

State of Practice for Statewide and Regional PMP-Where We've Been and What's Next

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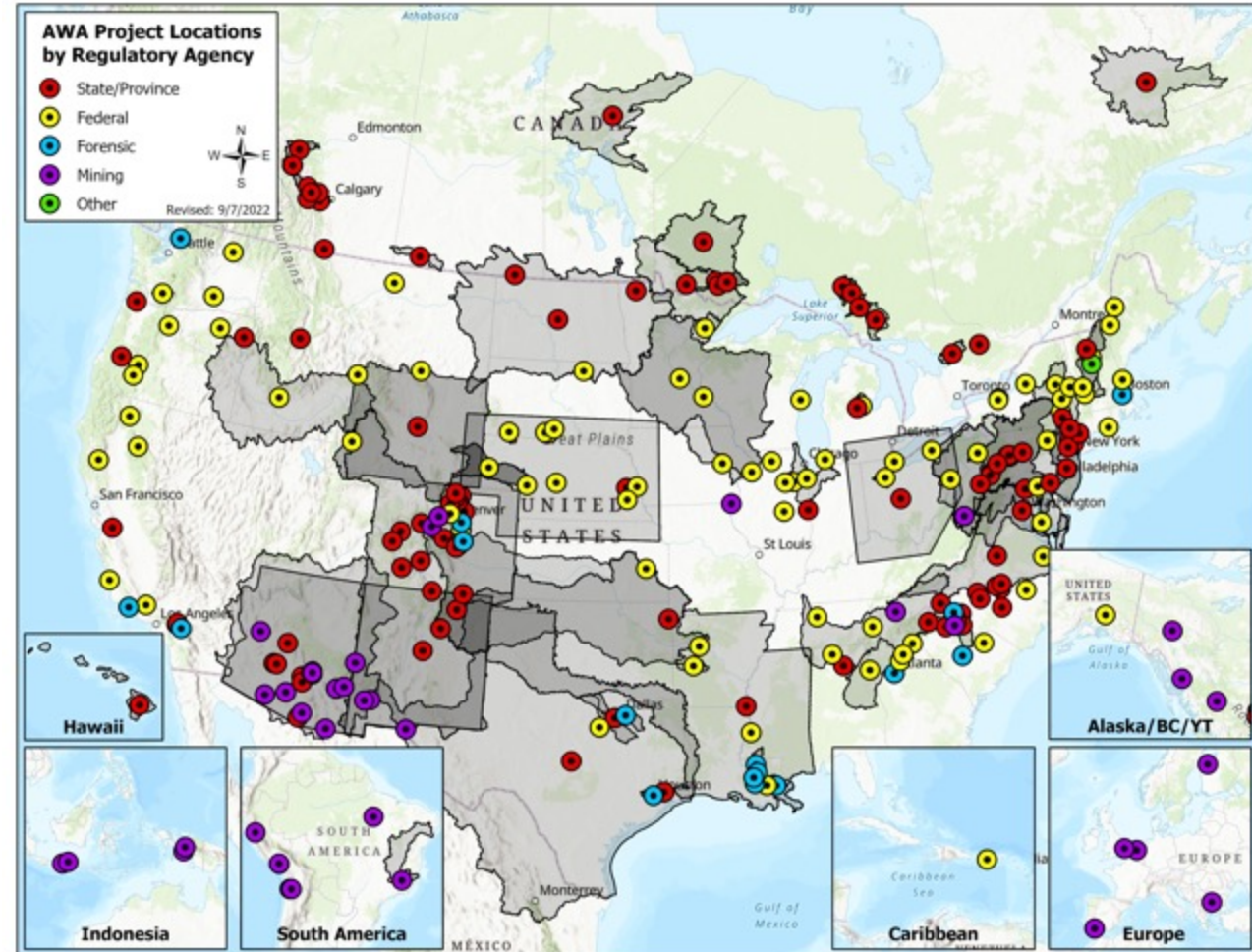
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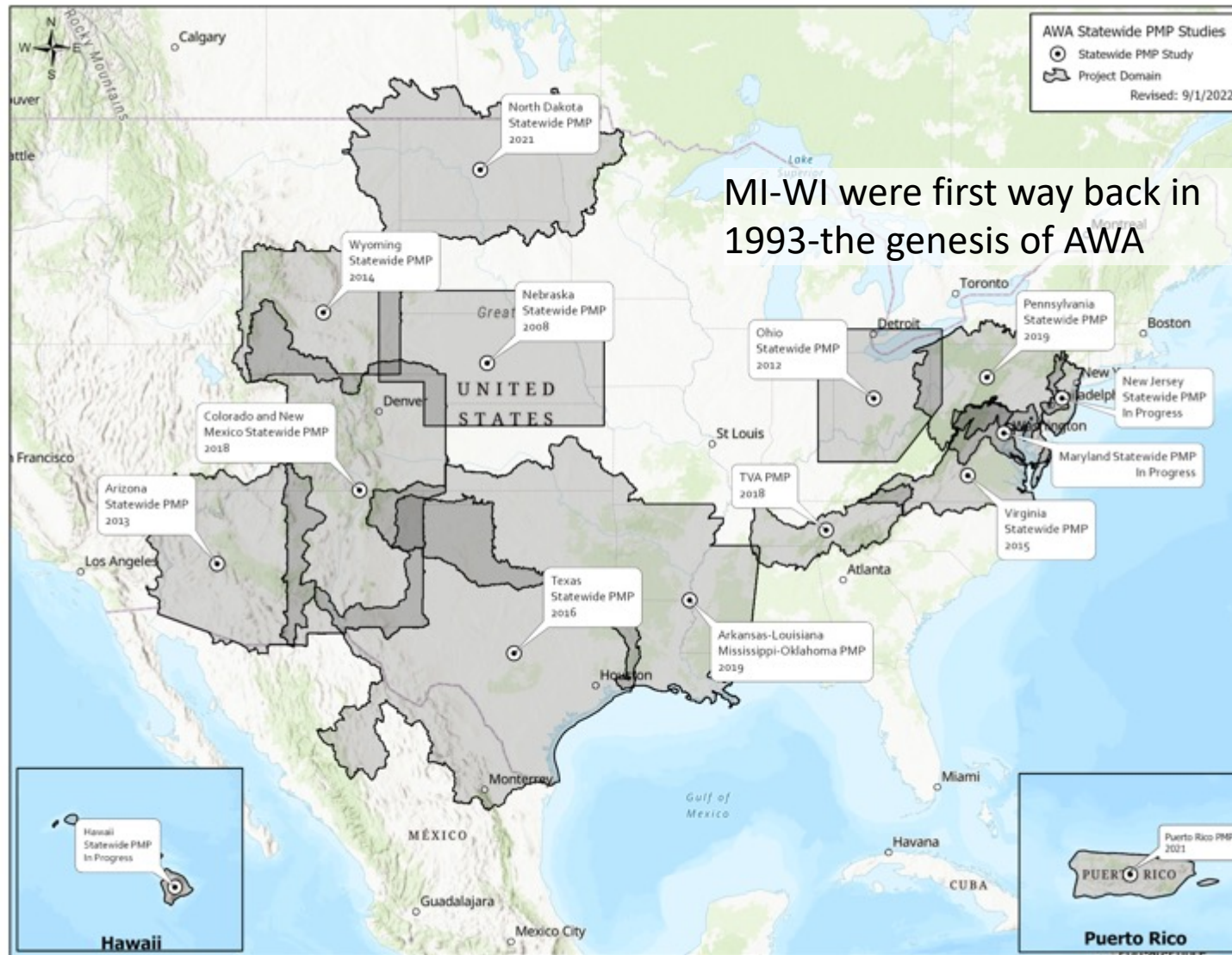


Statewide PMP Development Outline

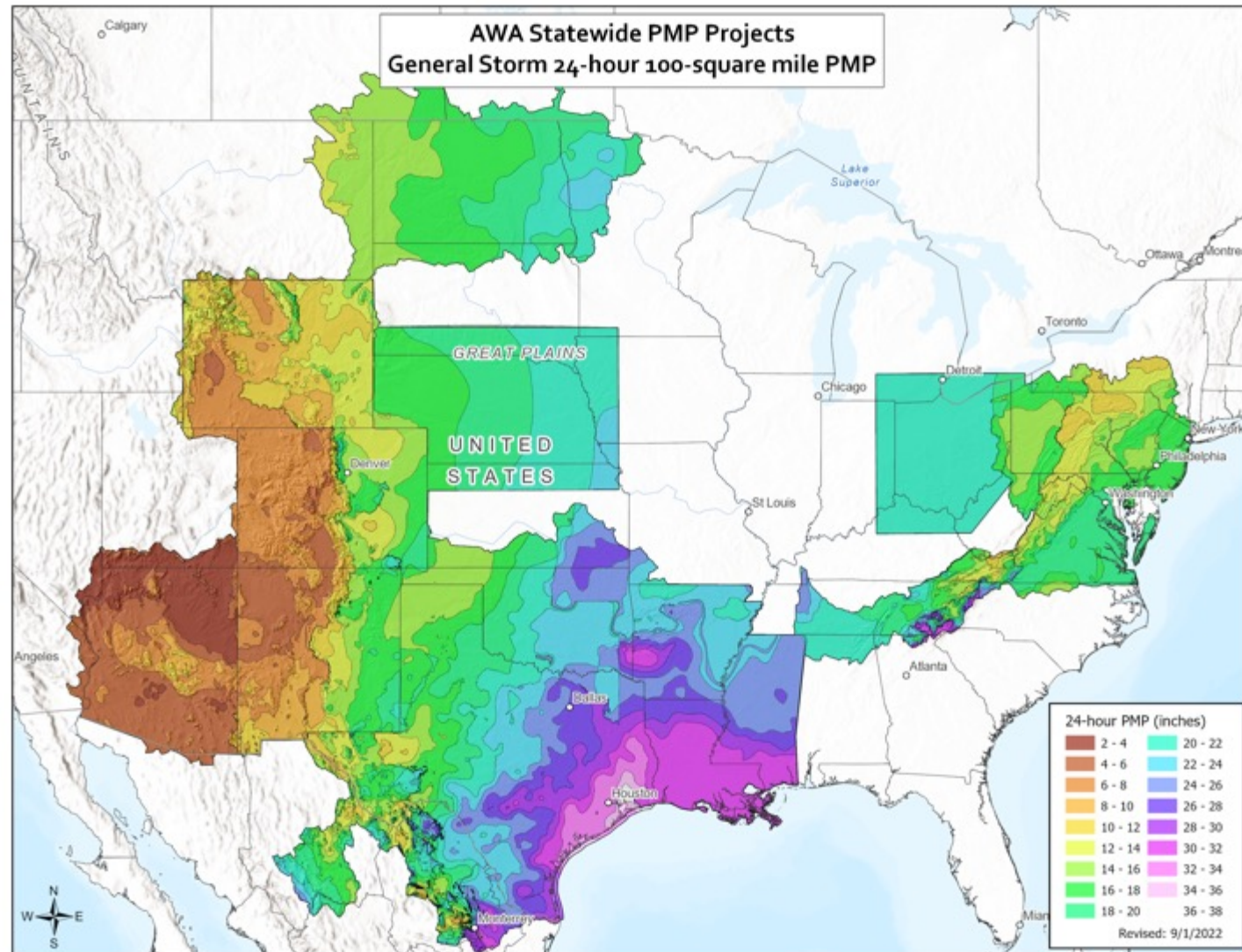
- Statewide studies-a brief history
- Where are we today
- What's next
 - PRECIP act
 - Public-Private partnership
 - Updates
 - Storage
 - Access



