Probable Maximum Precipitation (PMP)
3rd Steering Committee Meeting

Applied Weather Associates (AWA)

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Probable Maximum Precipitation

Definition: The *theoretically* greatest depth of precipitation for a given duration that is *physically possible* over a given storm area at a particular *geographic location* at a certain time of year (HMR 59, 1999)

Probable Maximum Precipitation - Major Tasks

- Review Previous/Ongoing Work
  - AWA PMP studies
  - HMRs 53, 52, 51, 48, 44, 33, 22, 20, etc
  - USACE, USBR, USGS, NRCS, other reports, etc
  - Scientific journals, NWS, etc

In process and ongoing during study for new storms and data

Probable Maximum Precipitation - Major Tasks

- Storm Search and Storm List
  - Complete a storm search to identify the most significant storms that could have occurred over the region where storms are transpositionable
  - Identify storms used in HMRs and other PMP studies
  - Identify the most significant flood events that have occurred in region
  - Identify extreme rainfall-producing storm types and seasons
  - Use SPAS to analyze
- Storm must have similar meteorology/topography to be considered transpositionable

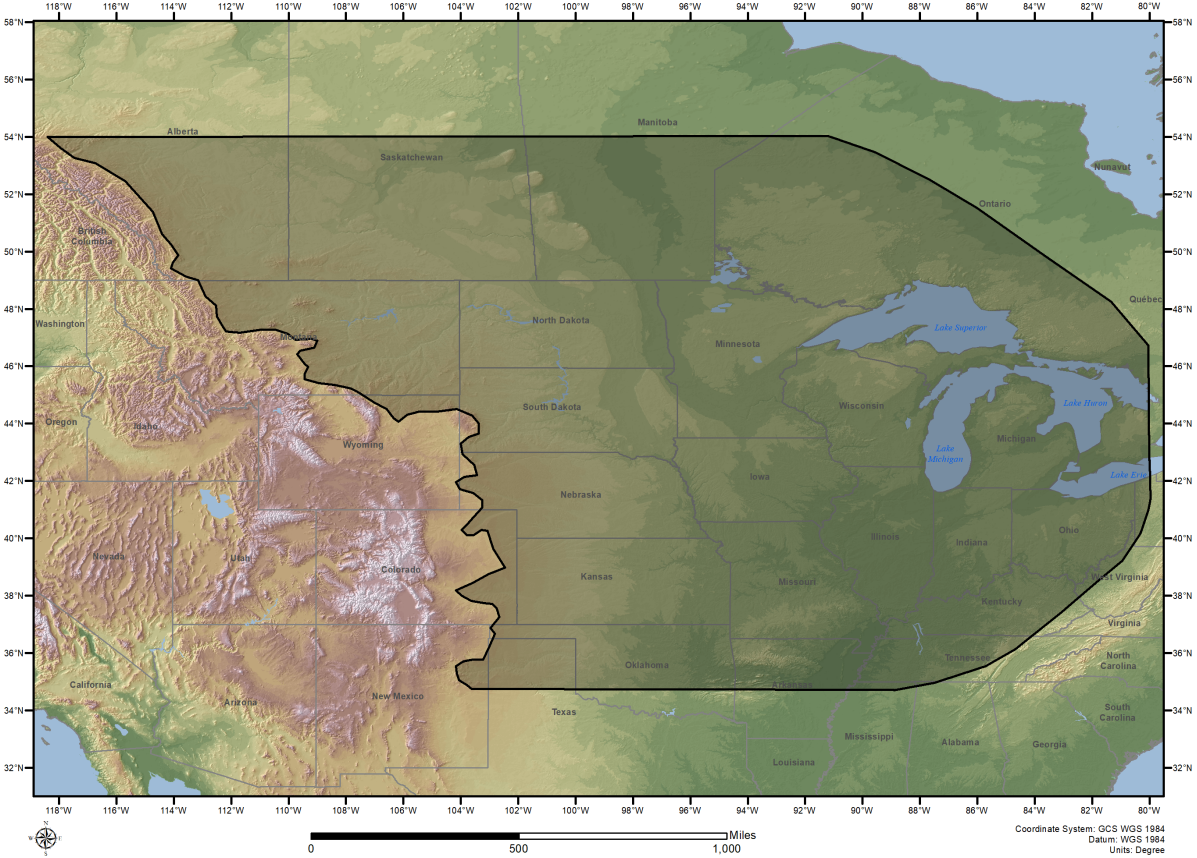
Completed

Probable Maximum Precipitation - Major Tasks

- Ensure consistency with other studies
- Already have a very good idea of important storms
- Two storm types of concern-how to define each
  - General (synoptic)
  - Local (thunderstorms)
- Rain-on-Snow and long duration an important new aspect
- Let the data talk to us
- Use adjustment factors

