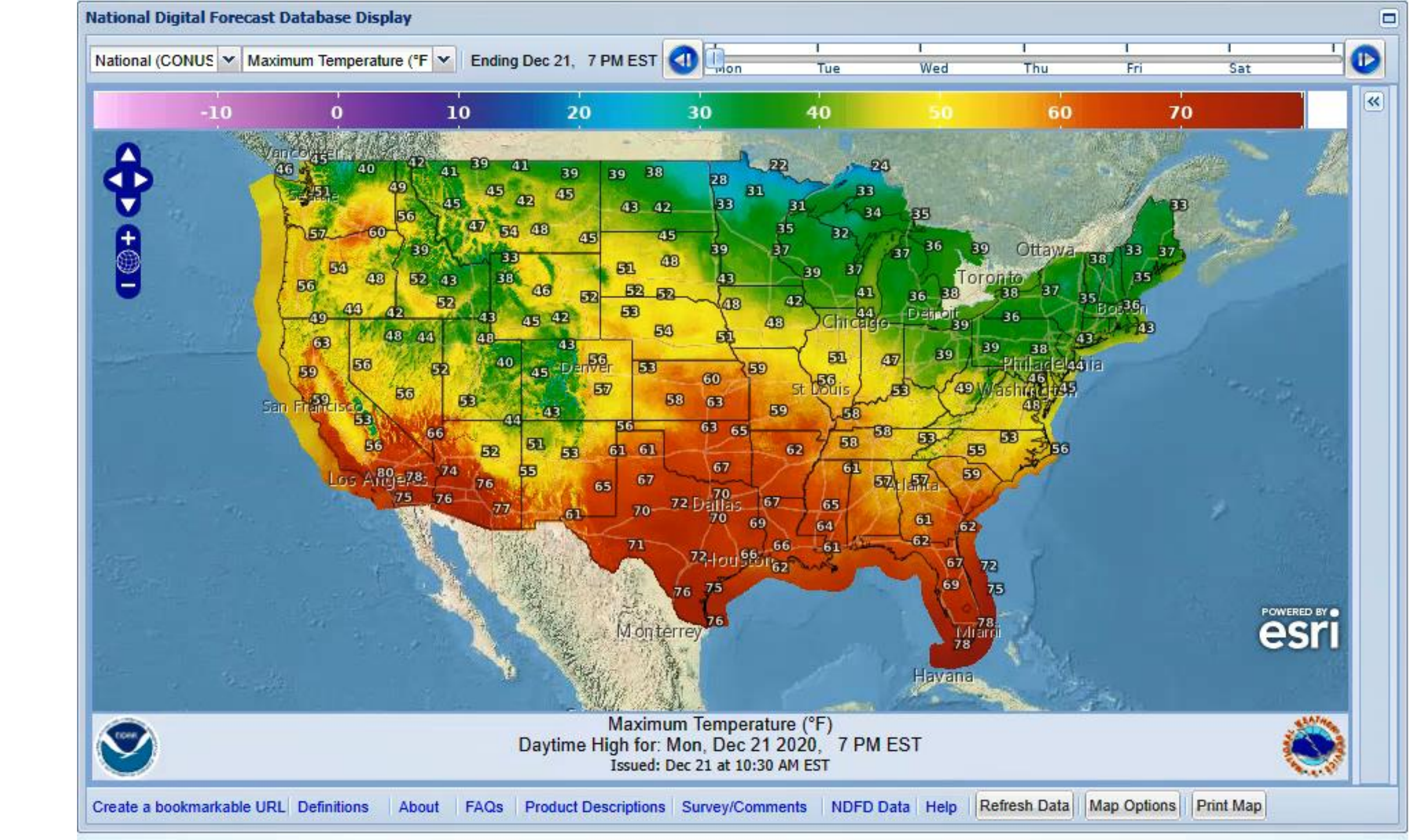
Definitions
About
FAQs
Product Descriptions
Survey/Comments
NDFD Data
Help
Refresh Data
Map Options
Print Map