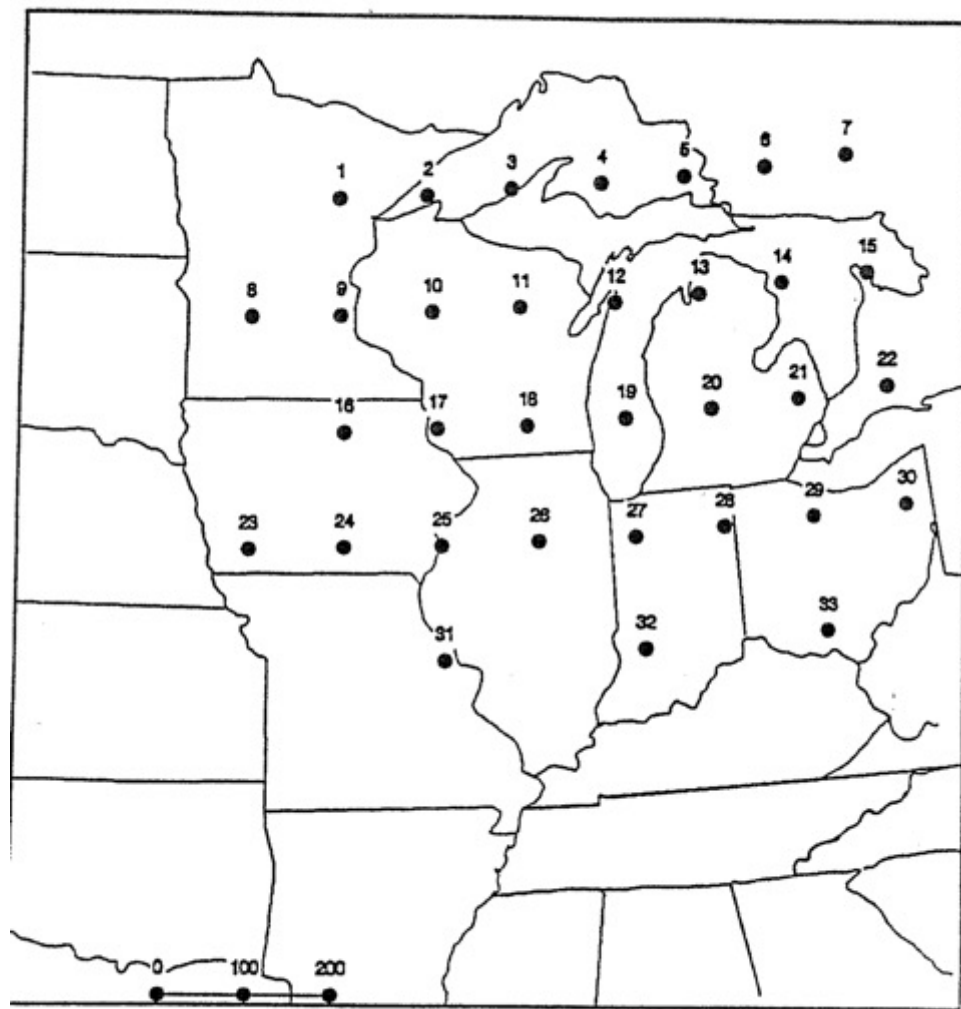
AWA Statewide Project Locations



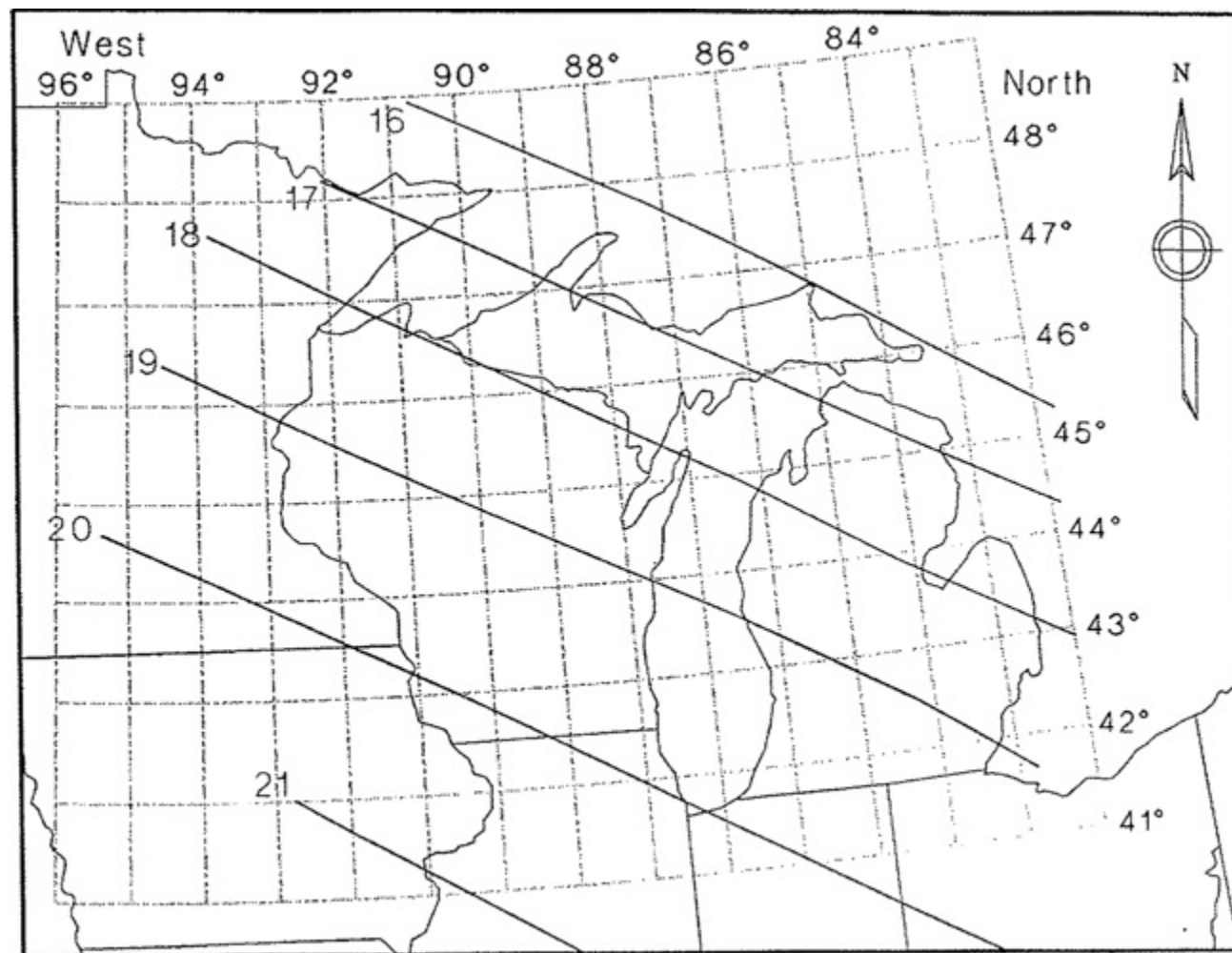
AWA Statewide PMP Depths All together



EPRI Michigan-Wisconsin-the First Step

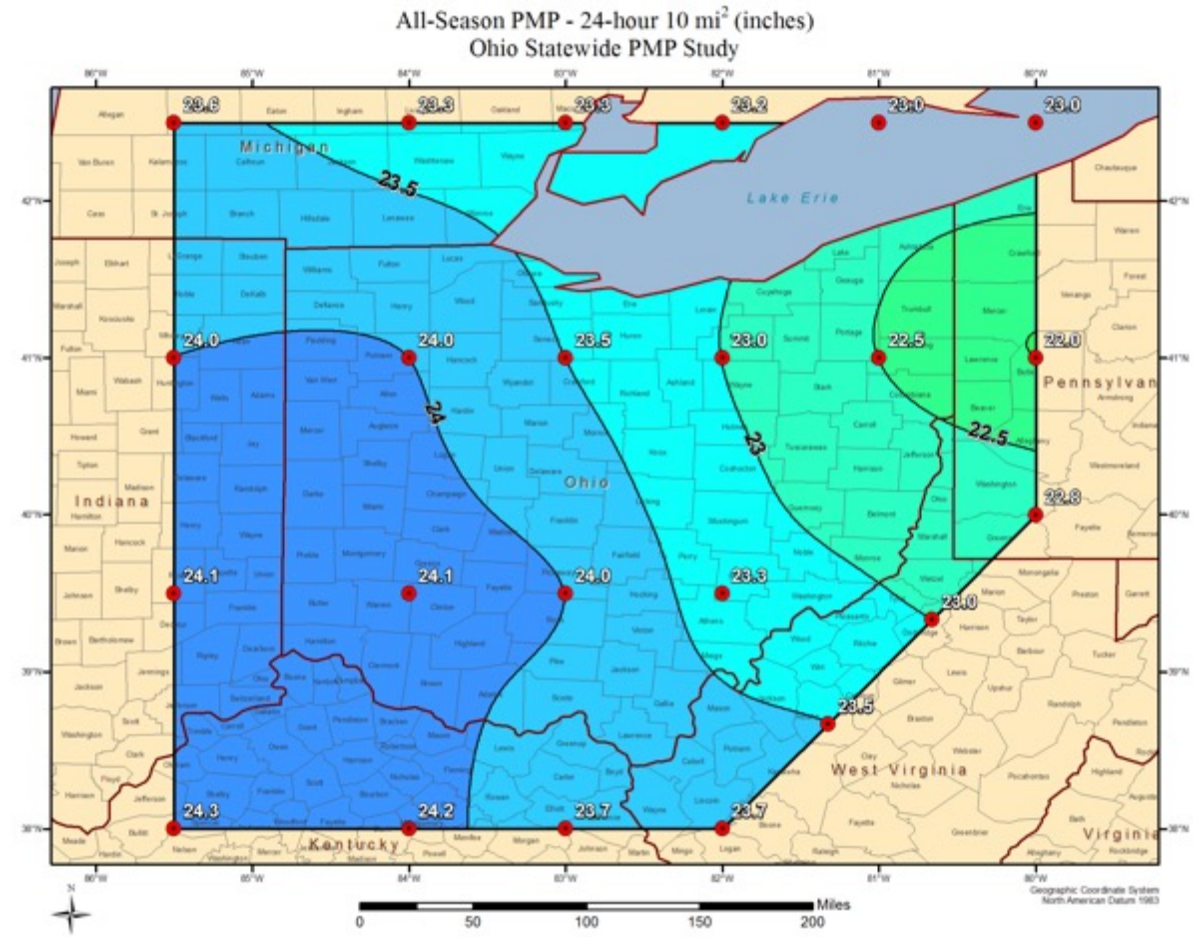
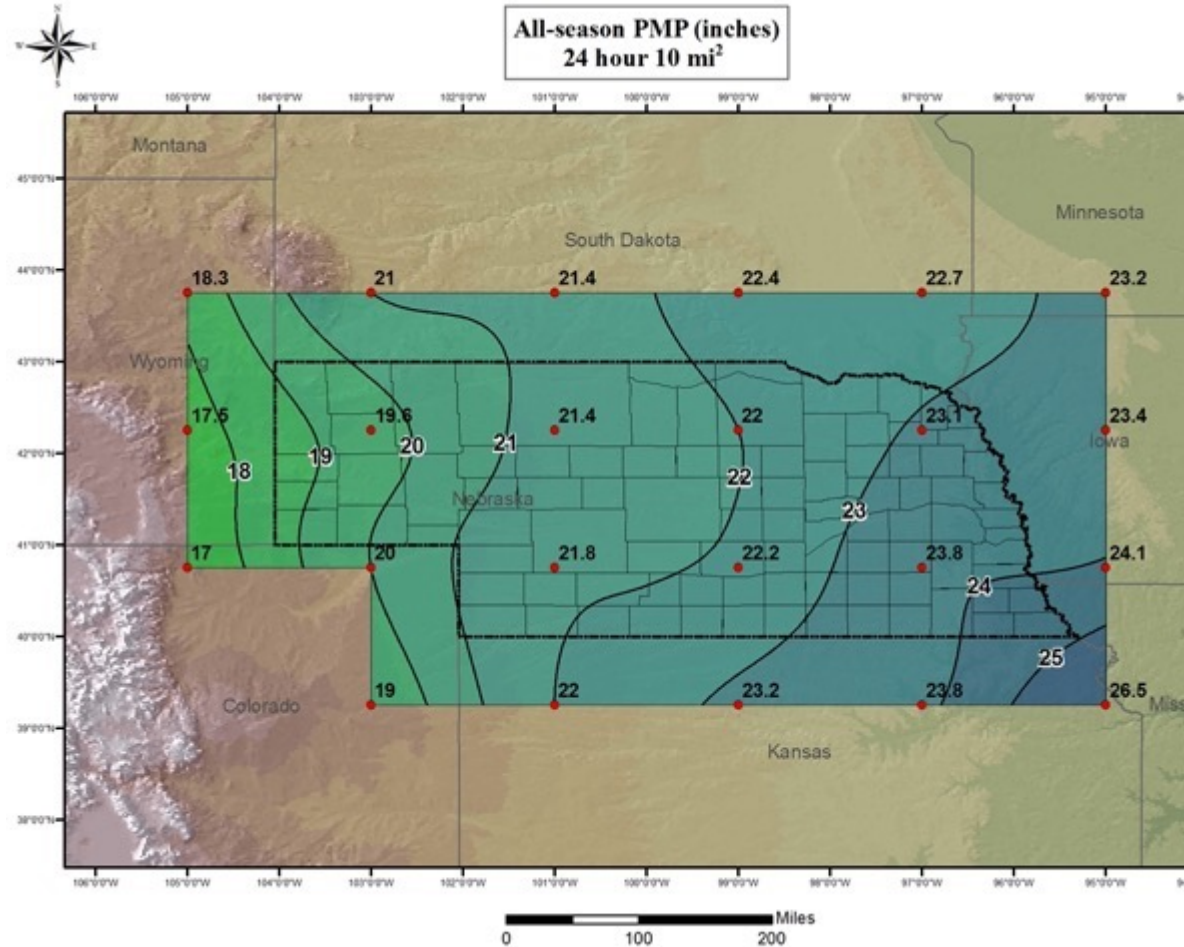