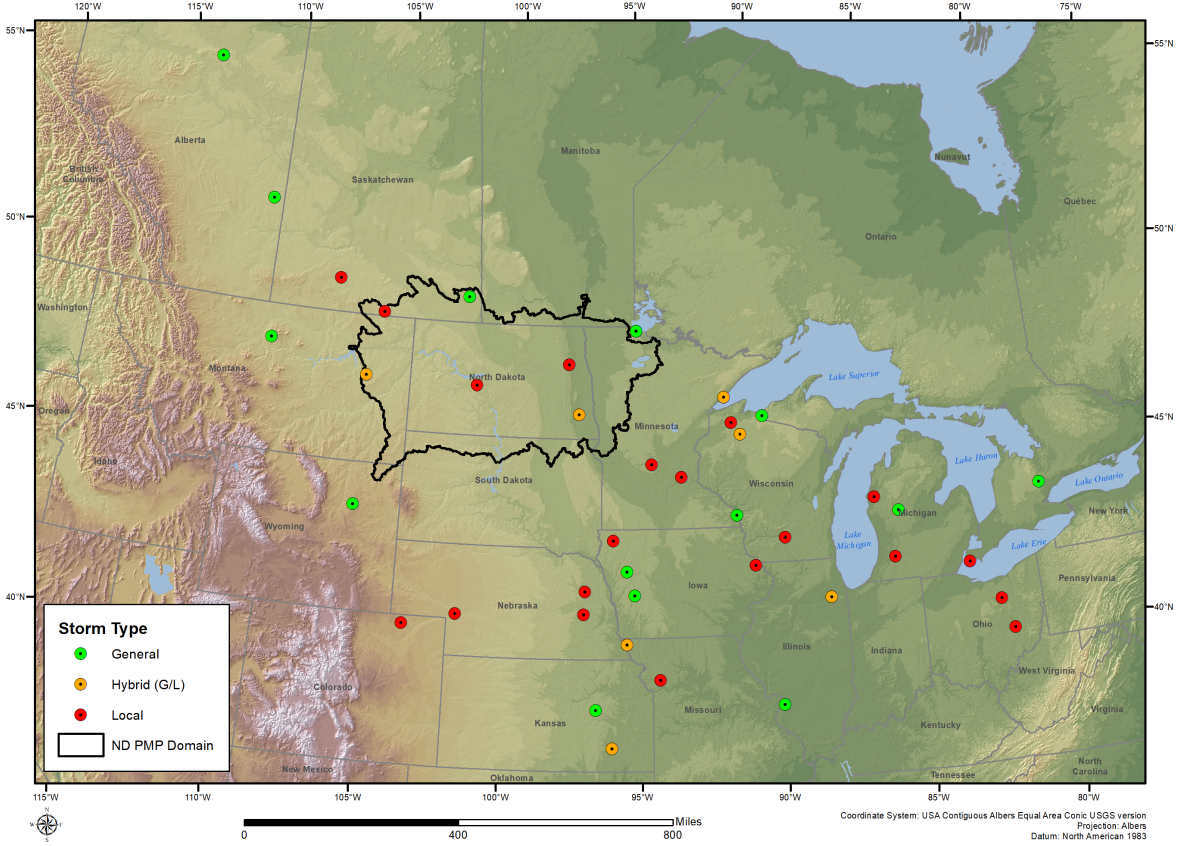
Probable Maximum Precipitation - Major Tasks