National Digital Forecast Database Display
National (CONUS
Maximum Temperature (°F
Ending Dec 21, 7 PM EST
Mon
Tue
Wed
Thu
Fri
Sat
-10
0
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30
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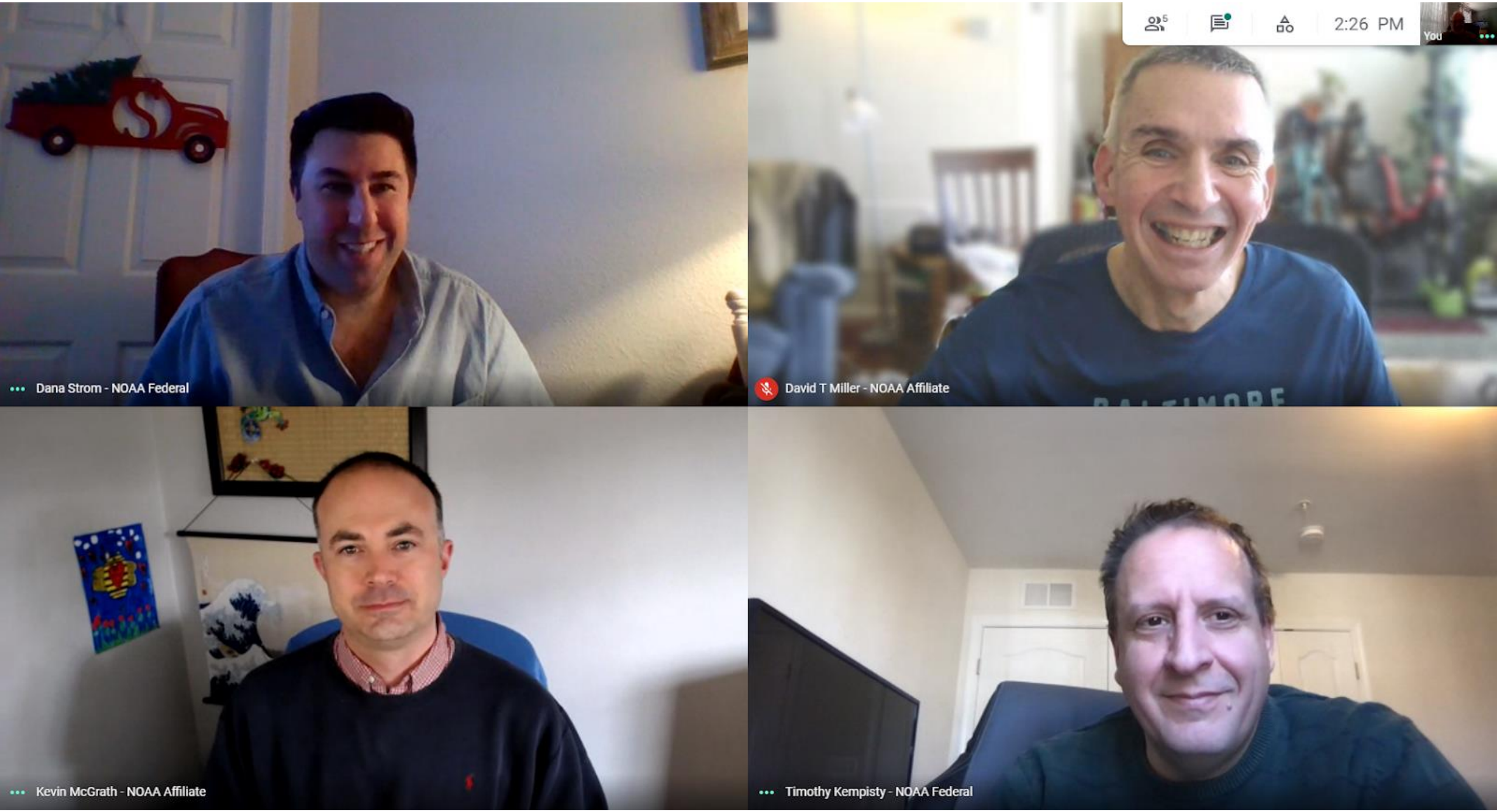
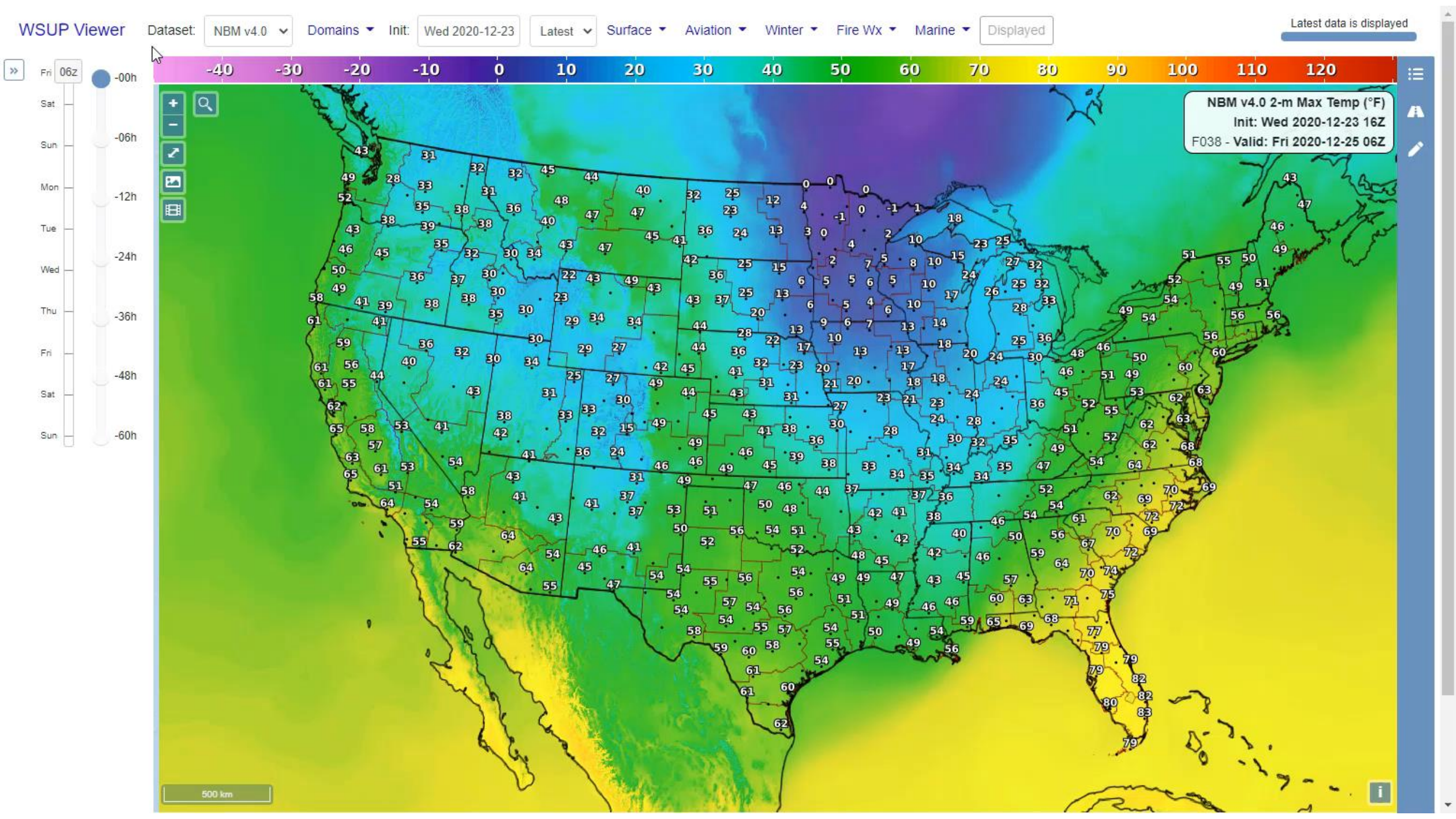
70
Vancouver
Seattle
Ottawa
Toronto
Detroit
Chicago
Boston
Philadelphia
Washington
St Louis
Denver
San Francisco
Los Angeles
Dallas
Atlanta
Houston
Monterrey
Miami
Havana
POWERED BY esri
Maximum Temperature (°F)
Daytime High for: Mon, Dec 21 2020, 7 PM EST
Issued: Dec 21 at 10:30 AM EST
Create a bookmarkable URL
Definitions
About
FAQs
Product Descriptions
Survey/Comments
NDFD Data
Help
Refresh Data
Map Options
Print Map