Transposition Grid

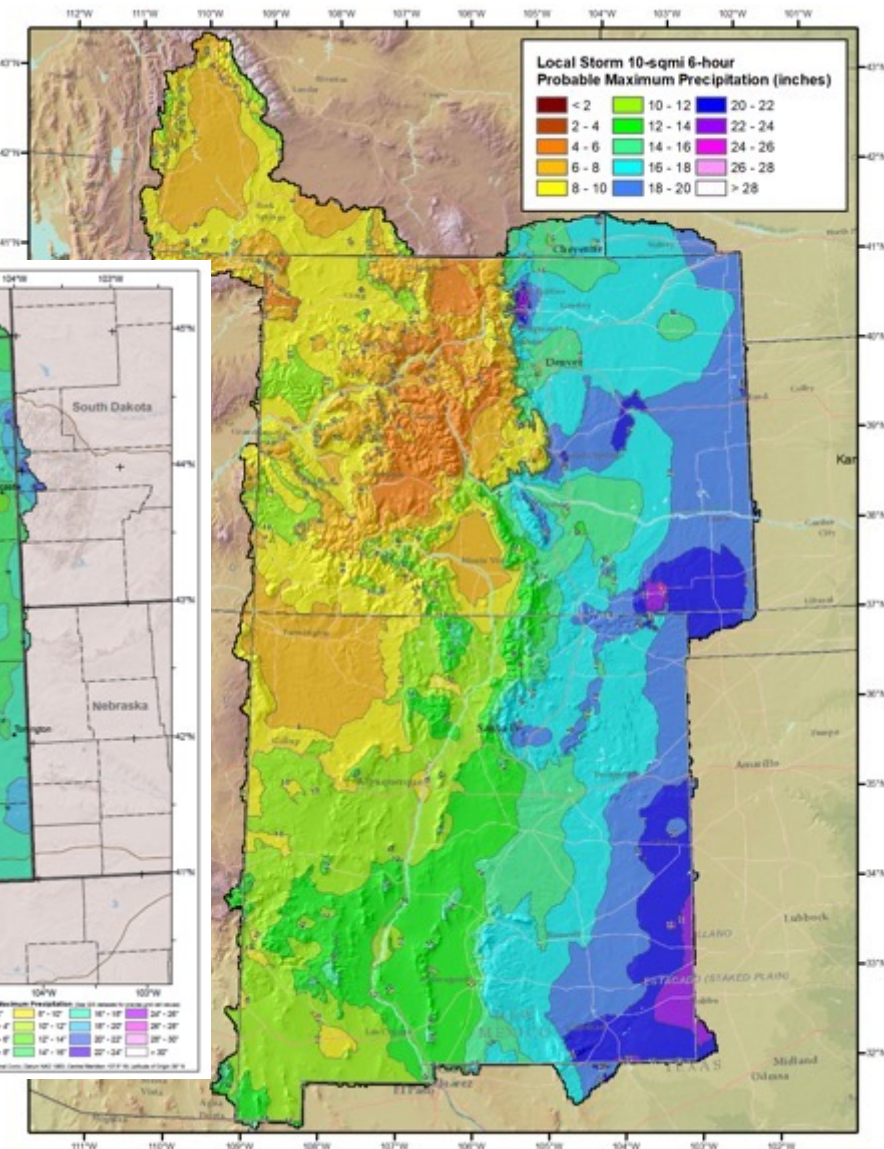
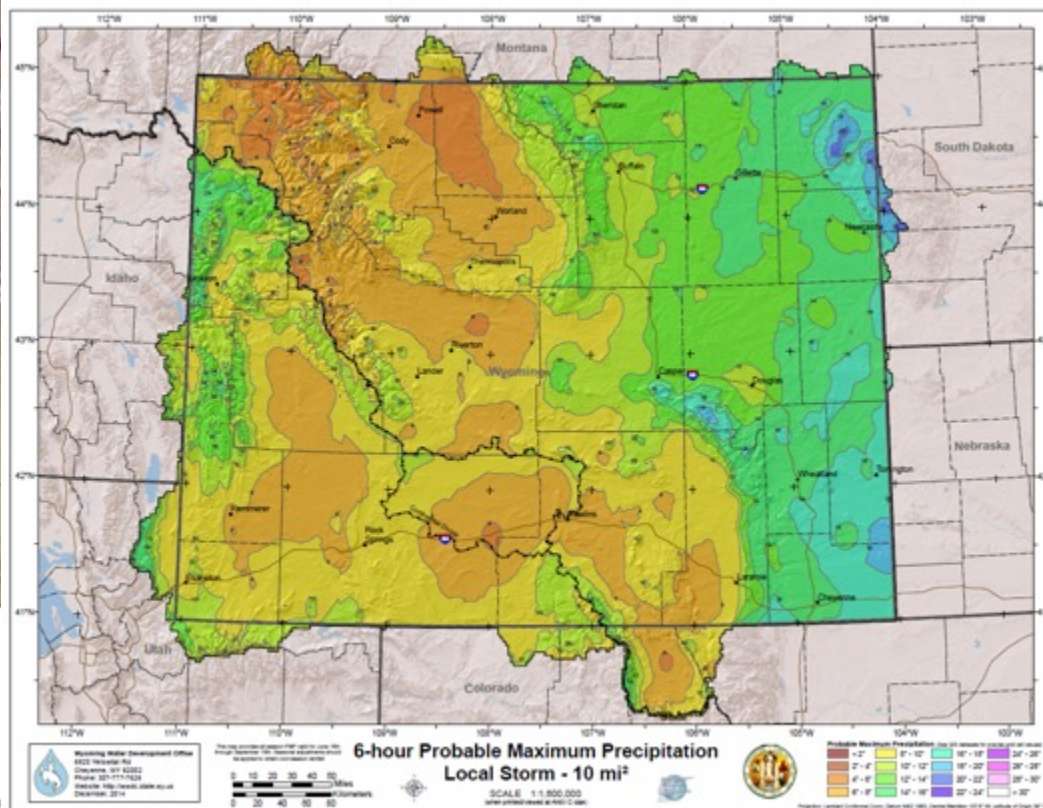
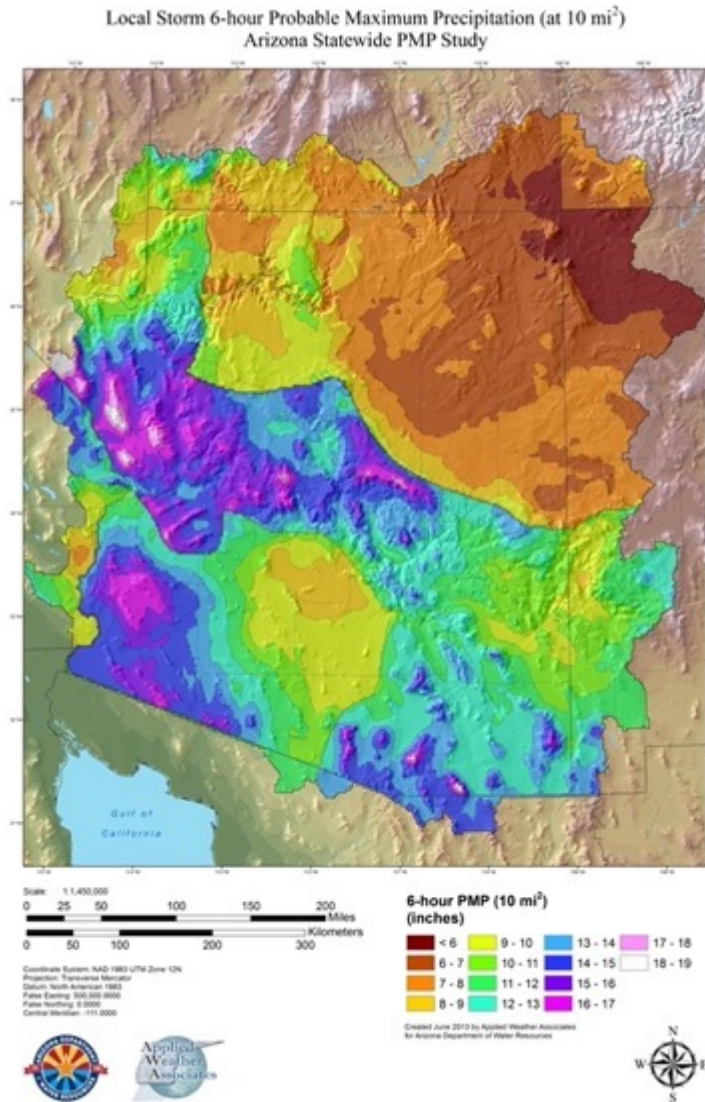


All-season PMP (in.) for 24 hr 100 mi²

AWA Statewide Output Examples-old school

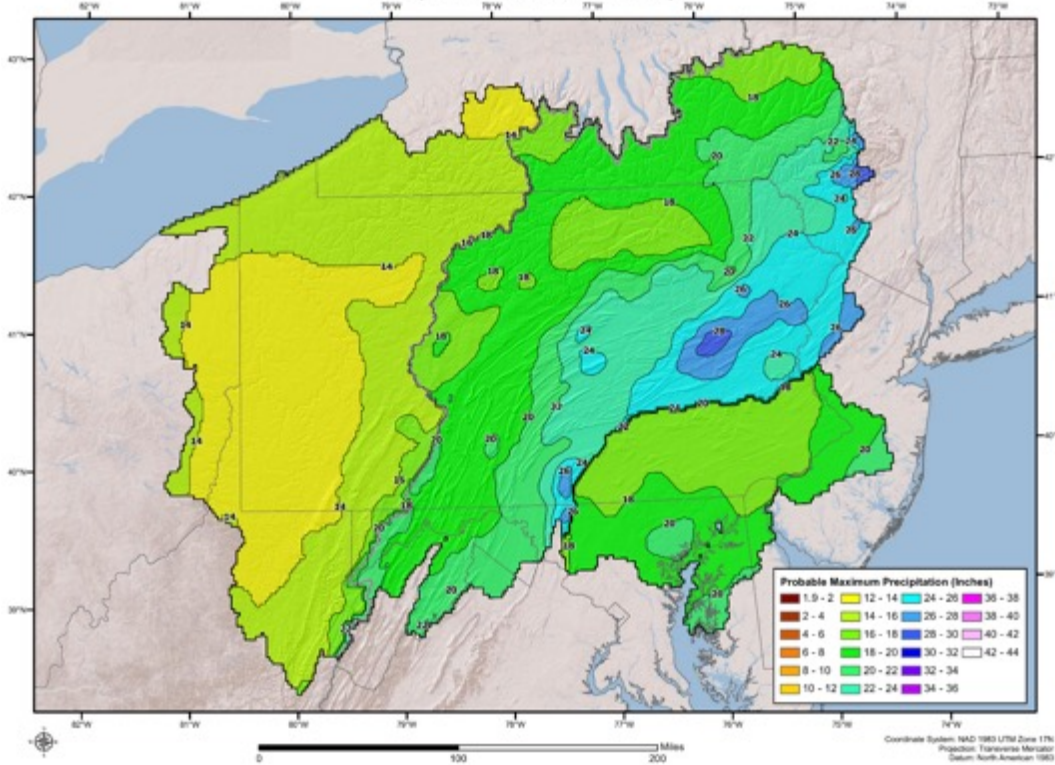


AWA Statewide Output Examples-Southwest-Rockies

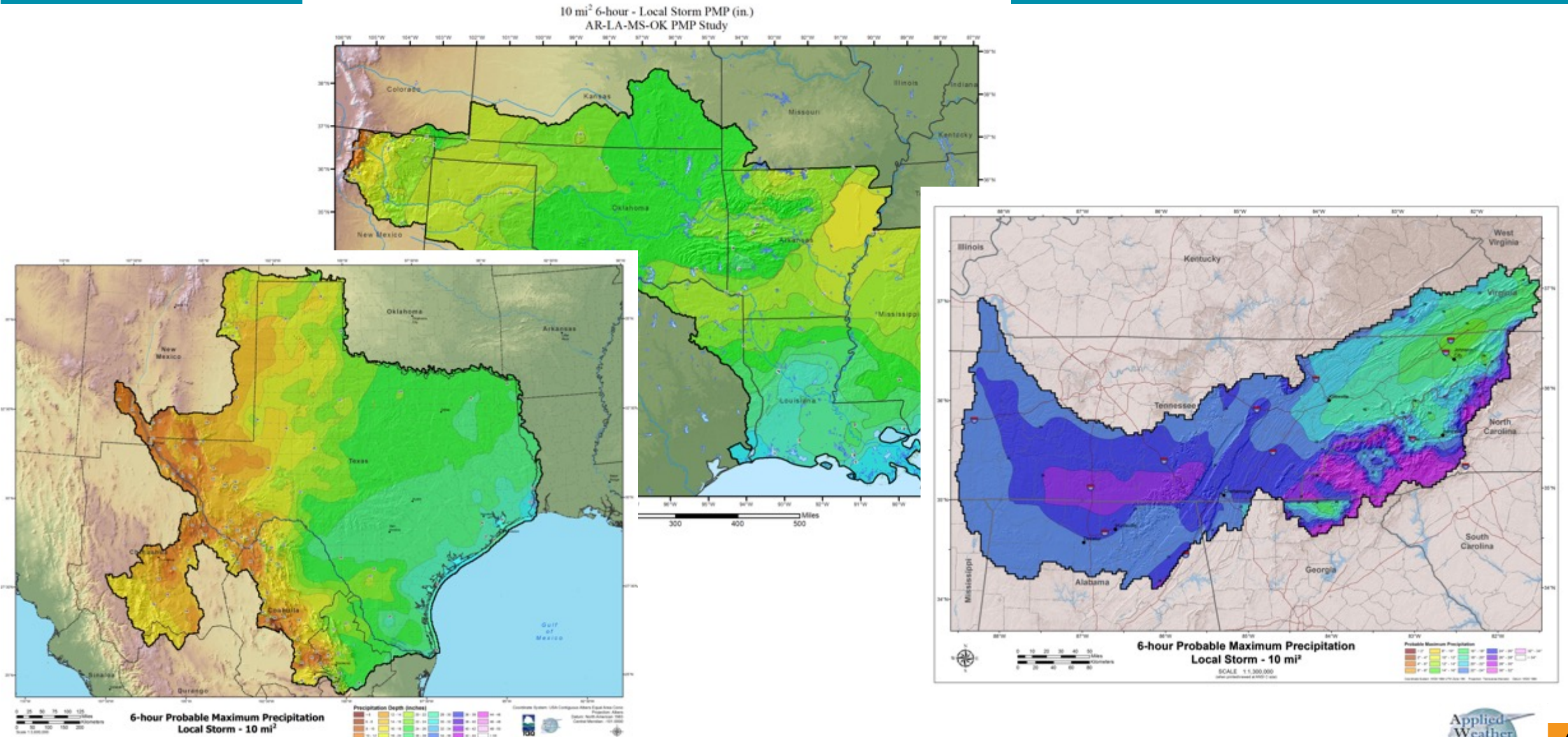


AWA Statewide Output Examples-East

24-Hour Tropical Storm Probable Maximum Precipitation (10 mi²)
Pennsylvania Statewide PMP Analysis