Storm Search Domain
North Dakota Statewide PMP Analysis



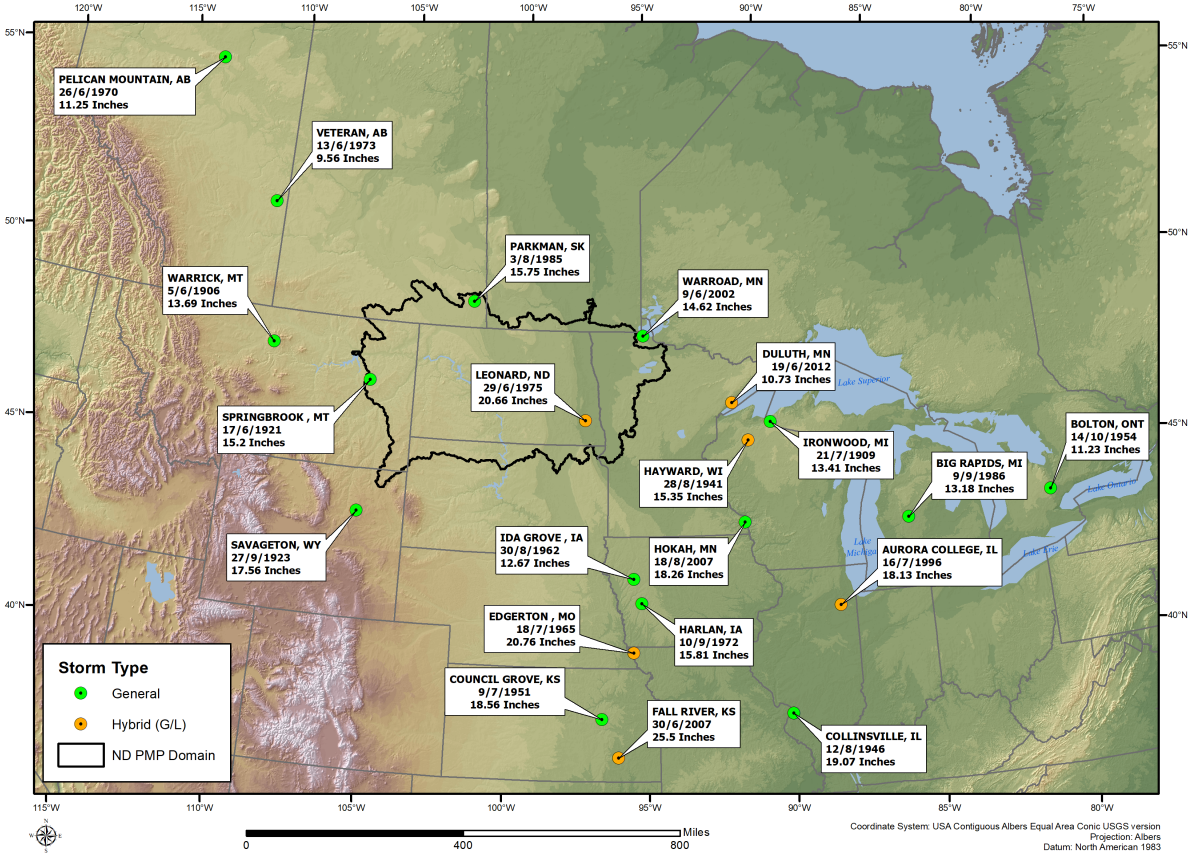
Current Storm Locations

Locations of all Warm Season Storm Events - Short List
North Dakota Statewide PMP Analysis



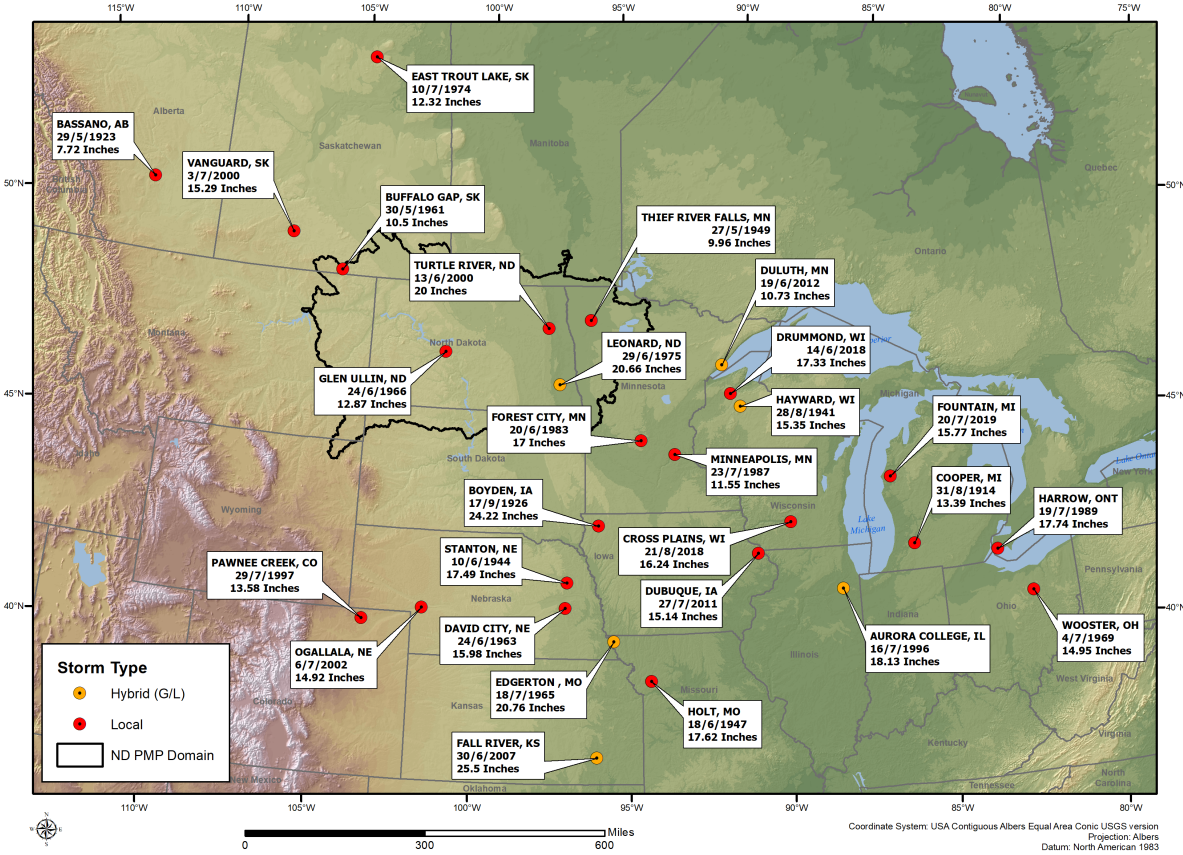
Current Storm Locations

Locations of all General Warm Season Storm Events - Short List
North Dakota Statewide PMP Analysis