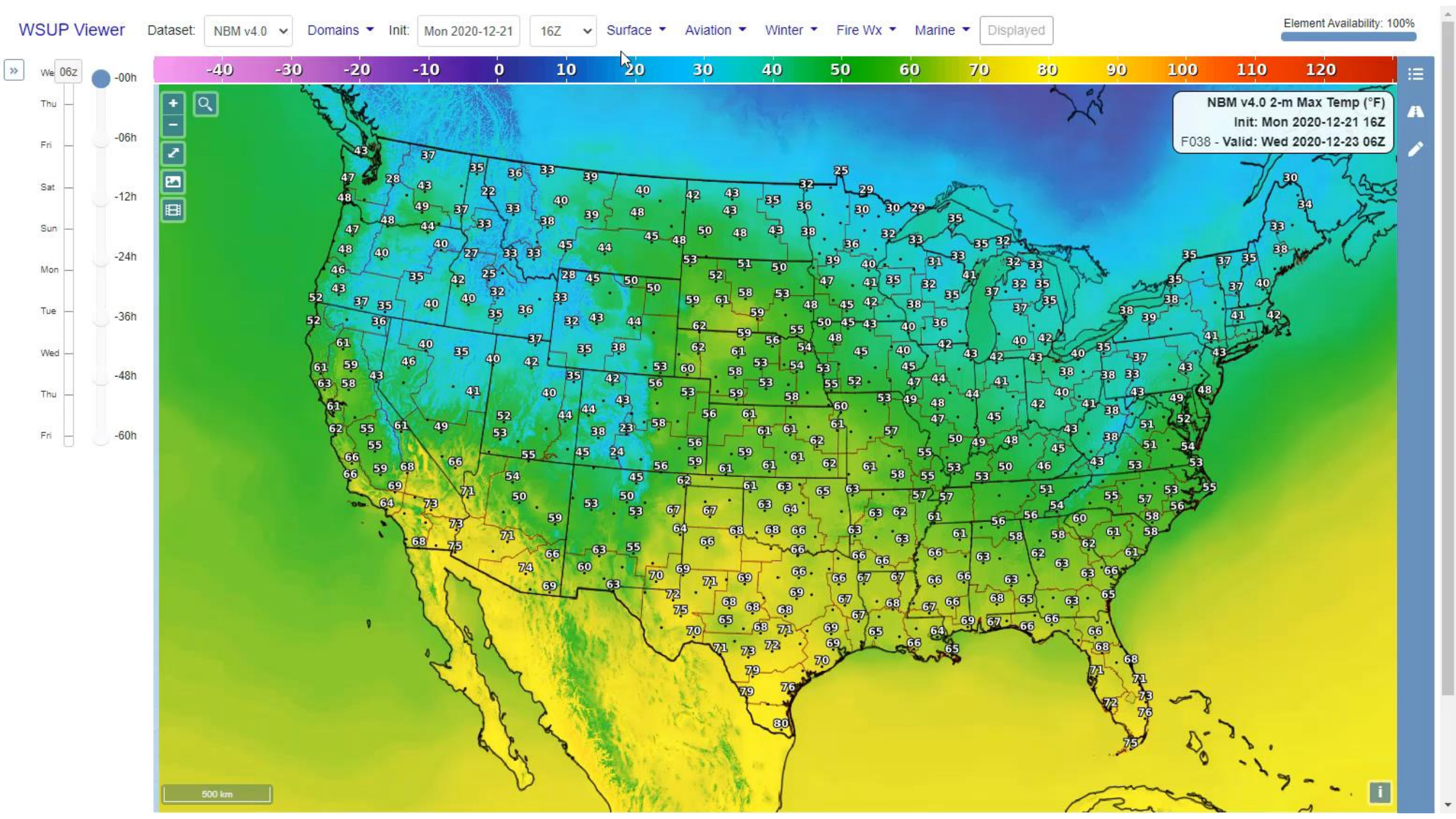

5
2:26 PM
You
Dana Strom - NOAA Federal
David T Miller - NOAA Affiliate
Kevin McGrath - NOAA Affiliate
Timothy Kempisty - NOAA Federal

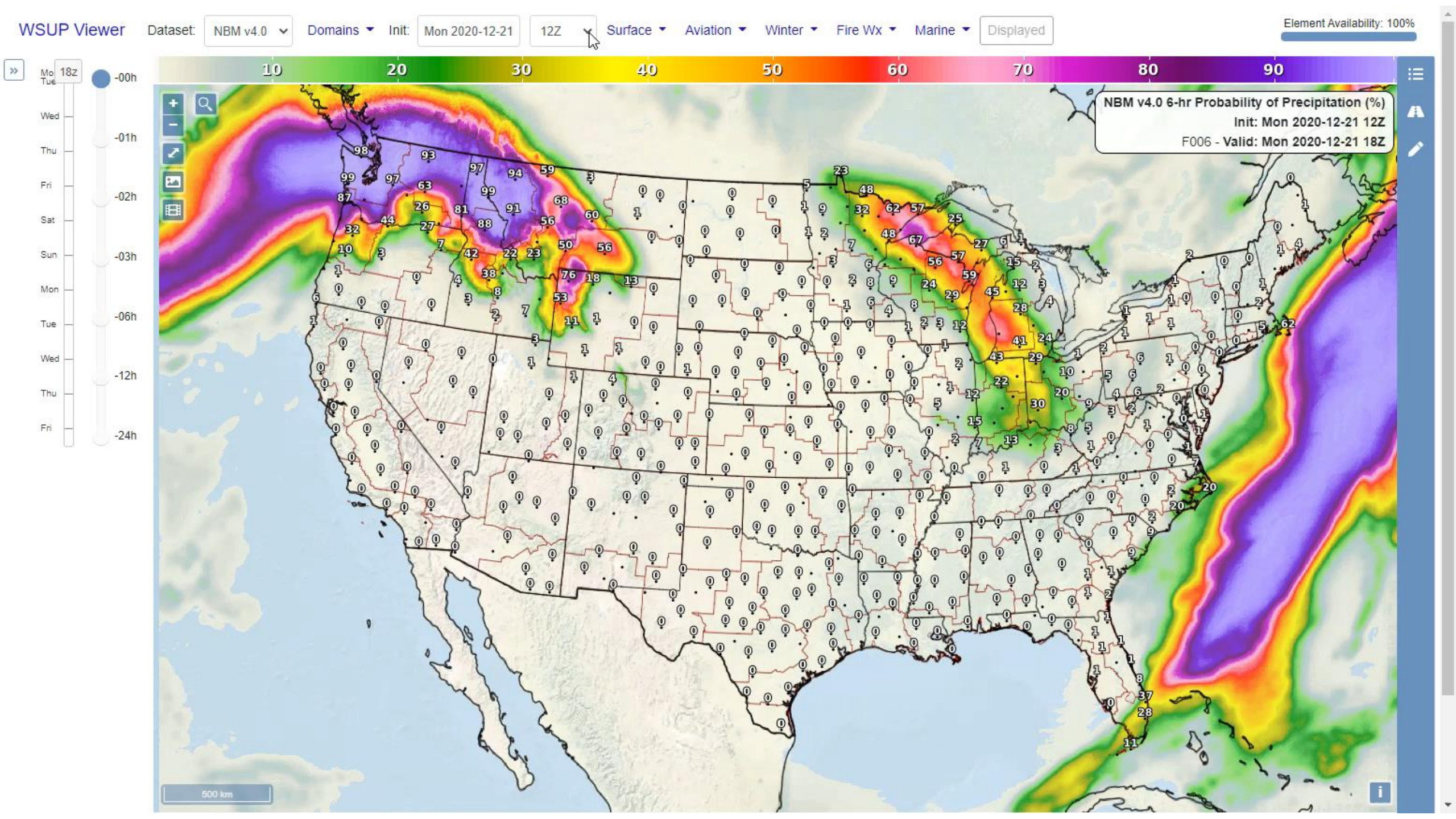
Cloud Host - AWS
Operating System - Centos 7
EC instance = c5.2xlarge (8 CPU, 32 GB of RAM)