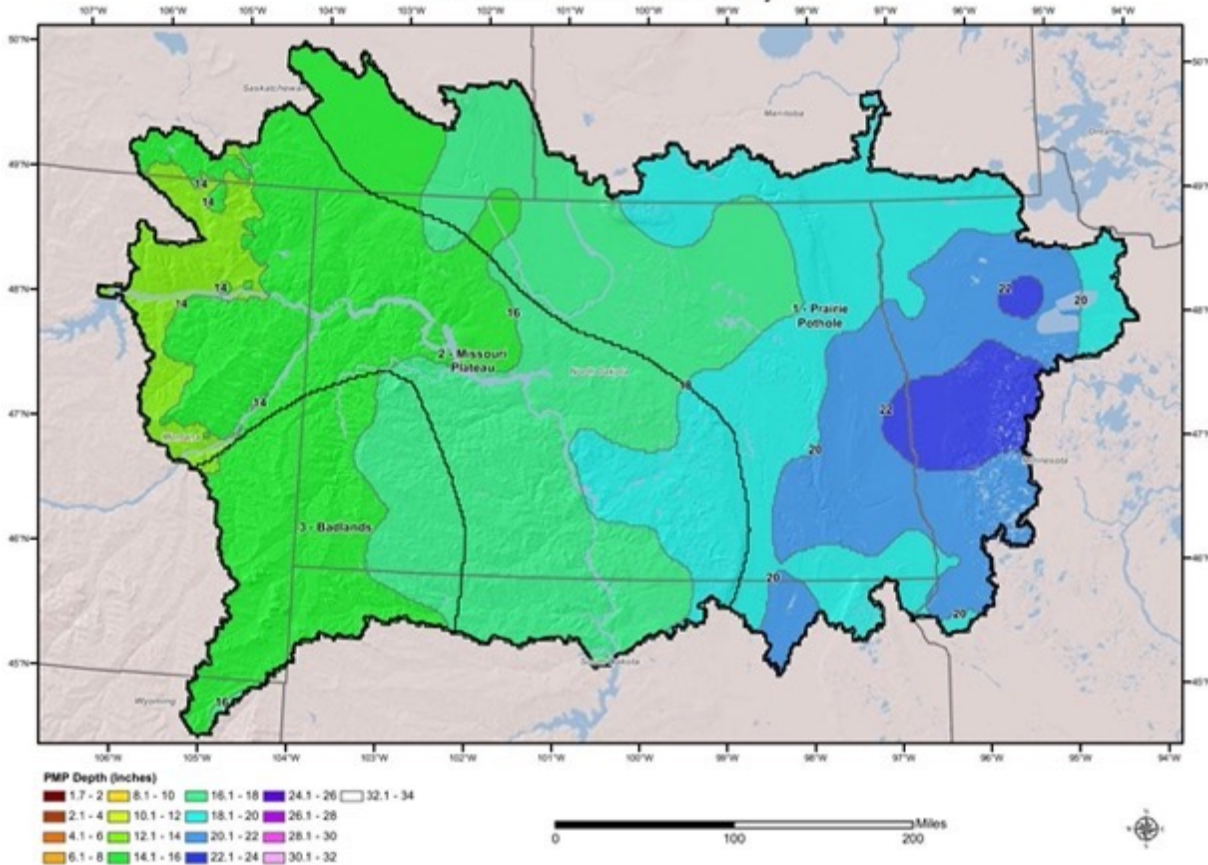


AWA Statewide Output Examples-South

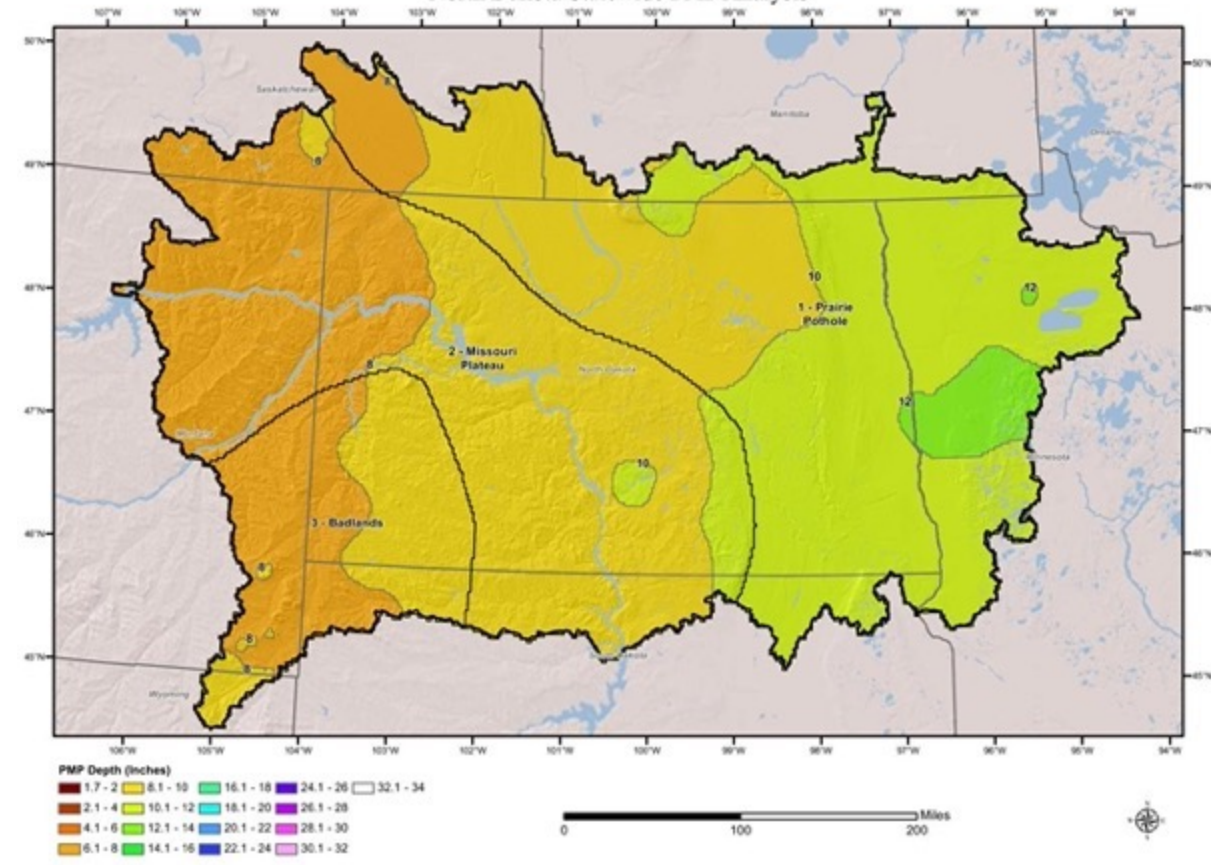


AWA Statewide Output Examples-North

24-Hour General Storm Probable Maximum Precipitation (100 mi²)
North Dakota Statewide PMP Analysis



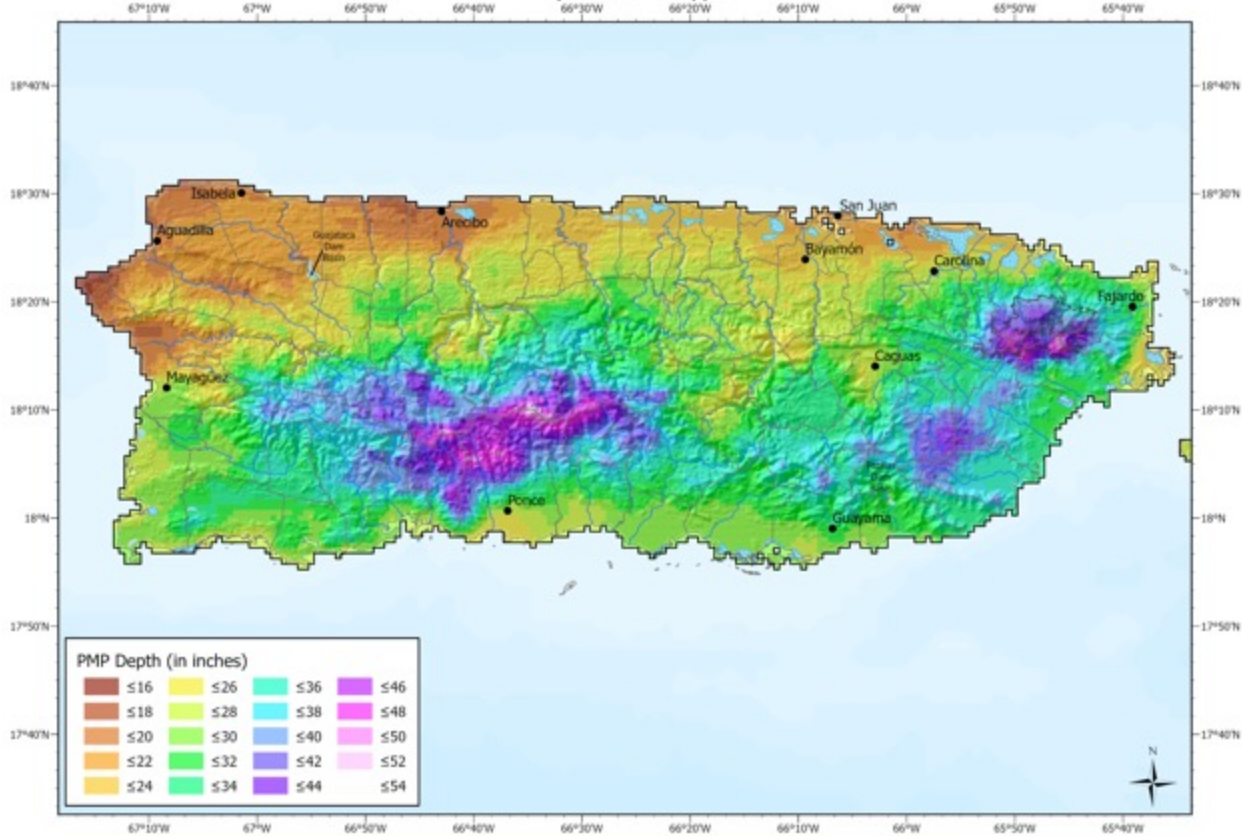
24-Hour Cool Season Storm Probable Maximum Precipitation (100 mi²)
North Dakota Statewide PMP Analysis



AWA Statewide Output Examples-Tropics

Puerto Rico Gridded 100 mi² 24-hour PMP (inches)