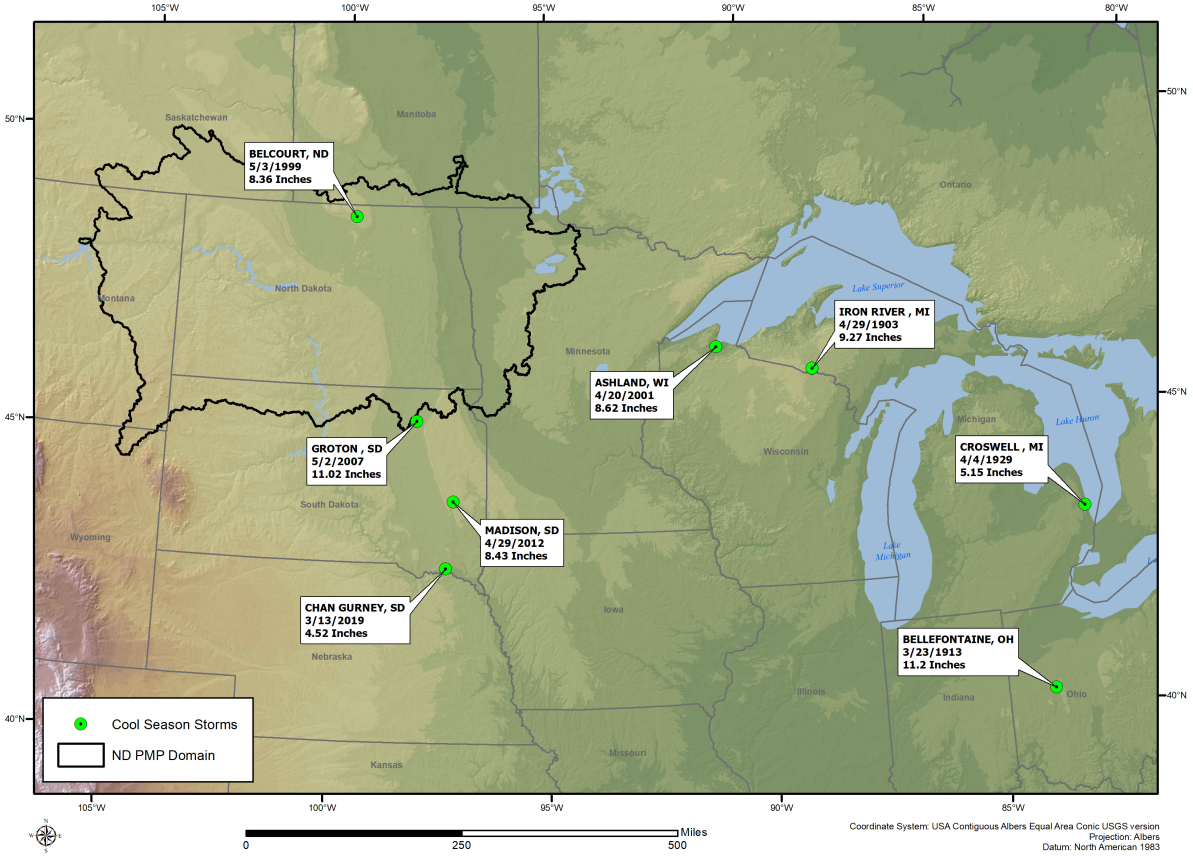
Current Storm Locations

Locations of all Local Warm Season Storm Events - Short List
North Dakota Statewide PMP Analysis



Current Storm Locations

Locations of all Cool Season Storm Events - Short List
North Dakota Statewide PMP Analysis