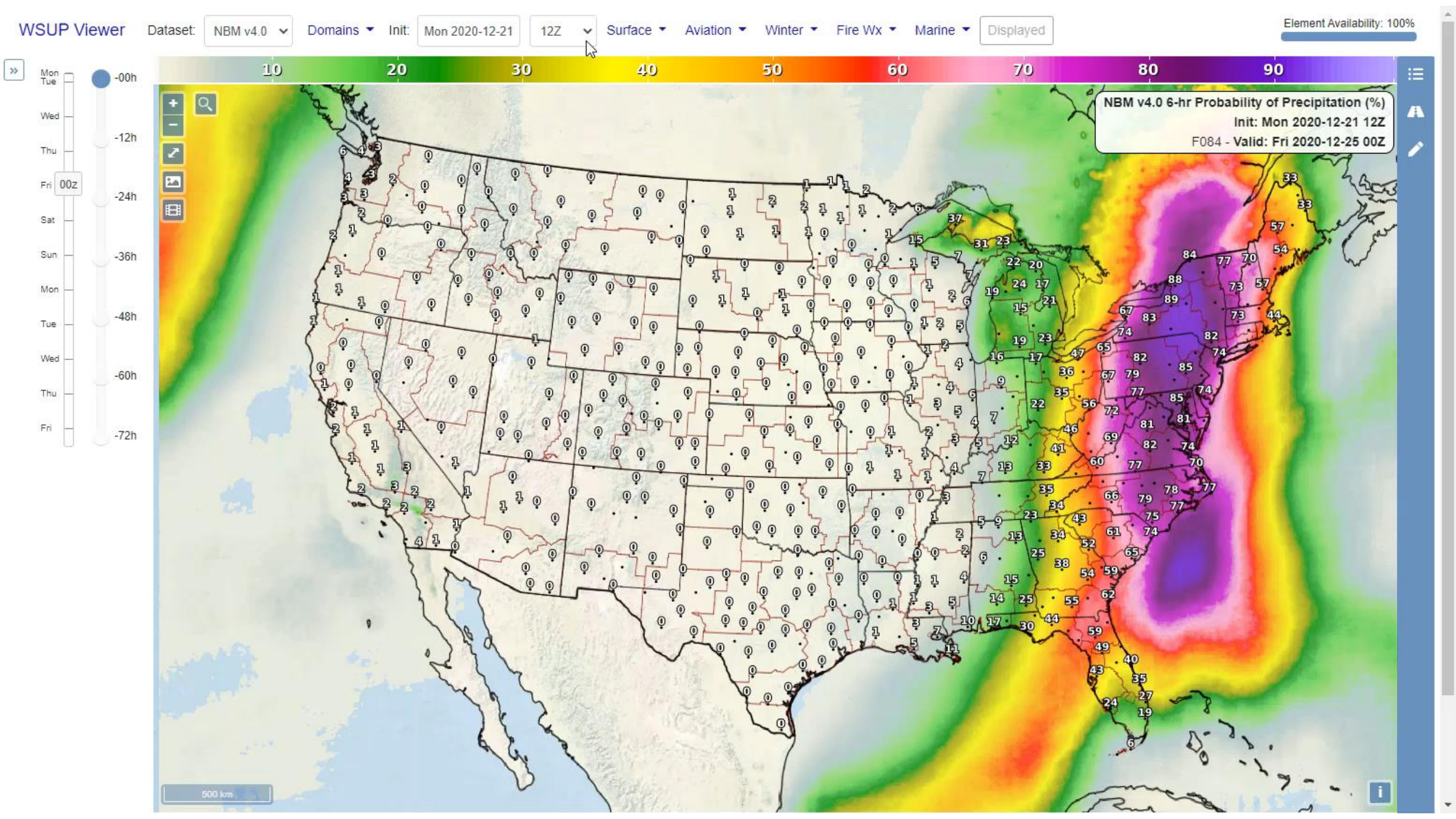
Apache - http2 (enables multi-threading)
OpenLayers version = 4.6.5
Image Rendering - MapServer/MapCache
Number of MapServer threads = 4

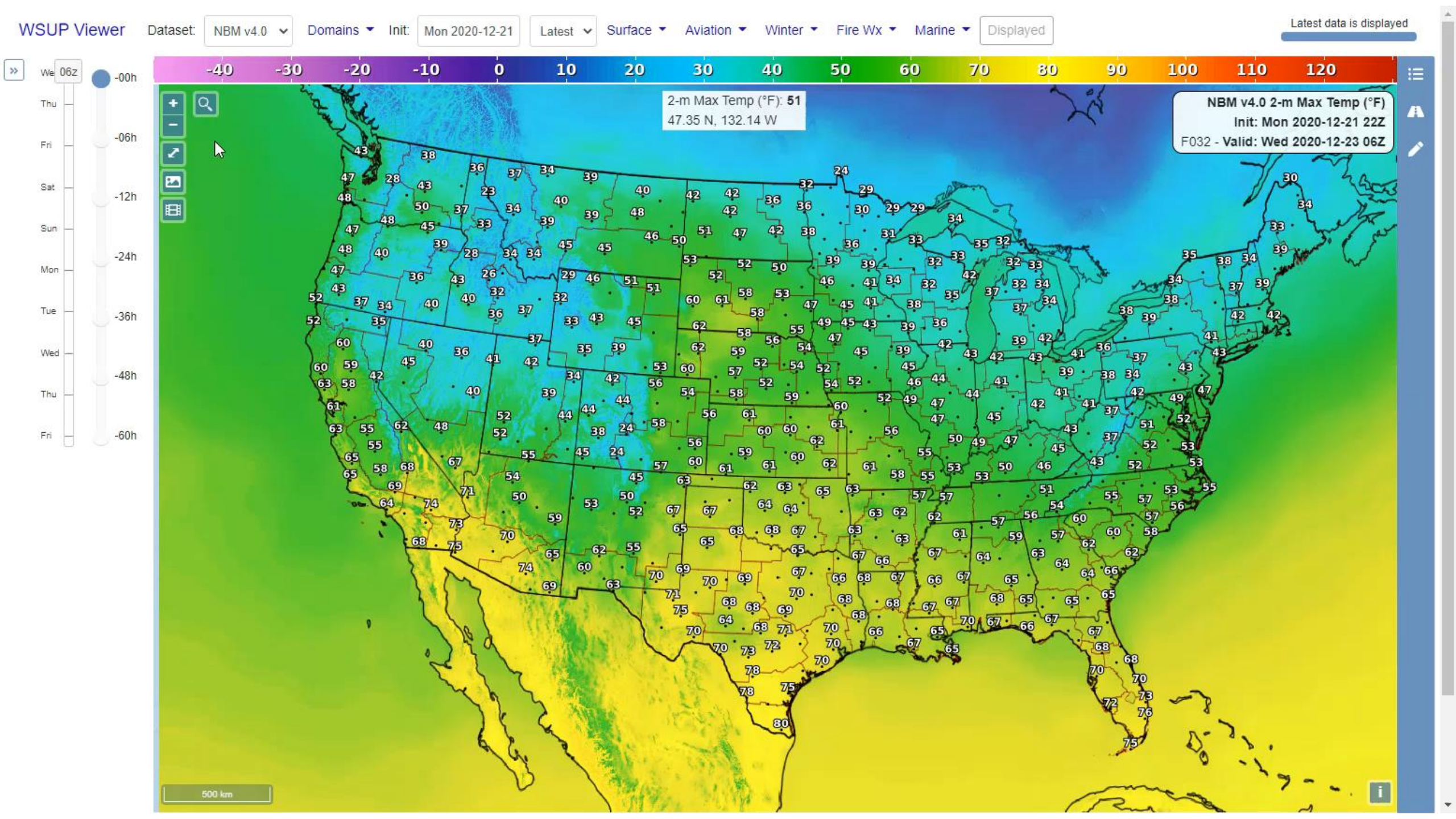
Data source = NCEP WCOSS
Grid data storage = Cloud-optimized GeoTiff in S3 buckets
Point data storage = Postgresql and Xarray/Zarr with Lustre