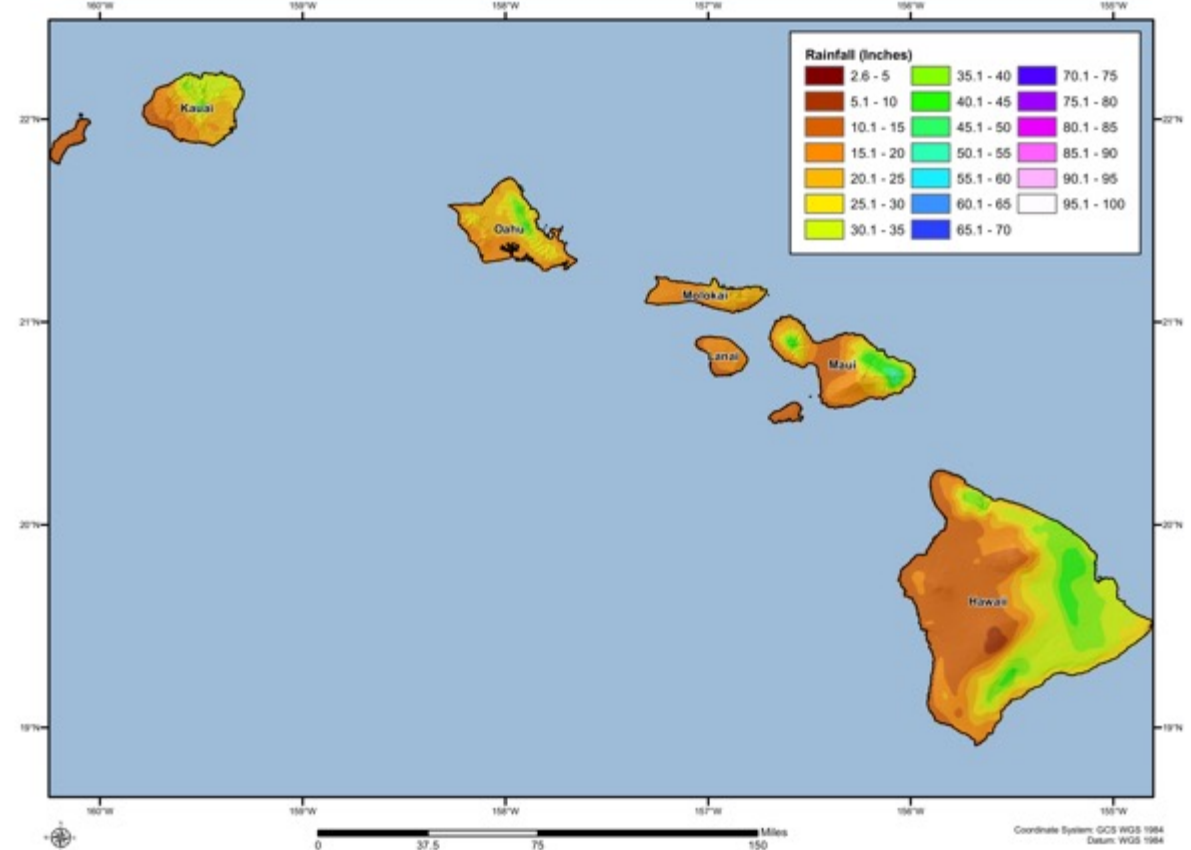
Tropical Storm Type



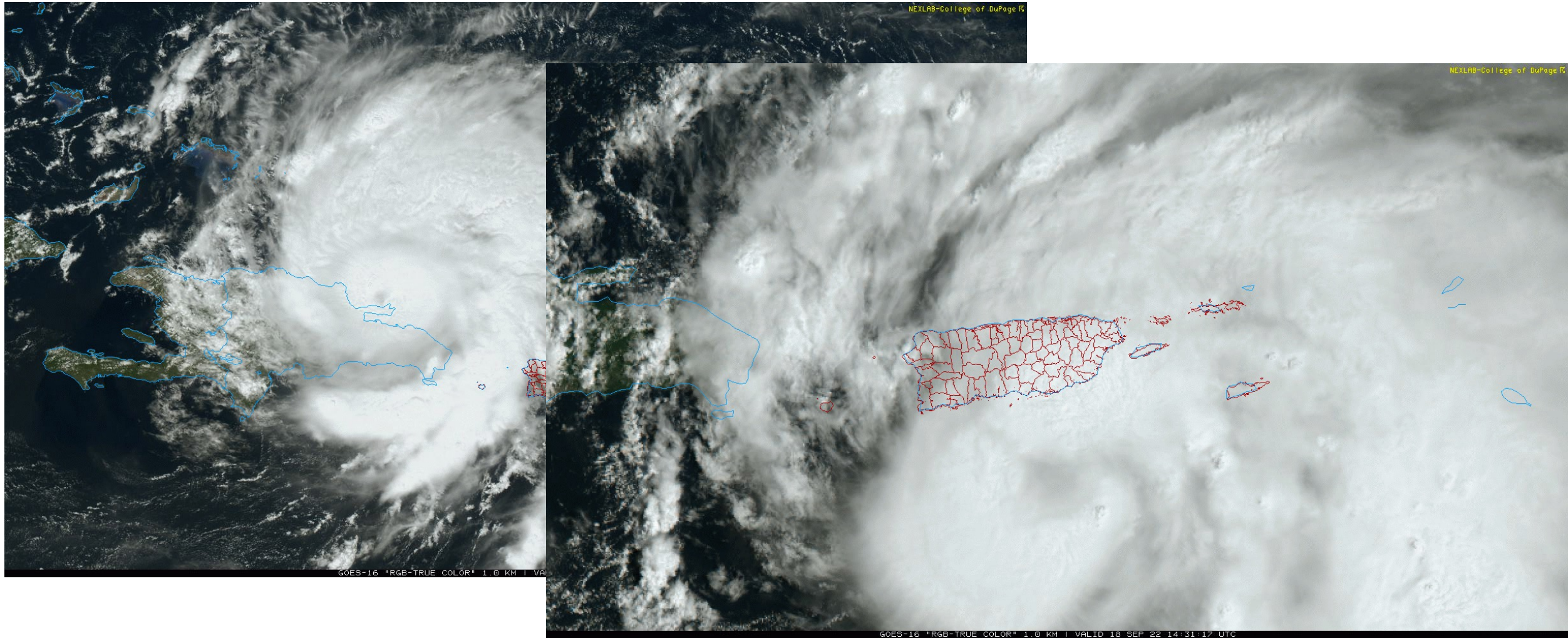
v2 DRAFT

24 Hour 100 Square Mile Probable Maximum Precipitation (PMP)
Hawaii Statewide PMP Analysis

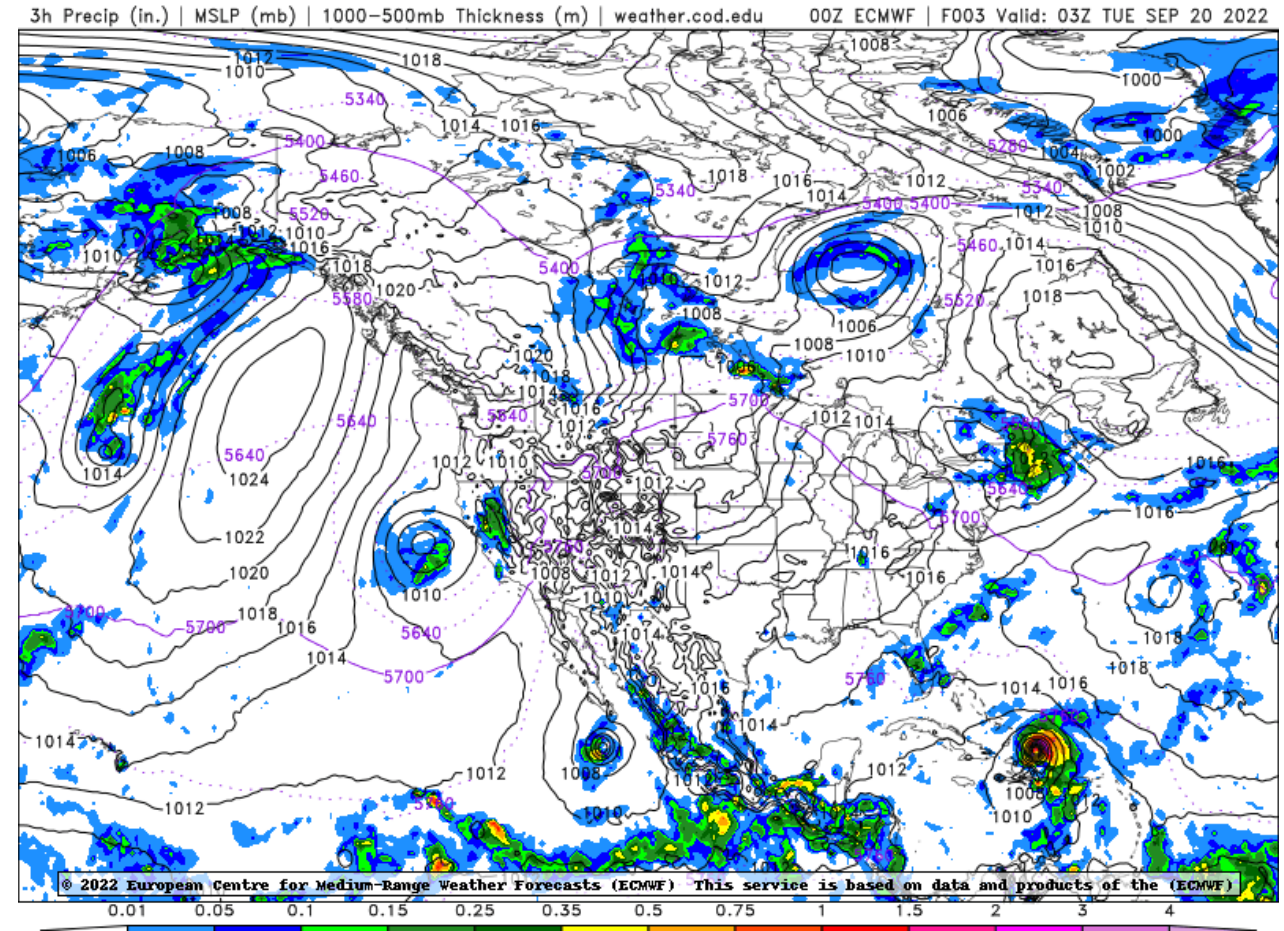
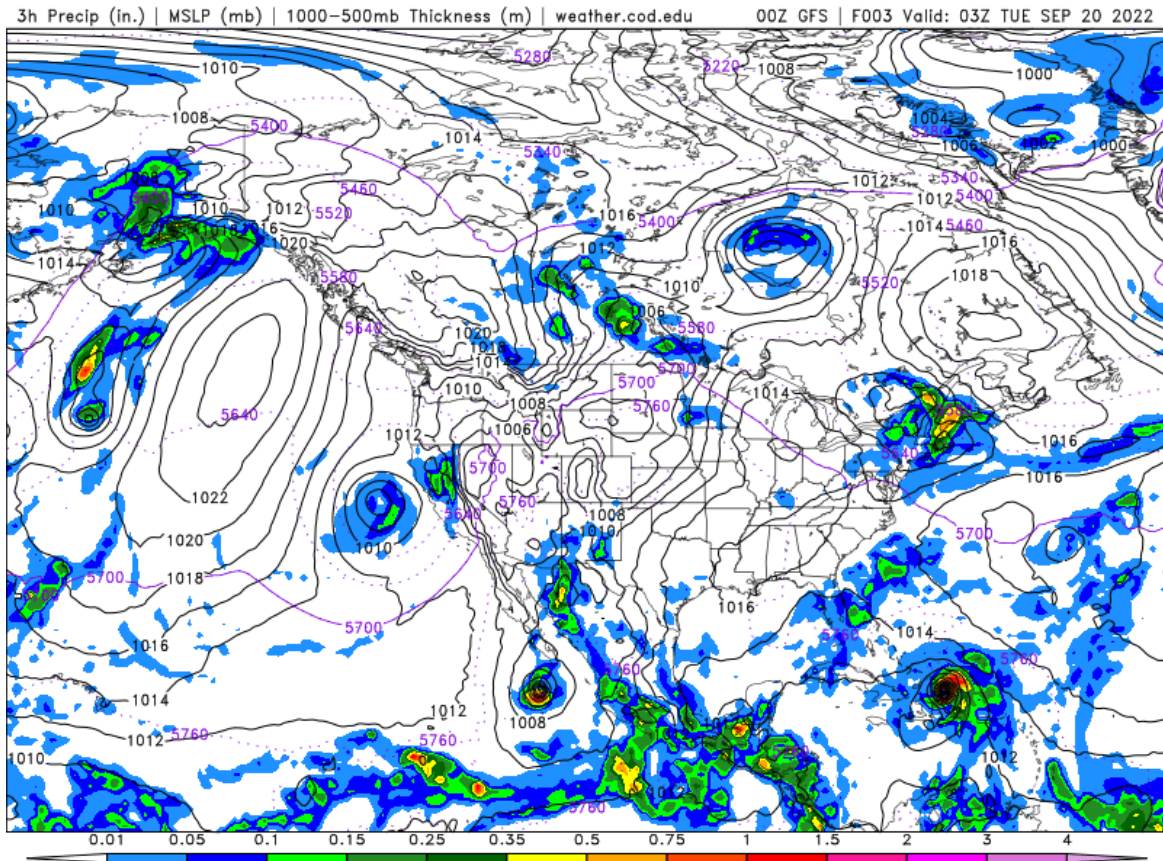
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Hurricane Fiona Satellite Loops



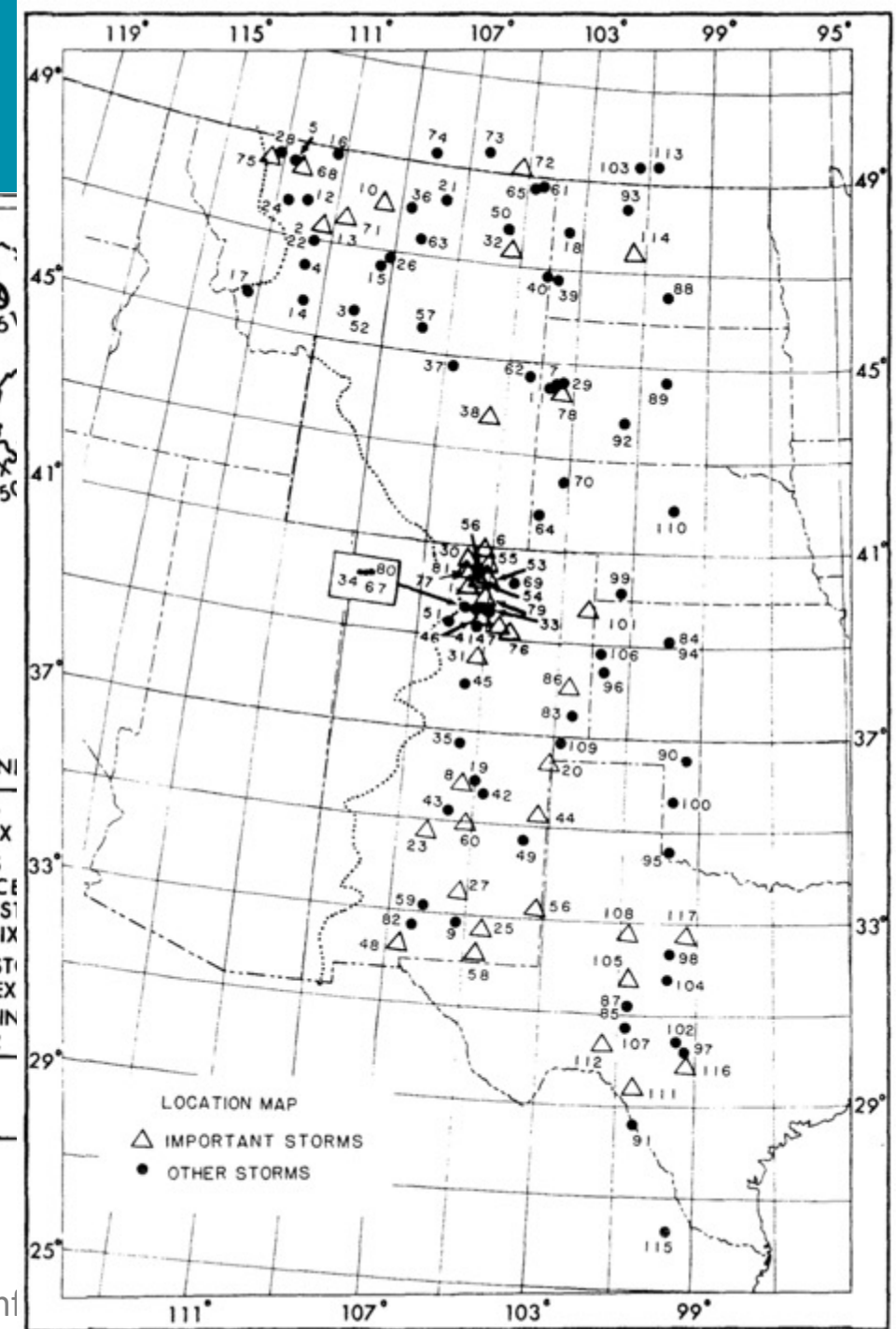
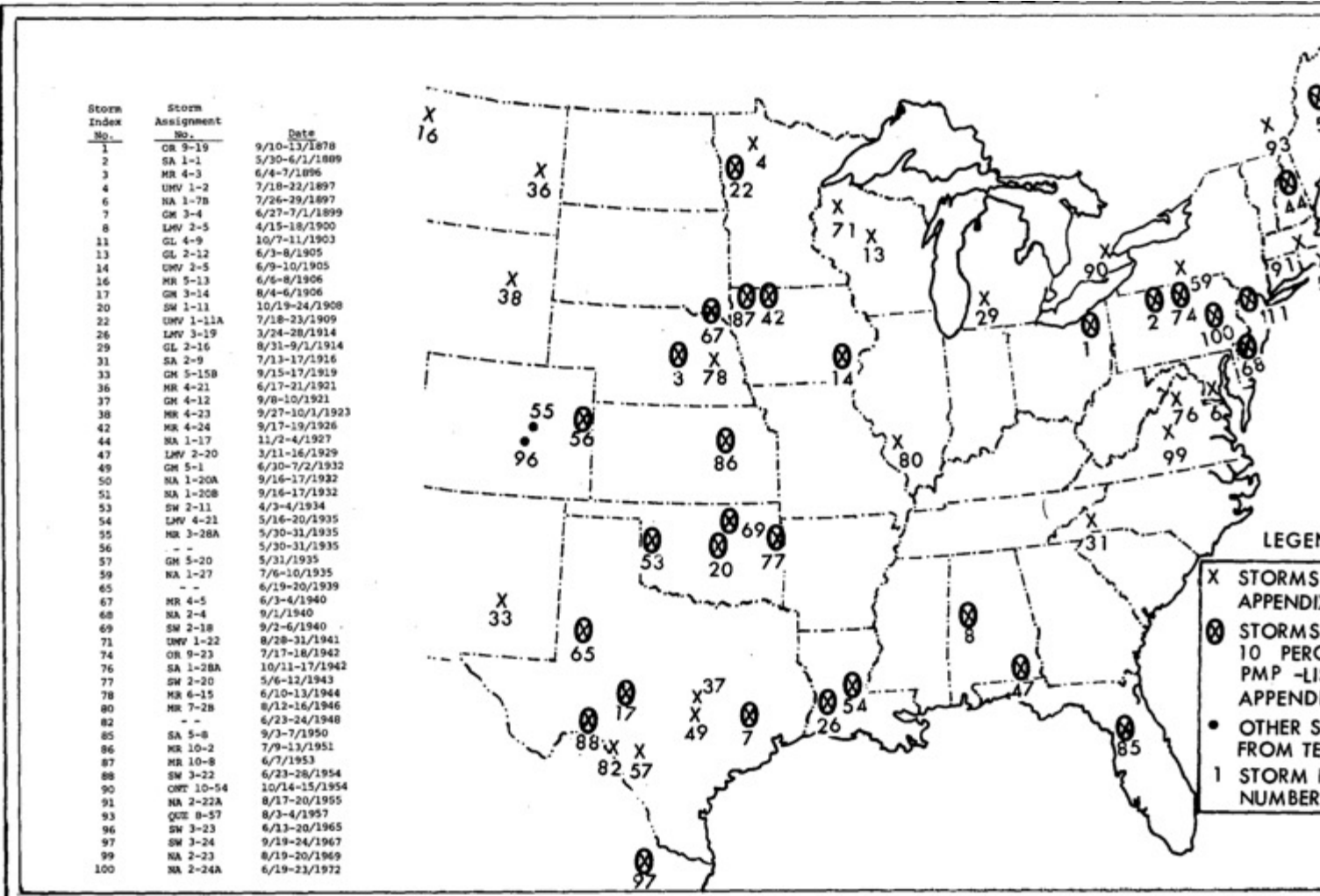
Hurricane Fiona Rainfall