Probable Maximum Precipitation - Major Tasks

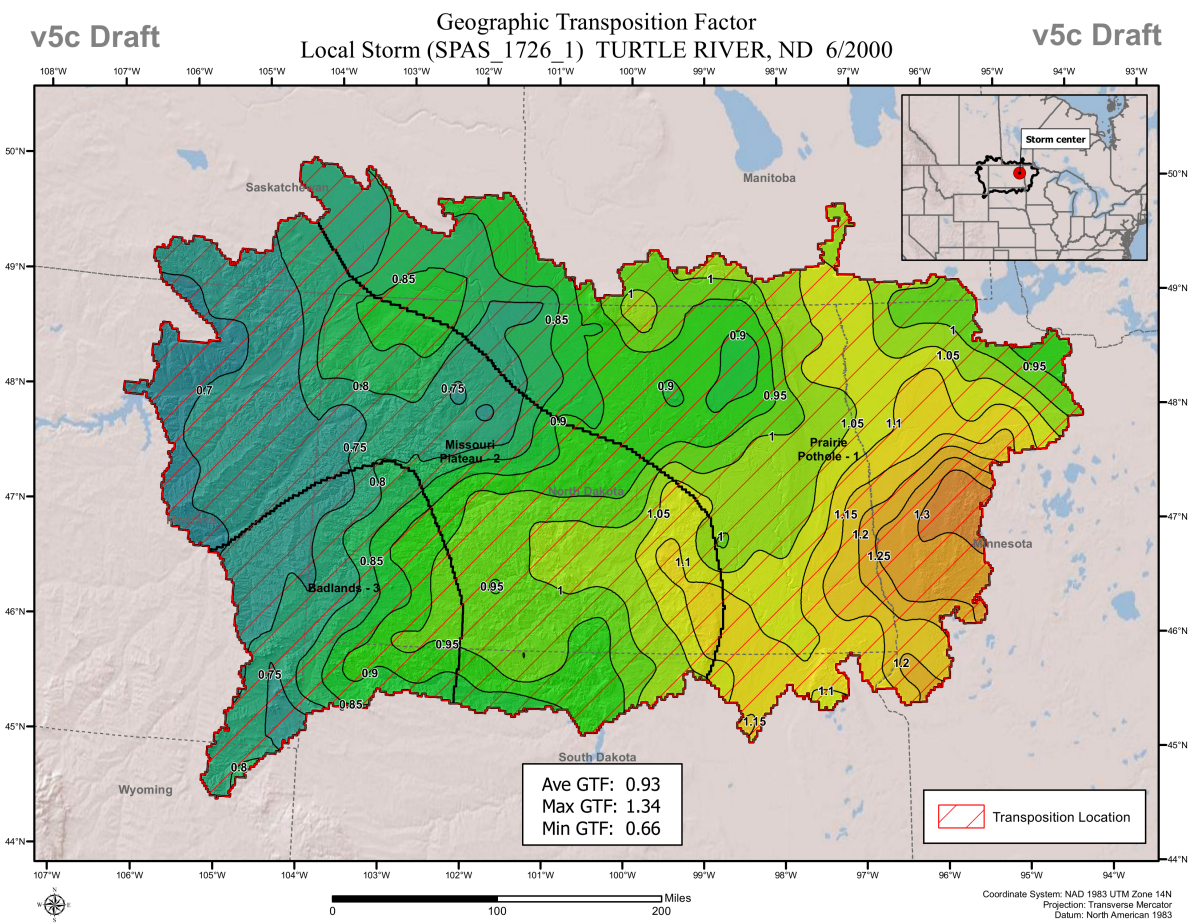
- Storm Maximization, Transposition, Orographics
  - Utilize the updated maximum dew point climatology for use in storm maximization and transpositioning
  - Maximum average dew point values
  - 3-, 6-, 12-, 24-hour
  - Utilize NOAA Atlas 14 precip frequency data
  - All previously analyzed storms already maximized

In-Place Maximization-Final

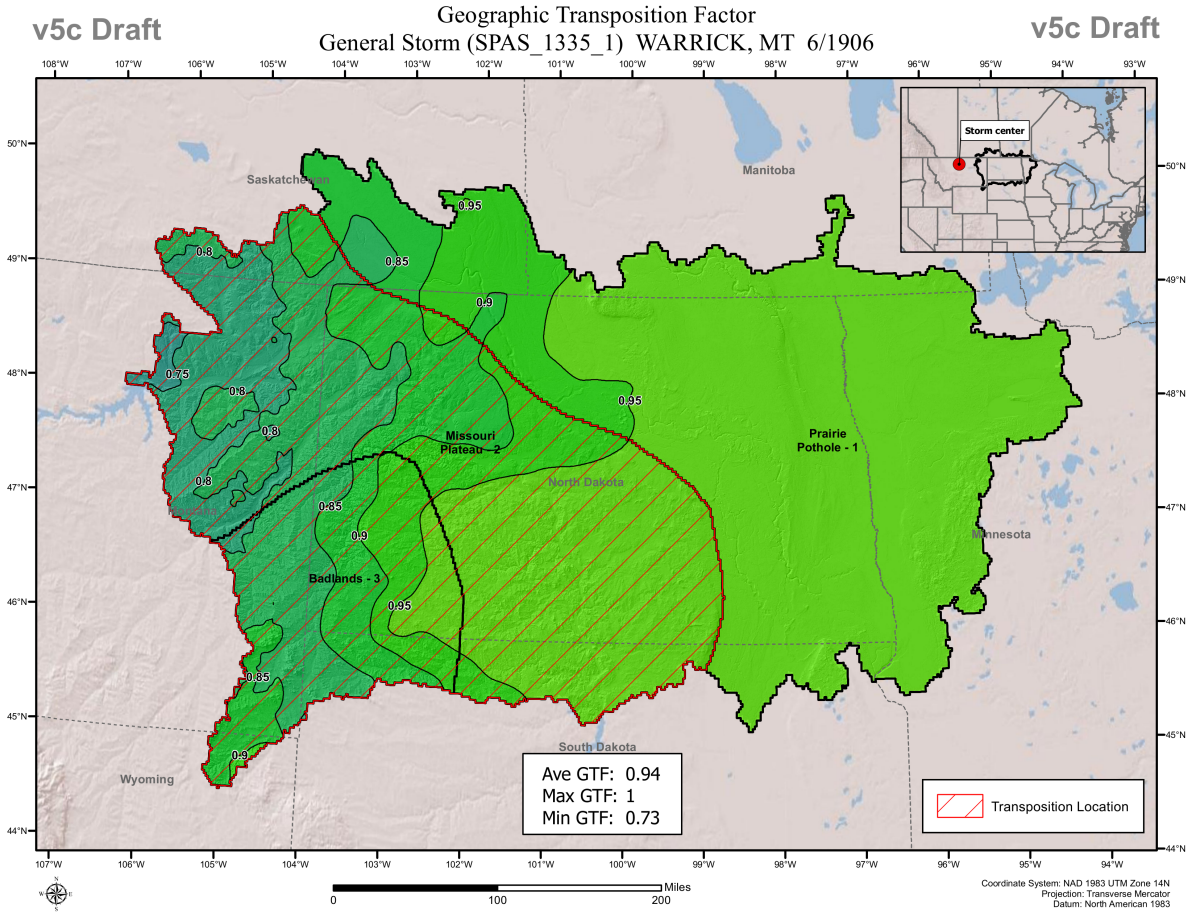
	SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Trans Date	T_d	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T_d	T_d Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	IPMF	6-hour Precip	Precip. Source
Storm Center Location	1726_1	-97.7550	47.9550	1,224	1,200	26-Jun	74.50	2.79	0.30	71	2.495	78.94	79.0	3.44	0.34	80	3.100	1.242	4.28	NOAA Atlas 14 v8