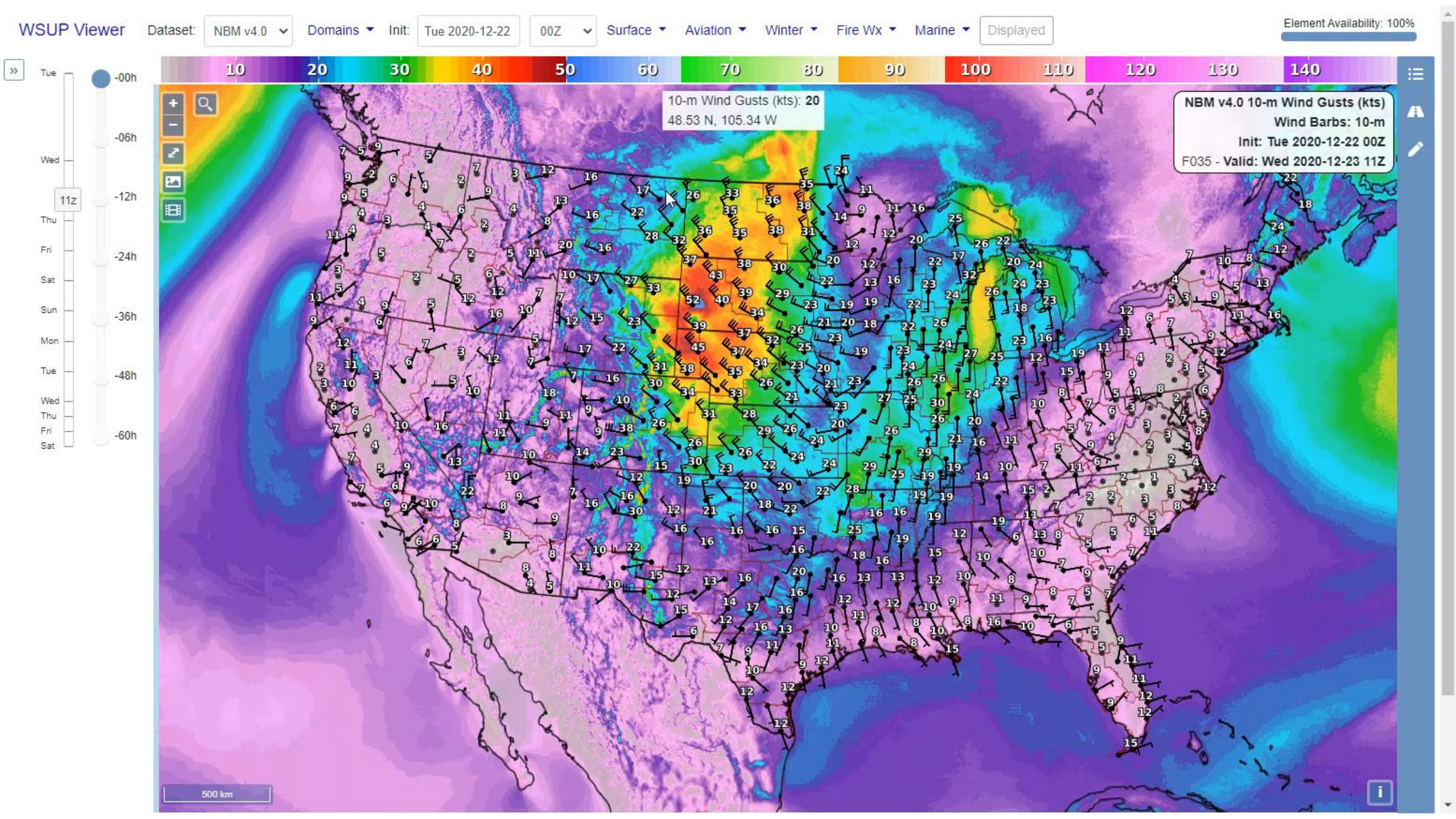

WSUP Viewer
Dataset: NBM v4.0
Domains
Init: Wed 2020-12-23
Latest
Surface
Aviation
Winter
Fire Wx
Marine
Displayed
Latest data is displayed
Fri 06z
Sat
Sun
Mon
Tue
Wed
Thu
Fri
Sat
Sun
-00h
-06h
-12h
-24h
-36h
-48h
-60h
-40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120
NBM v4.0 2-m Max Temp (°F)
Init: Wed 2020-12-23 16Z
F038 - Valid: Fri 2020-12-25 06Z
500 km


WSUP Viewer
Dataset: NBM v4.0
Domains
Init: Mon 2020-12-21
16Z
Surface
Aviation
Winter
Fire Wx
Marine
Displayed
Element Availability: 100%
06z
Thu
Fri
Sat
Sun
Mon
Tue
Wed
Thu
Fri
-00h
-06h
-12h
-24h
-36h
-48h
-60h
-40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120
NBM v4.0 2-m Max Temp (°F)
Init: Mon 2020-12-21 16Z
F038 - Valid: Wed 2020-12-23 06Z
500 km