AWA Statewide Progress Improvements

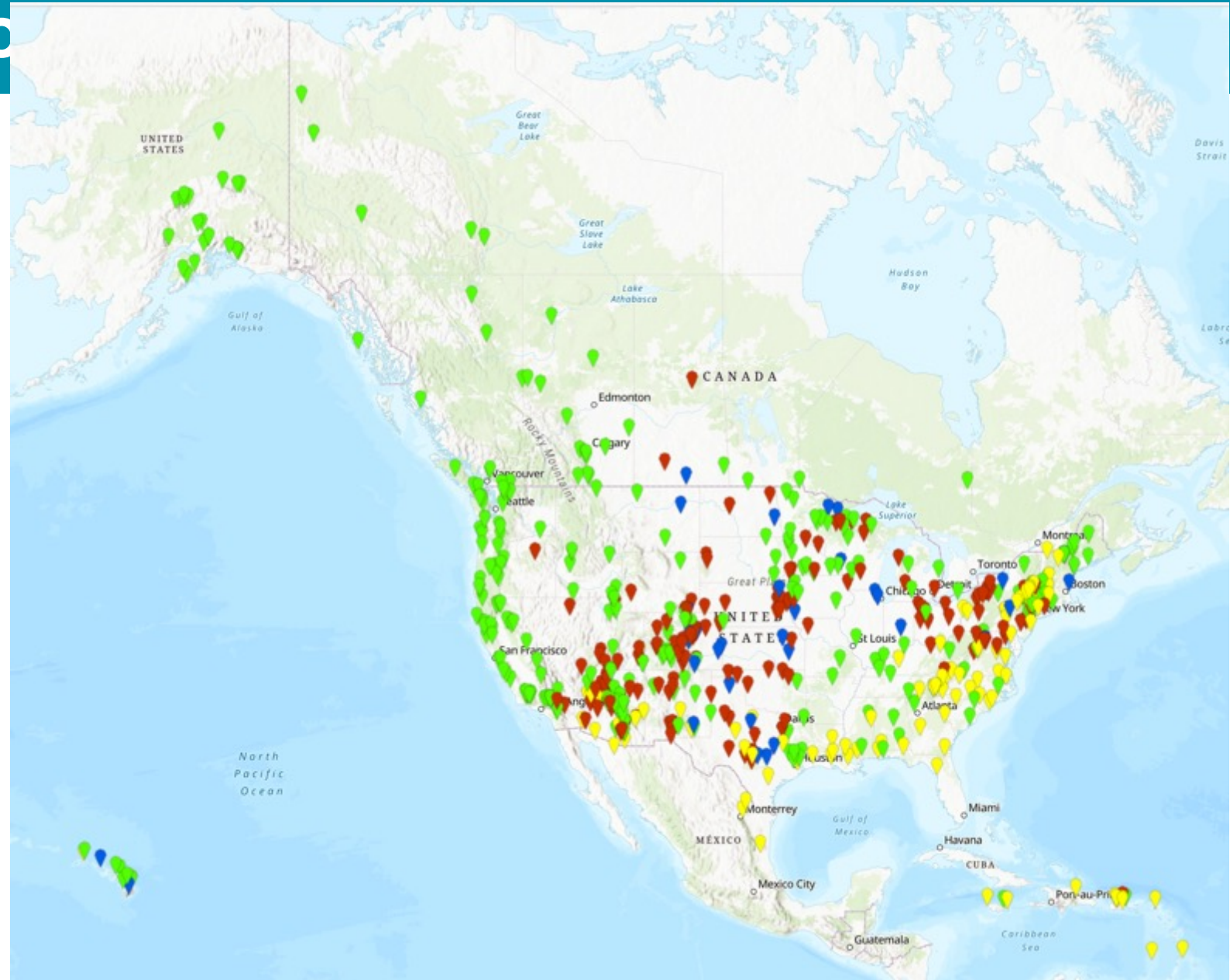
- Continual updates to the storm database
- Critical storm storm based PMP and meteorological analyses
- Storm based temporal patterns
- Storm based spatial patterns
- Input for probabilistic assessments

HMR Storm Database

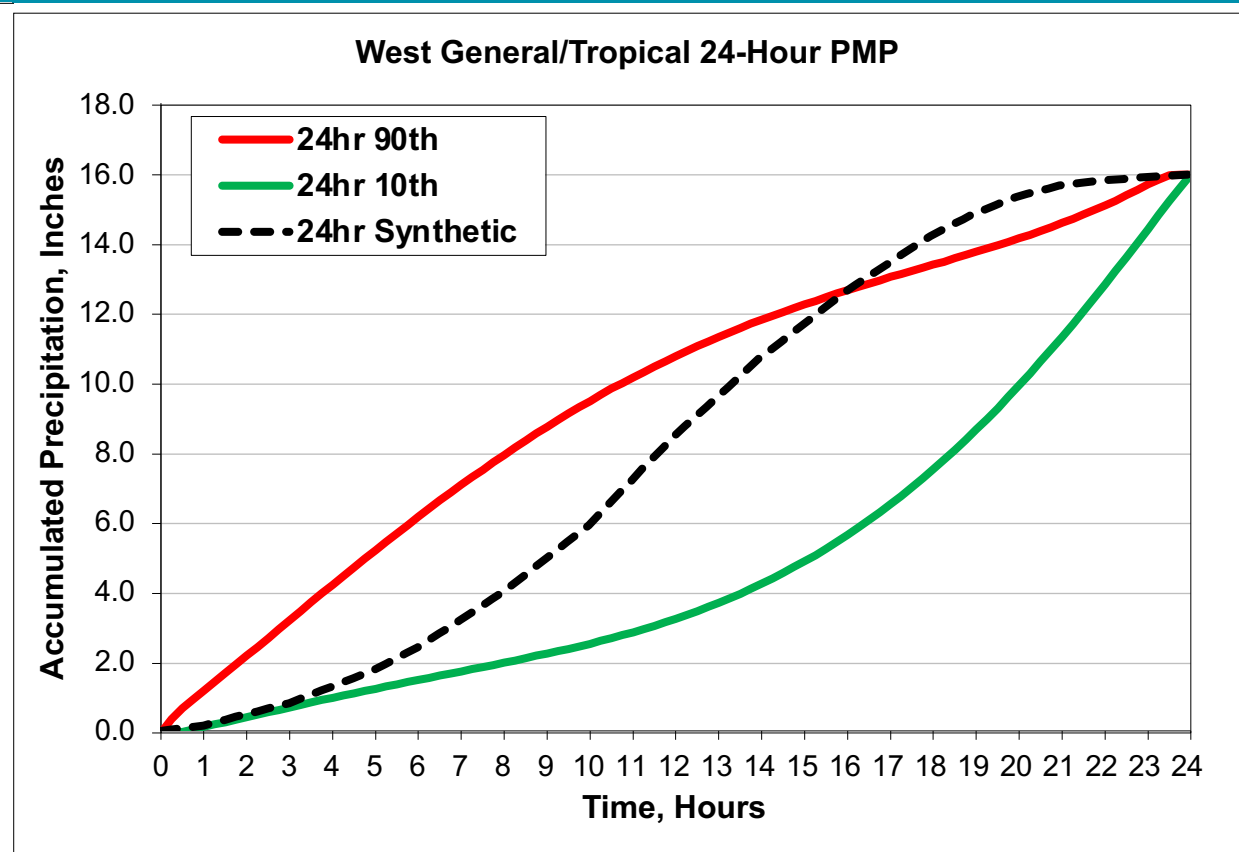
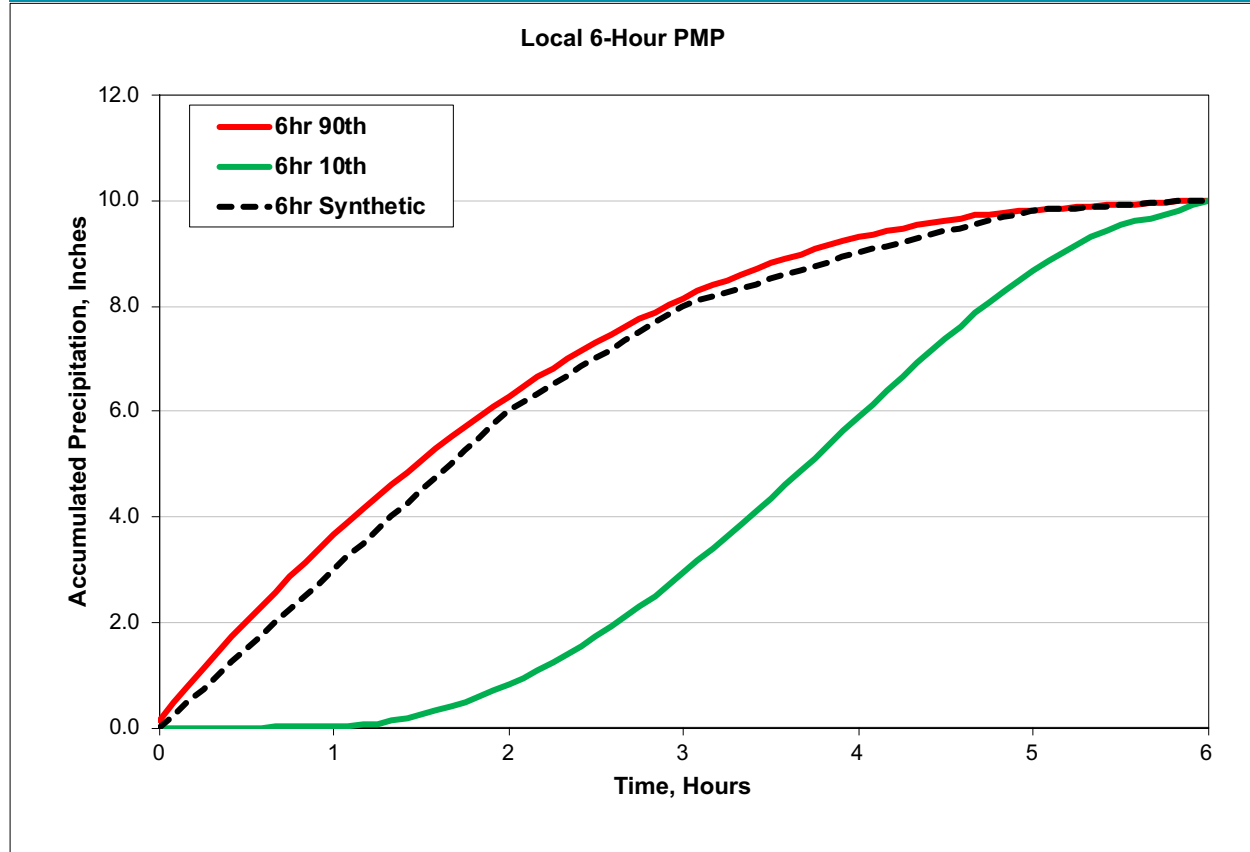