ID	STORM	LON	LAT	ZONE	ELEV	IPMF	MTF	GTF	TAF	TRANS
1	1726_1	-105.000	44.525	3	4,425	1.24	1.00	0.78	0.97	1
2	1726_1	-105.075	44.550	3	4,499	1.24	1.00	0.77	0.96	1
3	1726_1	-105.050	44.550	3	4,501	1.24	1.00	0.77	0.96	1
4	1726_1	-105.025	44.550	3	4,489	1.24	1.00	0.78	0.97	1
5	1726_1	-105.000	44.550	3	4,469	1.24	1.00	0.78	0.97	1
6	1726_1	-104.975	44.550	3	4,413	1.24	1.00	0.78	0.97	1
7	1726_1	-104.950	44.550	3	4,249	1.24	1.00	0.78	0.97	1
8	1726_1	-104.925	44.550	3	4,294	1.24	1.00	0.79	0.98	1
9	1726_1	-104.900	44.550	3	4,183	1.24	1.00	0.79	0.98	1
10	1726_1	-104.875	44.550	3	4,272	1.24	1.00	0.79	0.98	1
11	1726_1	-104.850	44.550	3	4,314	1.24	1.00	0.79	0.98	1
12	1726_1	-105.100	44.575	3	4,210	1.24	1.00	0.77	0.96	1
13	1726_1	-105.075	44.575	3	4,449	1.24	1.00	0.78	0.96	1
14	1726_1	-105.050	44.575	3	4,414	1.24	1.00	0.78	0.97	1
15	1726_1	-105.025	44.575	3	4,379	1.24	1.00	0.78	0.97	1
16	1726_1	-105.000	44.575	3	4,257	1.24	1.00	0.78	0.97	1
17	1726_1	-104.975	44.575	3	4,193	1.24	1.00	0.78	0.97	1
18	1726_1	-104.950	44.575	3	4,181	1.24	1.00	0.79	0.98	1
19	1726_1	-104.925	44.575	3	4,181	1.24	1.00	0.79	0.98	1
20	1726_1	-104.900	44.575	3	4,193	1.24	1.00	0.79	0.98	1
21	1726_1	-104.875	44.575	3	4,282	1.24	1.00	0.79	0.98	1
22	1726_1	-105.125	44.600	3	4,320	1.24	1.00	0.77	0.96	1
23	1726_1	-105.100	44.600	3	4,358	1.24	1.00	0.77	0.96	1
24	1726_1	-105.075	44.600	3	4,233	1.24	1.00	0.78	0.96	1
25	1726_1	-105.050	44.600	3	4,353	1.24	1.00	0.78	0.97	1
26	1726_1	-105.025	44.600	3	4,483	1.24	1.00	0.78	0.97	1