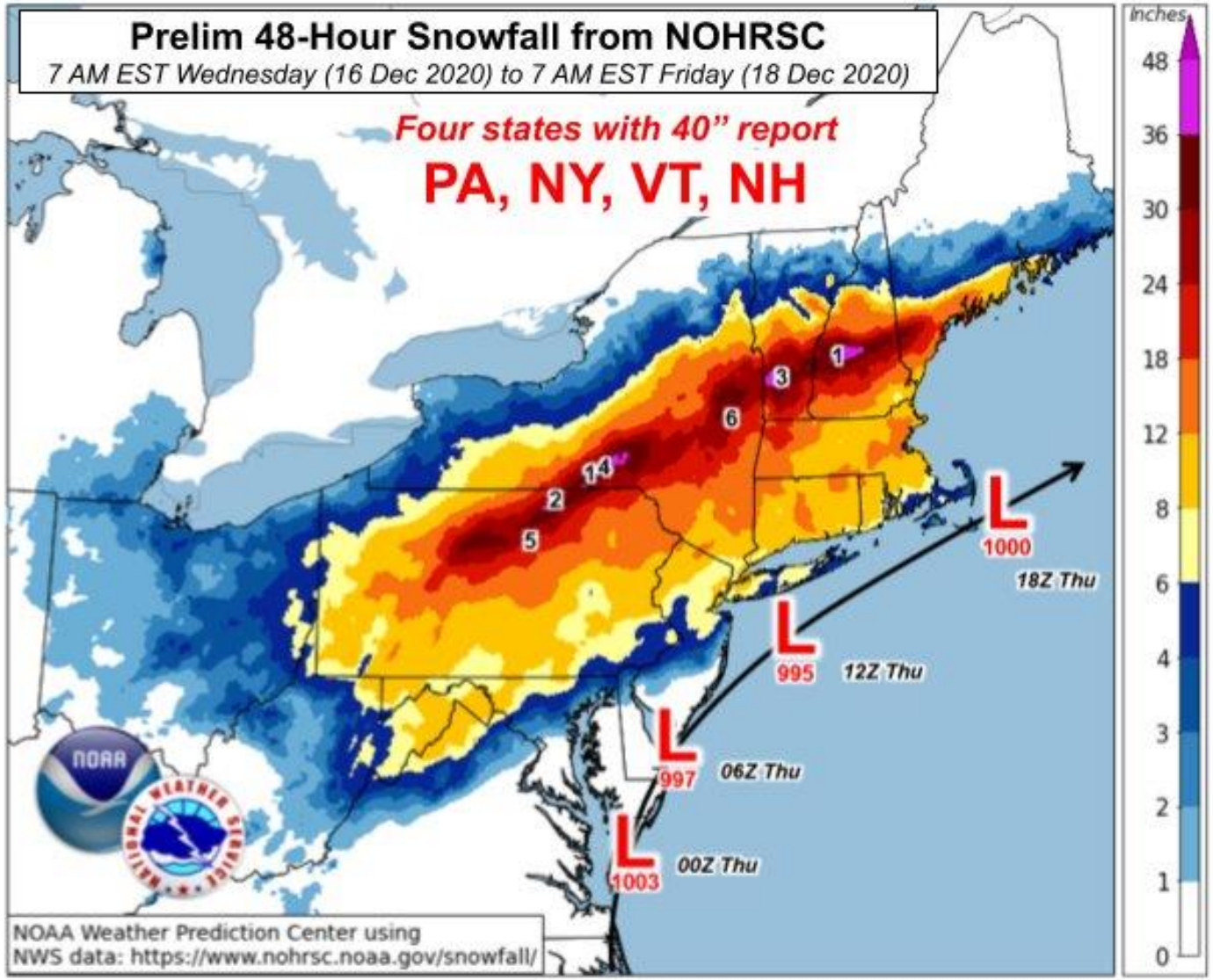

WSUP Viewer
Dataset: NBM v4.0
Domains
Init: Mon 2020-12-21
12Z
Surface
Aviation
Winter
Fire Wx
Marine
Displayed
Element Availability: 100%
18z
Mo Tue
Wed
Thu
Fri
Sat
Sun
Mon
Tue
Wed
Thu
Fri
-00h
-01h
-02h
-03h
-06h
-12h
-24h
10
20
30
40
50
60
70
80
90
NBM v4.0 6-hr Probability of Precipitation (%)
Init: Mon 2020-12-21 12Z
F006 - Valid: Mon 2020-12-21 18Z
500 km


WSUP Viewer
Dataset: NBM v4.0
Domains
Init: Mon 2020-12-21
12Z
Surface
Aviation
Winter
Fire Wx
Marine
Displayed
Element Availability: 100%
Mon Tue
Wed
Thu
Fri
00z
Sat
Sun
Mon
Tue
Wed
Thu
Fri
-00h
-12h
-24h
-36h
-48h
-60h
-72h
10
20
30
40
50
60
70
80
90
NBM v4.0 6-hr Probability of Precipitation (%)
Init: Mon 2020-12-21 12Z
F084 - Valid: Fri 2020-12-25 00Z
500 km