AWA SPAS St

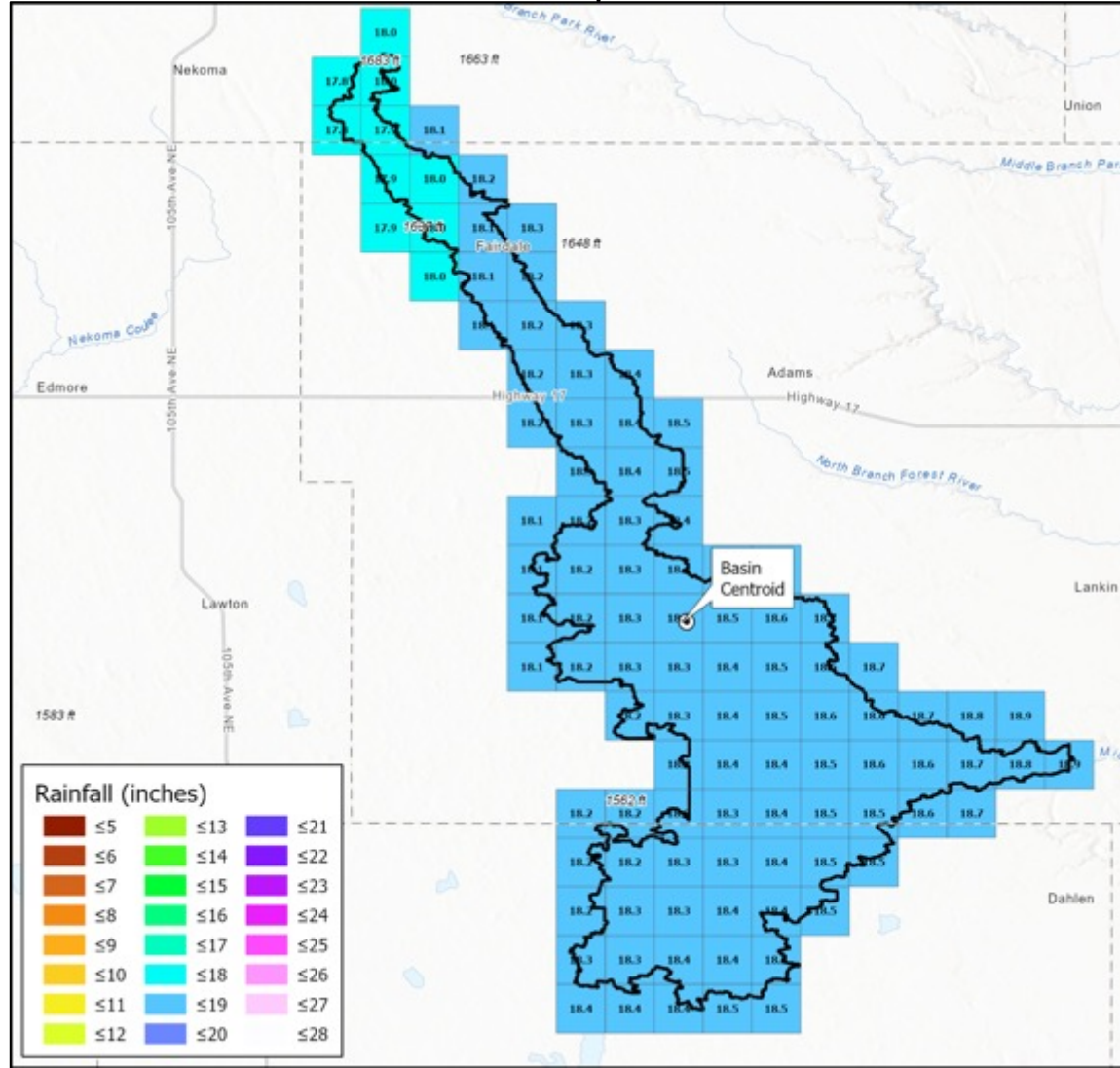


AWA Storm Based Temporal Patterns

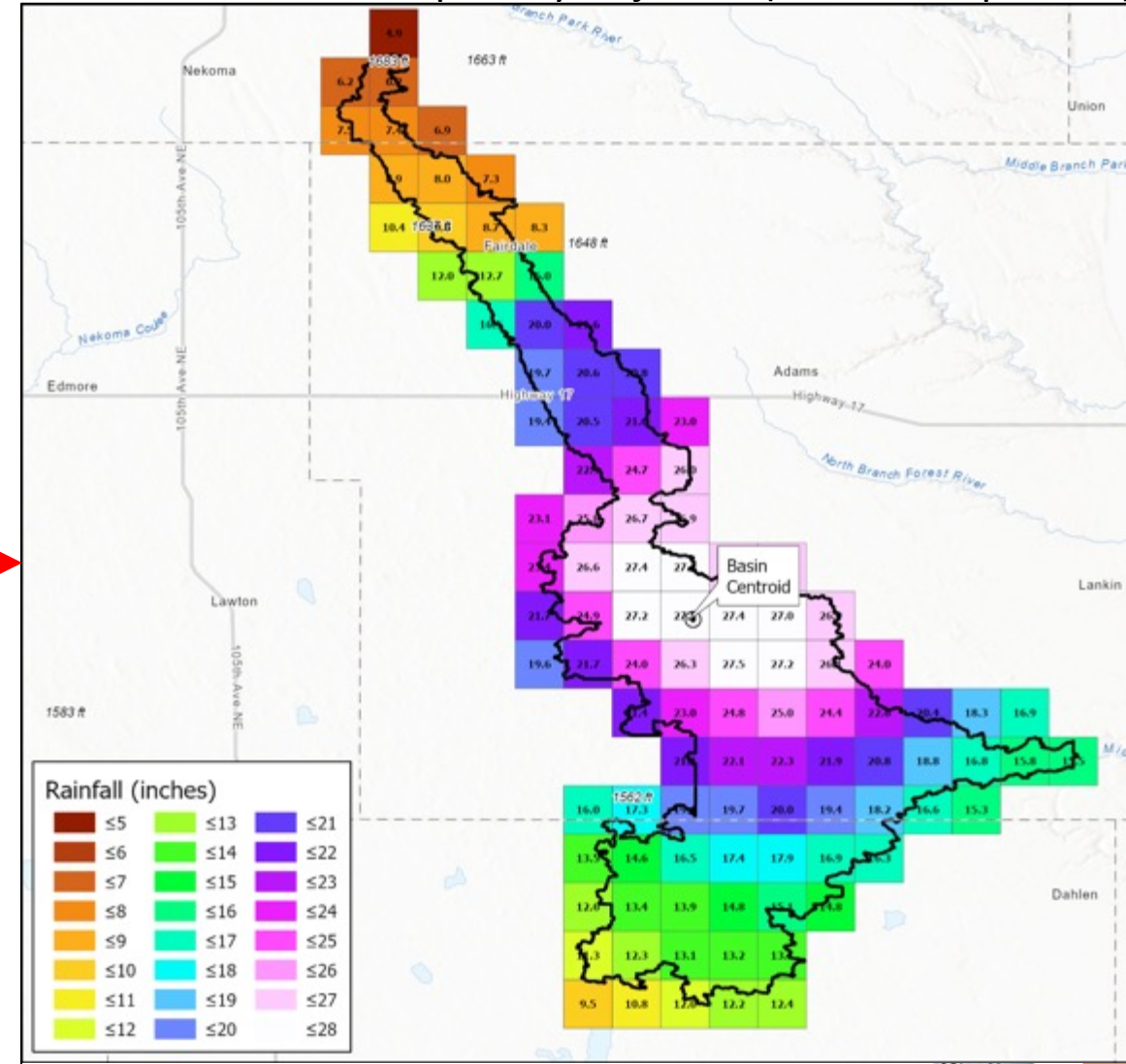


AWA Spatial Example: Parkman, SK

72-hour GS PMP – Default Spatial Pattern



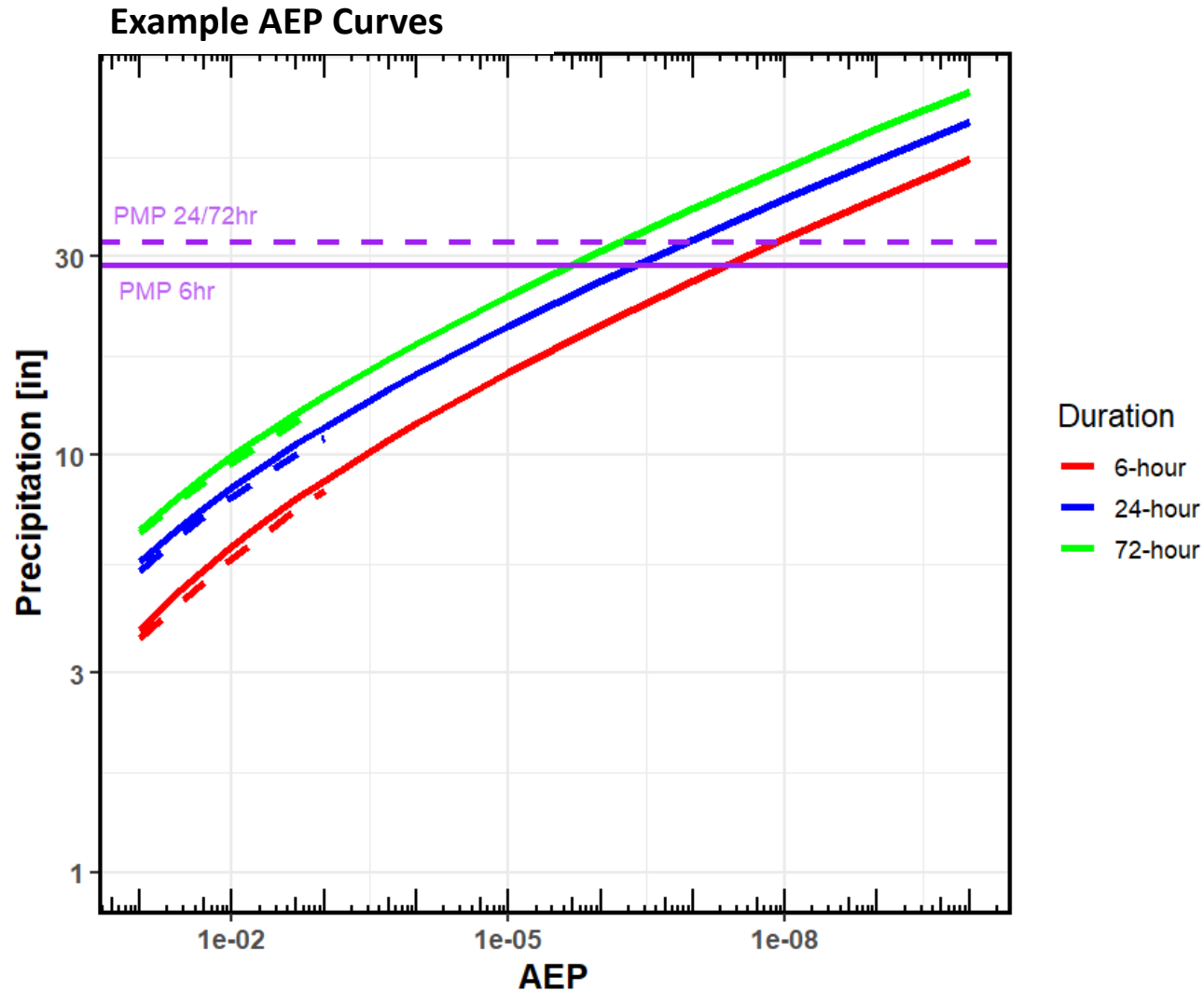
72-hour GS PMP – Spatially Adjusted (SPAS 1337 pattern)



AWA Example AEP Table

Example ARI	Frequency Analysis		6-hour			24-hour			72-hour		
	AEP	AEP	50%	5%	95%	50%	5%	95%	50%	5%	95%
1.01	0.99010	9.9^{-1}	1.0	0.9	1.1	2.0	1.8	2.2	2.4	2.2	2.6
2	0.50000	5.0^{-1}	2.3	2.1	2.5	3.6	3.4	3.9	4.3	4.0	4.6
5	0.20000	2.0^{-1}	3.2	2.9	3.4	4.8	4.4	5.1	5.7	5.2	6.1
10	0.10000	1.0^{-1}	3.8	3.5	4.1	5.5	5.1	6.0	6.6	6.1	7.1
25	0.04000	4.0^{-2}	4.7	4.3	5.0	6.6	6.1	7.2	7.9	7.3	8.5
50	0.02000	2.0^{-2}	5.3	4.9	5.8	7.5	6.9	8.2	8.9	8.2	9.7
100	0.01000	1.0^{-2}	6.0	5.5	6.7	8.4	7.7	9.2	9.9	9.1	10.9
200	0.00500	5.0^{-3}	6.8	6.2	7.6	9.3	8.5	10.4	11.0	10.1	12.3
500	0.00200	2.0^{-3}	7.9	7.1	8.9	10.6	9.6	12.1	12.6	11.4	14.3
1,000	0.00100	1.0^{-3}	8.7	7.8	10.1	11.7	10.4	13.5	13.9	12.4	16.0
5,000	0.00020	2.0^{-4}	10.9	9.5	13.1	14.4	12.5	17.2	17.1	14.9	20.4
10,000	0.00010	1.0^{-4}	11.9	10.3	14.5	15.7	13.5	19.1	18.6	16.0	22.6
100,000	0.00001	1.0^{-5}	15.8	13.1	20.5	20.4	16.9	26.5	24.2	20.0	31.3
1,000,000	0.000001	1.0^{-6}	20.5	16.3	28.3	26.2	20.7	36.1	31.0	24.5	42.7
10,000,000	0.0000001	1.0^{-7}	26.2	19.9	38.7	33.1	25.0	48.8	39.1	29.7	57.8
100,000,000	0.00000001	1.0^{-8}	33.1	24.0	52.5	41.3	29.9	65.5	48.9	35.4	77.6
1,000,000,000	0.000000001	1.0^{-9}	41.4	28.6	70.7	51.2	35.3	87.4	60.6	41.9	103.5
10,000,000,000	0.0000000001	1.0^{-10}	51.4	33.9	94.7	63.1	41.5	116.1	74.7	49.2	137.5