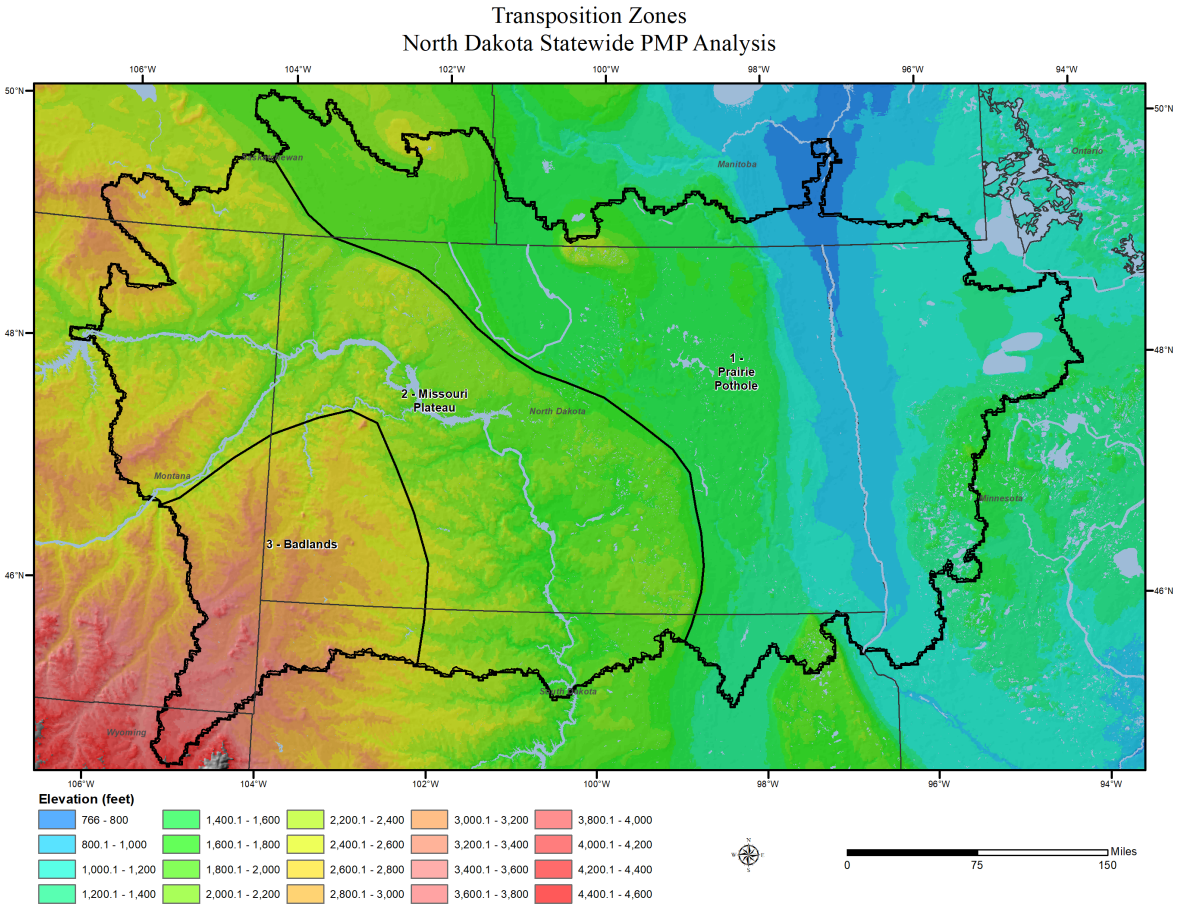
Geographic Transposition Factor Example



Geographic Transposition Factor Example



North Dakota Transposition Zones



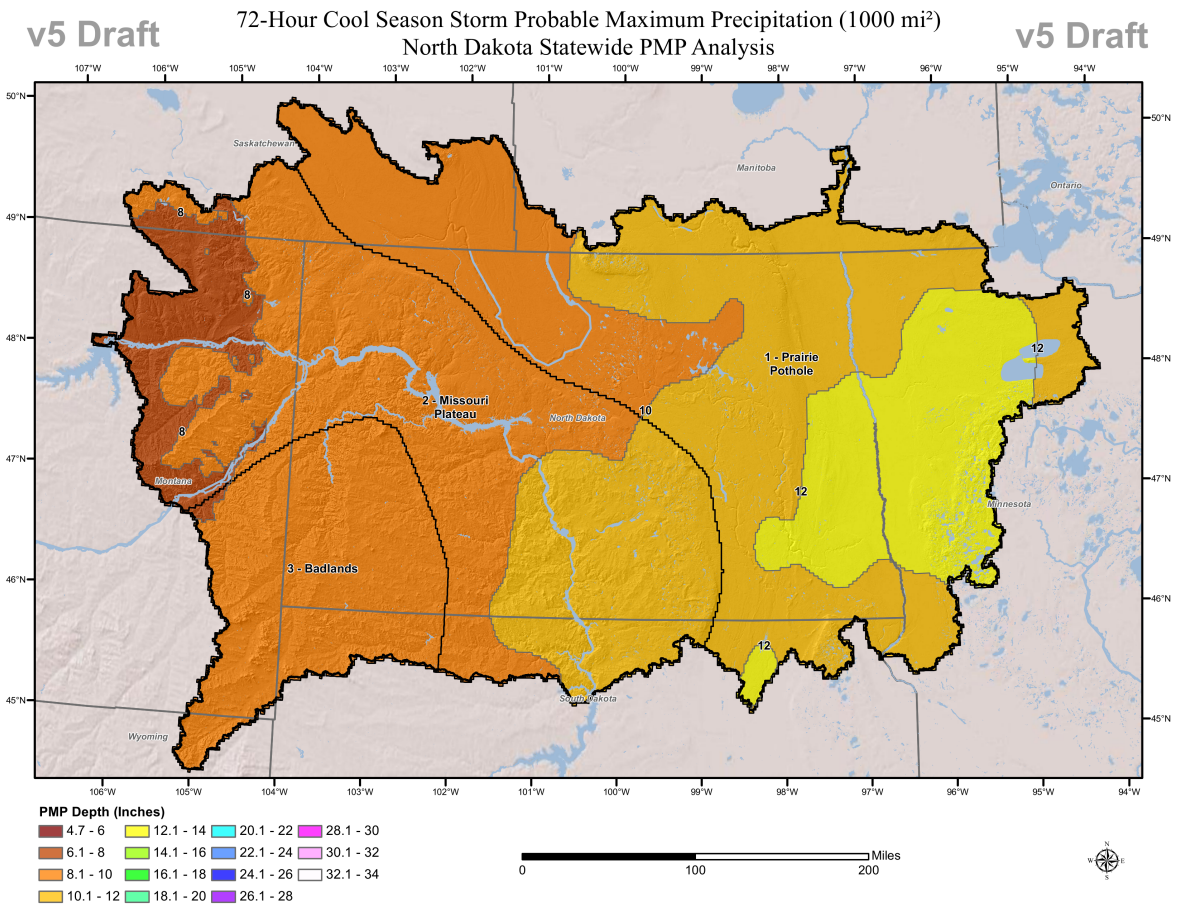
Probable Maximum Precipitation - Major Tasks