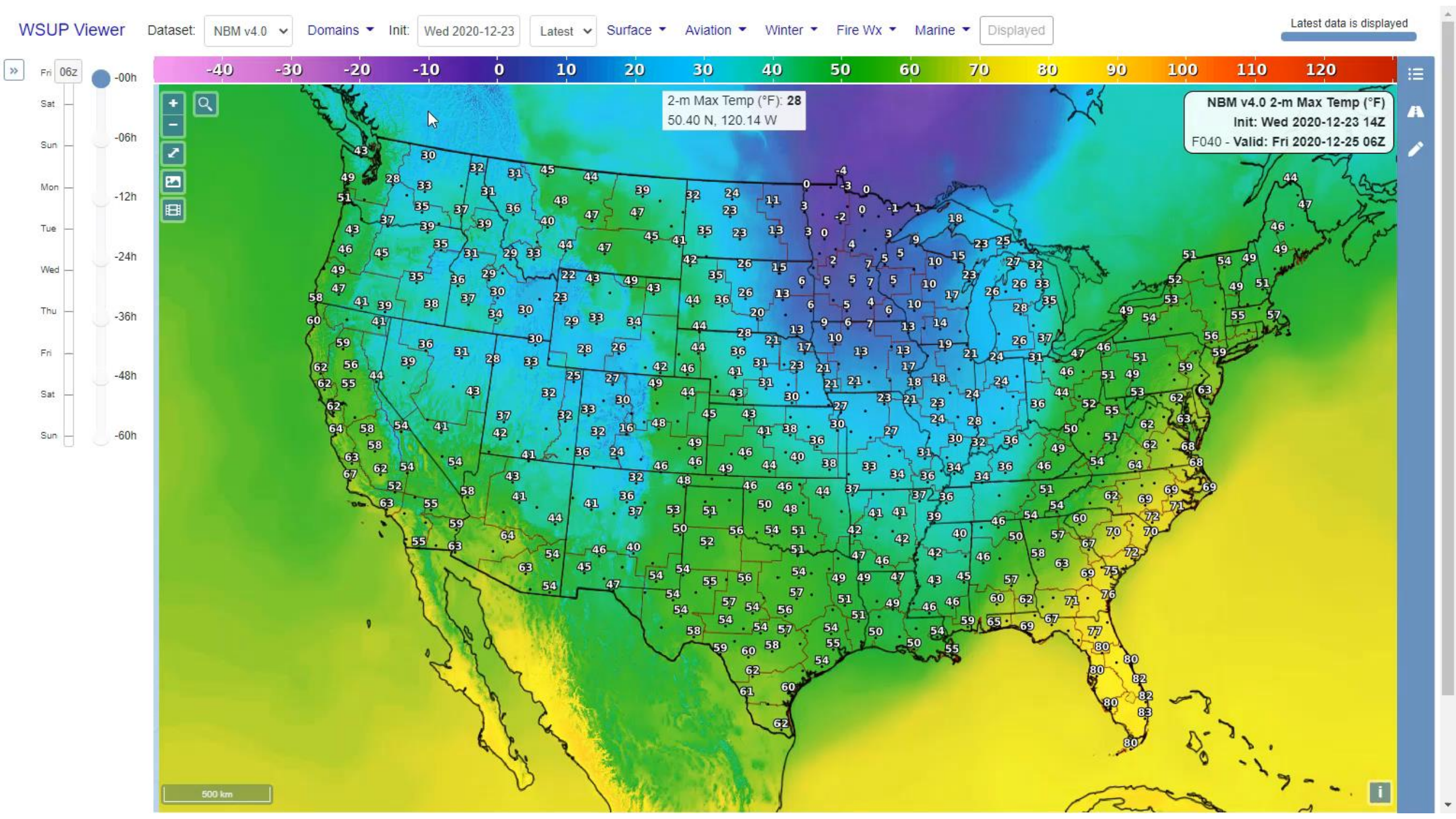

WSUP Viewer
Dataset: NBM v4.0
Domains
Init: Mon 2020-12-21
Latest
Surface
Aviation
Winter
Fire Wx
Marine
Displayed
Latest data is displayed
We 06z
Thu
Fri
Sat
Sun
Mon
Tue
Wed
Thu
Fri
-00h
-06h
-12h
-24h
-36h
-48h
-60h
-40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120
2-m Max Temp (°F): 51
47.35 N, 132.14 W
NBM v4.0 2-m Max Temp (°F)
Init: Mon 2020-12-21 22Z
F032 - Valid: Wed 2020-12-23 06Z
500 km

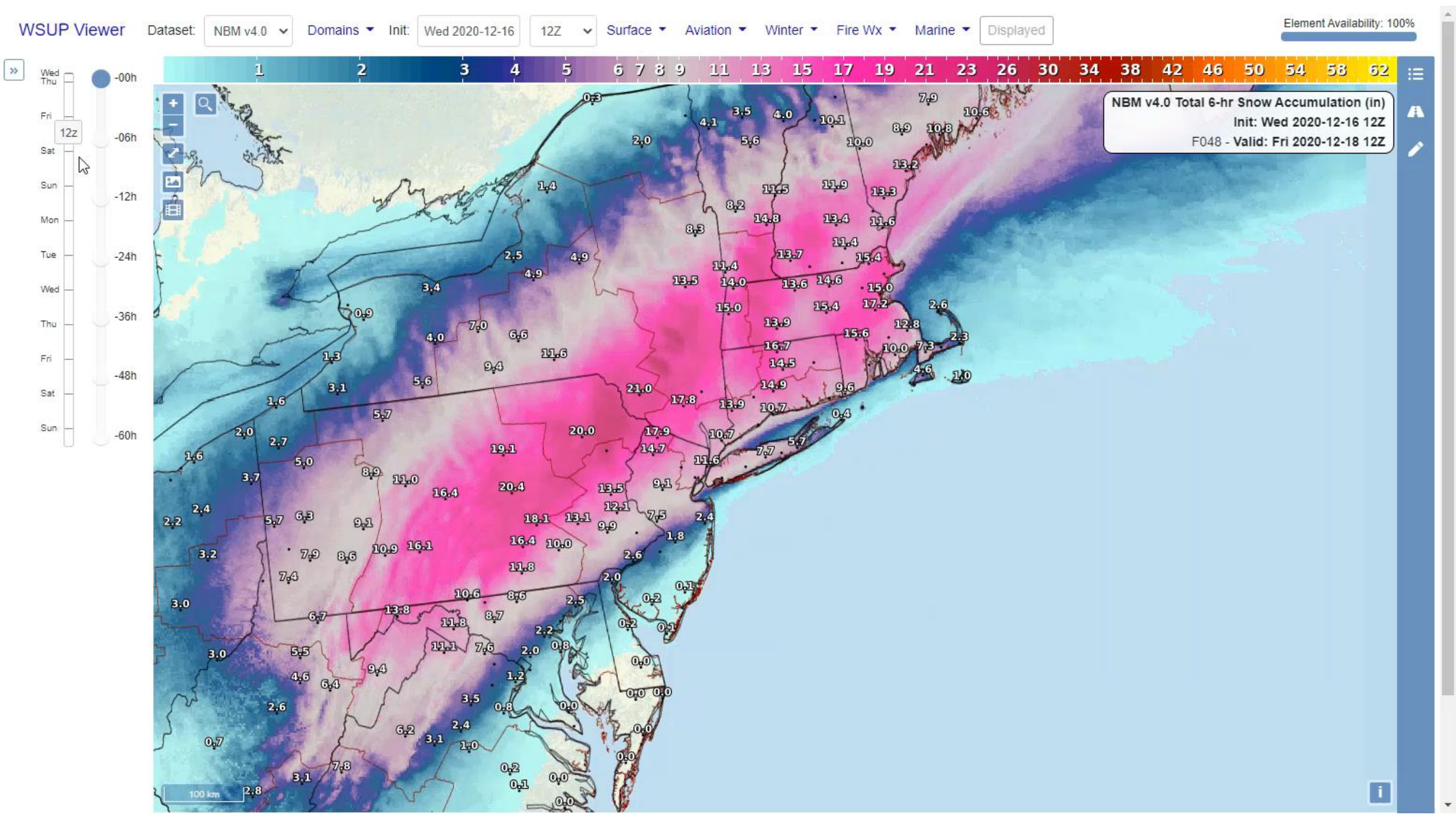

WSUP Viewer
Dataset: NBM v4.0
Domains
Init: Tue 2020-12-22
00Z
Surface
Aviation
Winter
Fire Wx
Marine
Displayed
Element Availability: 100%
10 20 30 40 50 60 70 80 90 100 110 120 130 140
Tue -00h
-06h
Wed
11z
-12h
Thu
Fri -24h
Sat
Sun -36h
Mon
Tue -48h
Wed
Thu
Fri -60h
Sat
10-m Wind Gusts (kts): 20
48.53 N, 105.34 W
NBM v4.0 10-m Wind Gusts (kts)
Wind Barbs: 10-m
Init: Tue 2020-12-22 00Z
F035 - Valid: Wed 2020-12-23 11Z
500 km