AWA Example AEP outputs

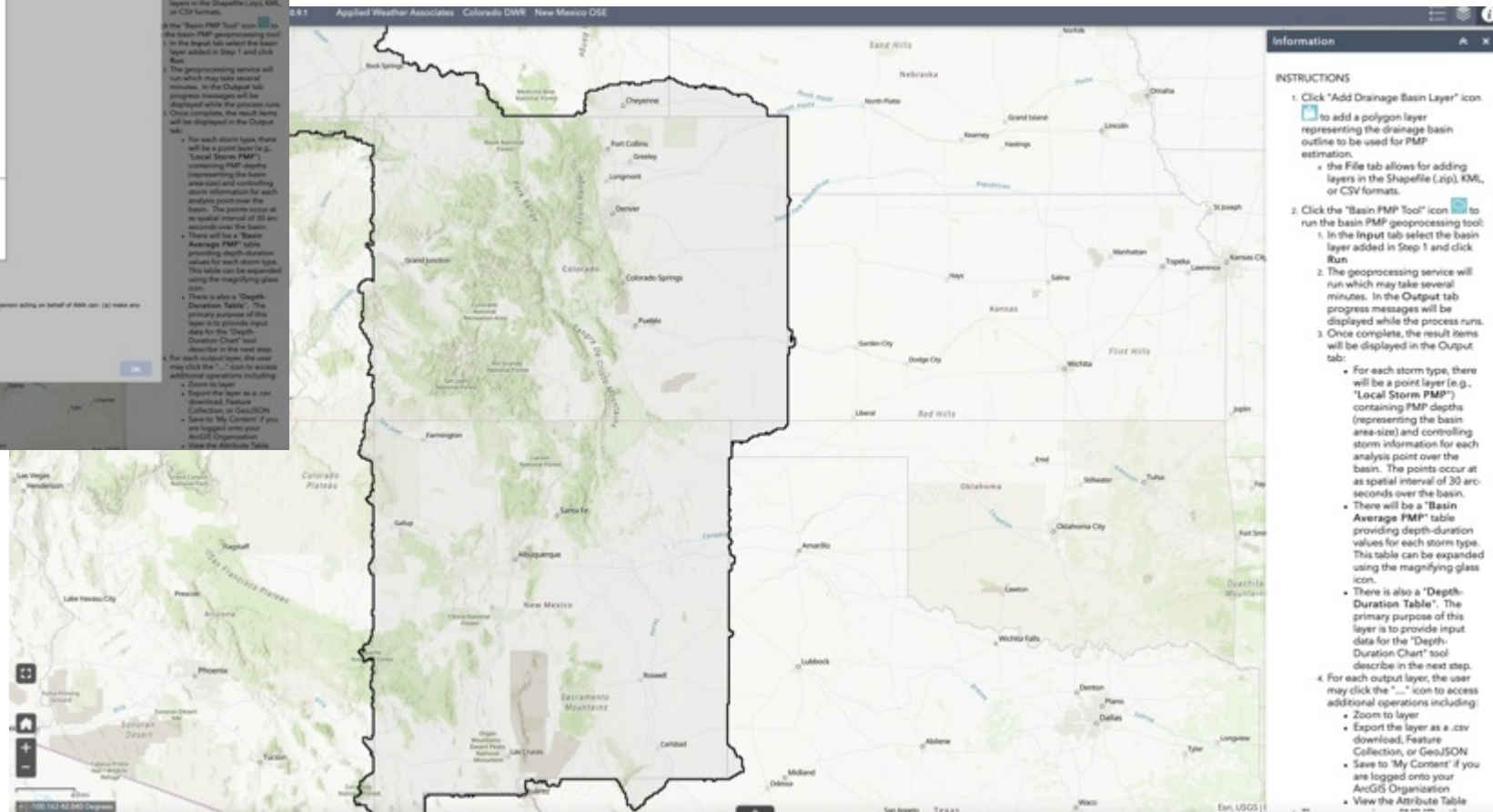
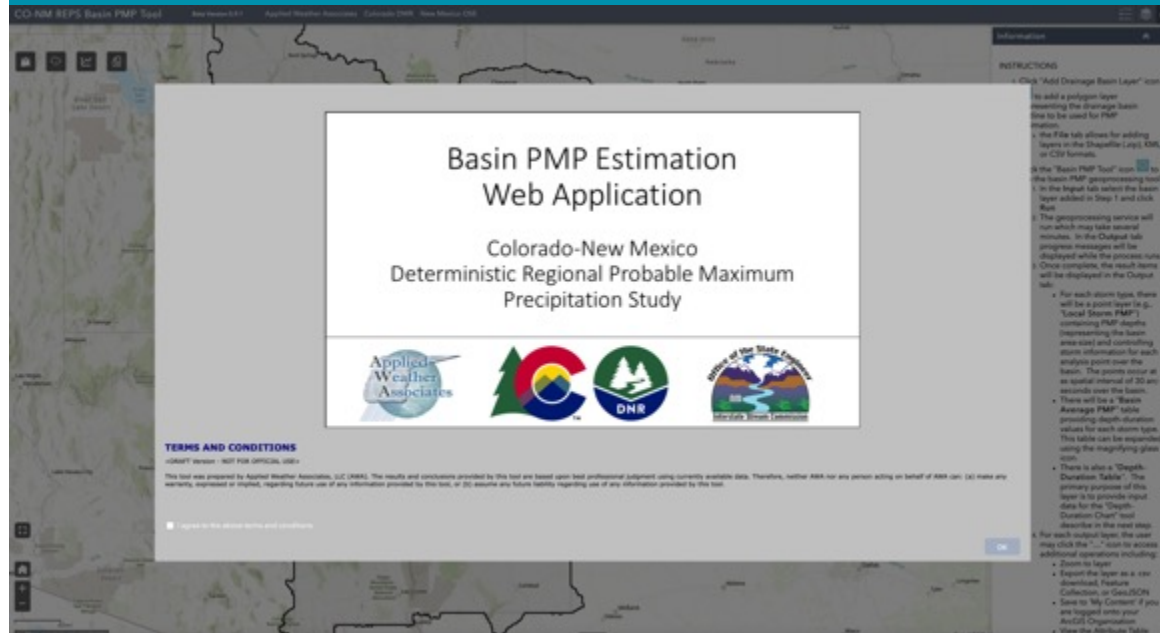


Example AEP and ARI of PMP			
Estimate	PMP (in)	AEP	ARI
6hr	28.5	2.51^{-8}	39,829,769
24hr	32.4	1.09^{-7}	9,144,104
72hr	32.4	3.93^{-7}	2,540,551

Statewide Projects-Now and What's Next

- Web interface for all studies
- Eliminate need for desktop GIS
- Incorporate updates, improvements for all states
- Provide consolidated support and maintenance
- Continually updated storm database

AWA Web PMP Tool Example



Statewide Project-What About Climate Change

- Climate Change assessments completed
- Wide range of outcomes and projections
- Precipitation is the most uncertain variable
- Extreme precipitation even more uncertain

Application of Climate Change Results

- Results are presented as median values based on model ensemble
 - Max/min provided for sensitivity
- Results are through 2100 and can be scaled to other periods
 - Example, for 2050 adjustment scale 2100 results by 0.59.
 - Recommend SSP45 climate scenario as “likely”, SSP85 as “unlikely”
- Range of uncertainty and natural variability noted
 - Only recommend updates when outside of these ranges

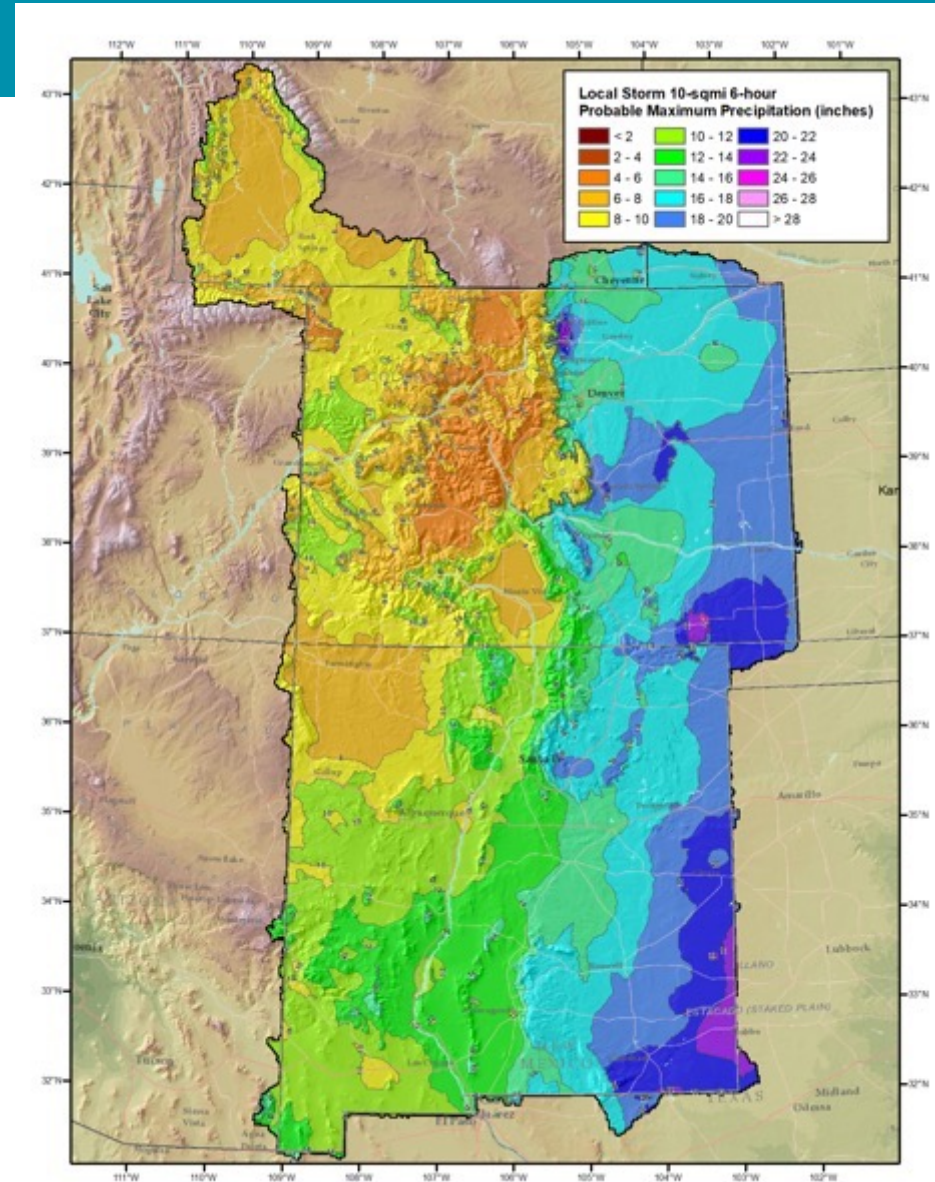
	SSP45				SSP85			
	Mean	Median	Min	Max	Mean	Median	Min	Max
Temperature 1-Day; C	2.3	2.0	0.7	5.8	5.5	4.8	3.0	11.2
Temperature 1-Day Summer; C	2.3	2.0	0.7	5.8	5.5	4.8	3.0	11.2
Temperature 1-Day Winter PF; C	2.1	2.1	0.8	4.2	5.0	4.8	2.8	9.1
Precipitation 1-Day PF; %	6	3	-9	47	6	6	-14	26
Precipitation 1-Day Summer PF; %	11	7	-12	51	11	12	-22	63
Precipitation 1-Day Winter PF; %	7	5	-11	47	6	7	-9	26
Precipitation 3-Day PF; %	12	7	-16	52	16	16	-14	55
Precipitation 3-Day Summer PF; %	8	8	-32	54	9	5	-21	66
Precipitation 3-Day Winter PF; %	14	15	-14	50	18	16	-9	48
Precipitation Annual PF; %	10	10	-5	20	13	13	-2	25

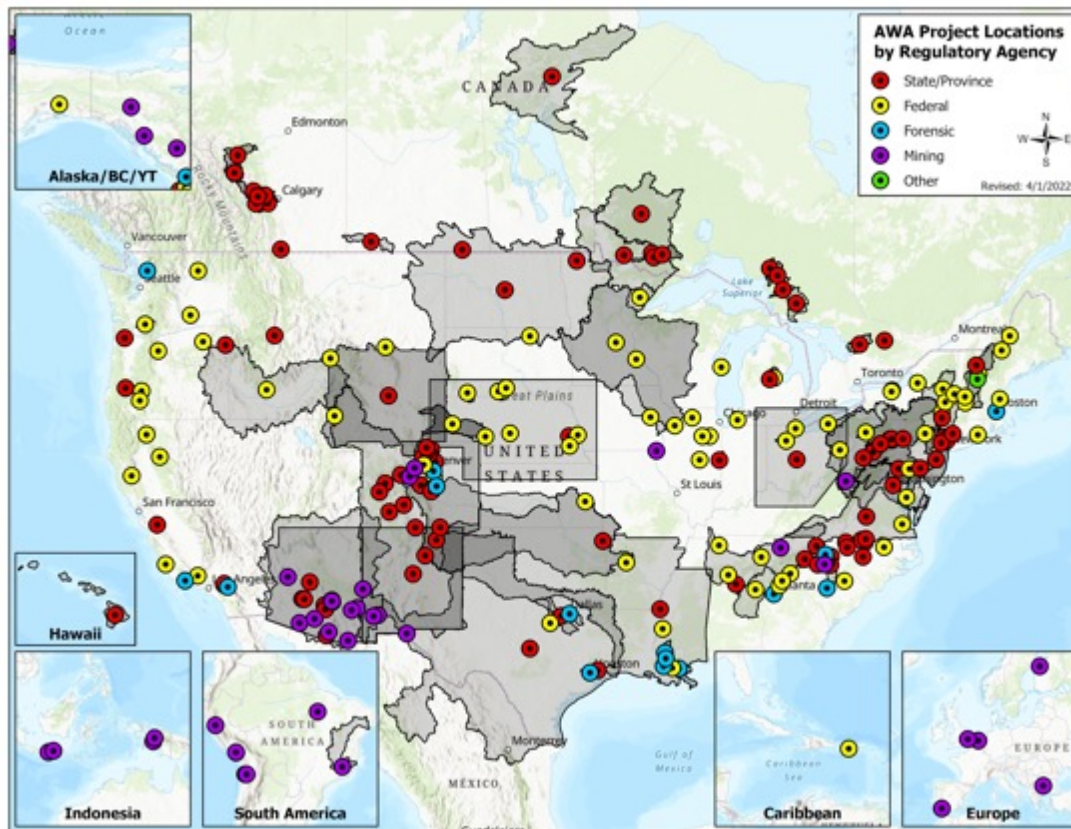
	2050	2100
1-Day Summer PF; %	4	7
1-Day Winter PF; %	3	5
3-Day Summer PF; %	5	8
3-Day Winter PF; %	9	15

Climate Change Projections from 2015 through 2100

What's Next

- Federal involvement?
 - What about the studies that have already been completed
 - Nationwide coverage
- Storage of database/updates
 - How to handoff to the next generation
- Numerical Modeling





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