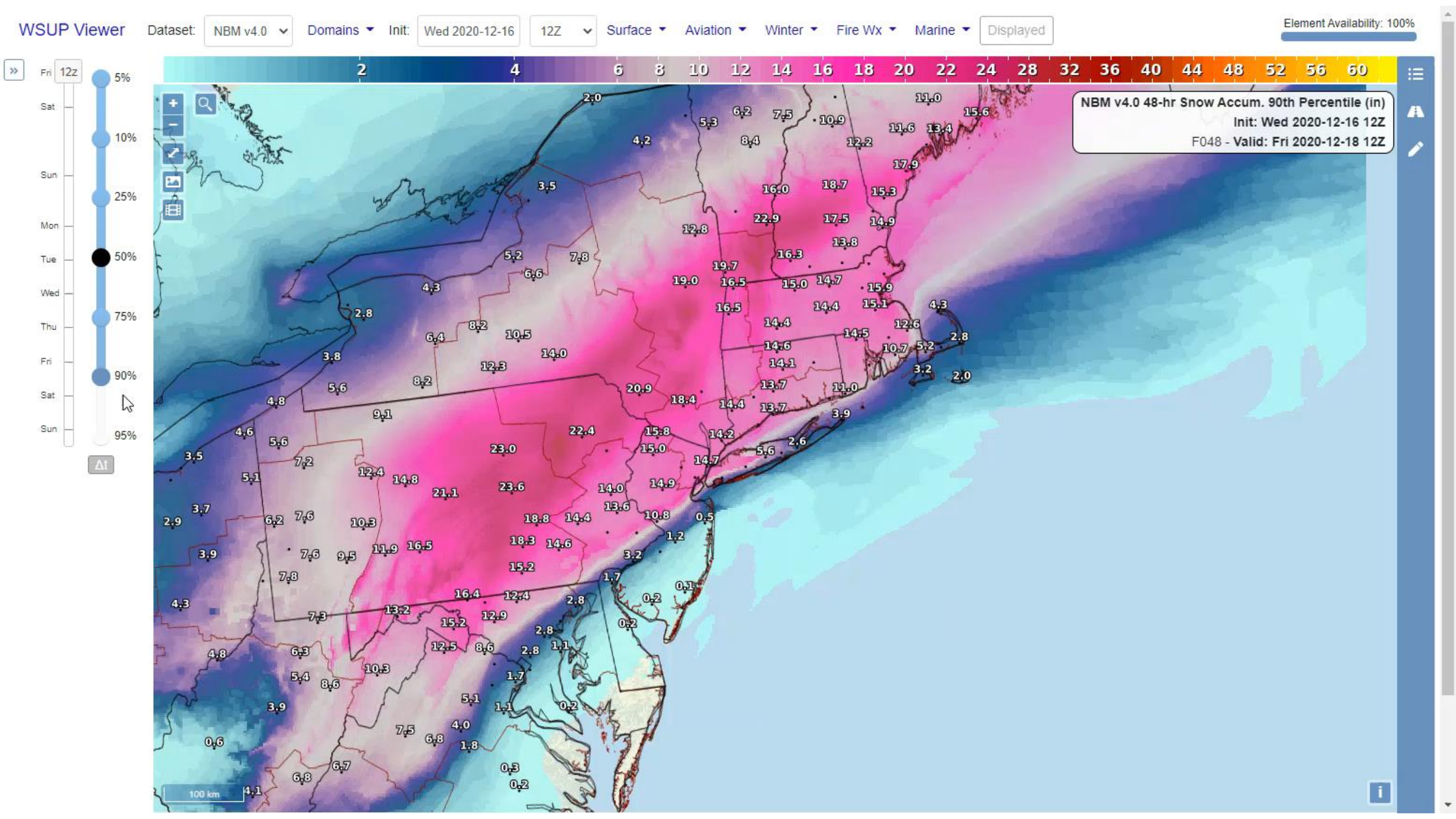
Record-Setting Snowstorm in the Interior Northeast



1. **Event Maximum: 44" near Newark Valley, NY and near Croydon, NH** *(Croydon report is only 5" shy of the 24-hr record for NH set on Mount Washington!)*
2. **Potential 24-Hour Pennsylvania State Record: 43.3" near Alba, PA** *(current 38"; requires validation from State Climate Extremes Committee)*
3. **Potential 24-Hour Vermont State Record: 42" near Landgrove, VT** *(current 42"; would tie; requires validation from State Climate Extremes Committee)*
4. **Two-day snowfall record (40.0") at Binghamton, NY** *(69y p.o.r.)*. **Snow depth was 39"** *breaking the record from the Blizzard of '93.*
5. **Two-day snowfall record (24.7") at Williamsport, PA** *(125y p.o.r)*
6. **8th largest snowstorm on record (22.9") at Albany, NY**. *4th largest in the month of December.*


WSUP Viewer
Dataset: NBM v4.0
Domains
Init: Wed 2020-12-23
Latest
Surface
Aviation
Winter
Fire Wx
Marine
Displayed
Latest data is displayed
Fri 06z
Sat
Sun
Mon
Tue
Wed
Thu
Fri
Sat
Sun
-00h
-06h
-12h
-24h
-36h
-48h
-60h
-40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120
2-m Max Temp (°F): 28
50.40 N, 120.14 W
NBM v4.0 2-m Max Temp (°F)
Init: Wed 2020-12-23 14Z
F040 - Valid: Fri 2020-12-25 06Z
500 km


WSUP Viewer
Dataset: NBM v4.0
Domains
Init: Wed 2020-12-16
12Z
Surface
Aviation
Winter
Fire Wx
Marine
Displayed
Element Availability: 100%
Wed Thu
Fri
Sat
Sun
Mon
Tue
Wed
Thu
Fri
Sat
Sun
12z
-00h
-06h
-12h
-24h
-36h
-48h
-60h
1 2 3 4 5 6 7 8 9 11 13 15 17 19 21 23 26 30 34 38 42 46 50 54 58 62
NBM v4.0 Total 6-hr Snow Accumulation (in)
Init: Wed 2020-12-16 12Z
F048 - Valid: Fri 2020-12-18 12Z
100 km


WSUP Viewer
Dataset: NBM v4.0
Domains
Init: Wed 2020-12-16
12Z
Surface
Aviation
Winter
Fire Wx
Marine
Displayed
Element Availability: 100%
Fri 12z
Sat
Sun
Mon
Tue
Wed
Thu
Fri
Sat
Sun
5%
10%
25%
50%
75%
90%
95%
Δt
2 4 6 8 10 12 14 16 18 20 22 24 28 32 36 40 44 48 52 56 60
NBM v4.0 48-hr Snow Accum. 90th Percentile (in)
Init: Wed 2020-12-16 12Z
F048 - Valid: Fri 2020-12-18 12Z
100 km

The National Weather Service Whole Story Uncertainty and Probabilities Viewer

Next Steps

- Probabilistic Forecast Review Capabilities
- Historical (Forecast and Observational) Context
- Additional ensemble datasets (e.g., ECMWF)