- Develop PMP, Spatial, Temporal Information
  - PMP provided by storm type (general, local)
  - Unique accumulation patterns for each
  - Spatial information from gridded data
- Can apply other spatial patterns based on past storms

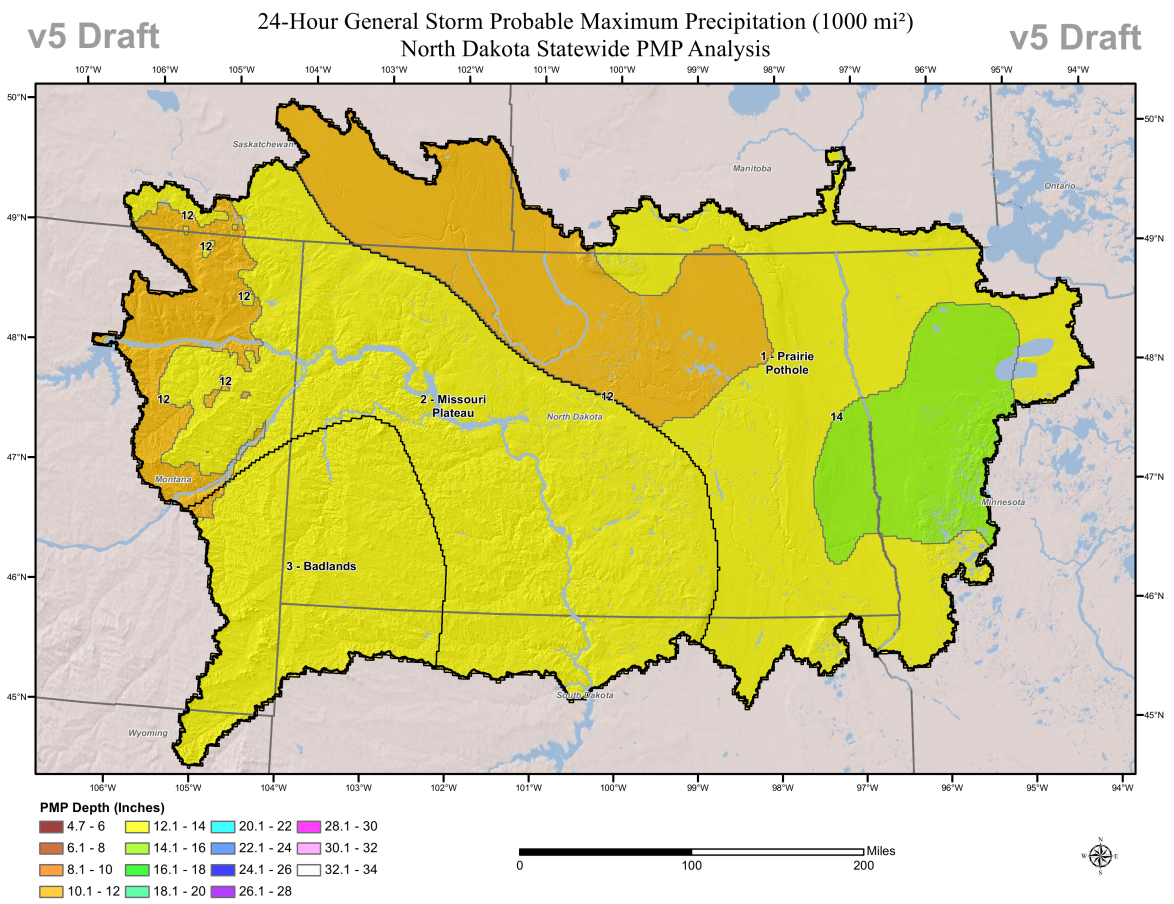
PMP Completed

Spatial and Temporal Development in process

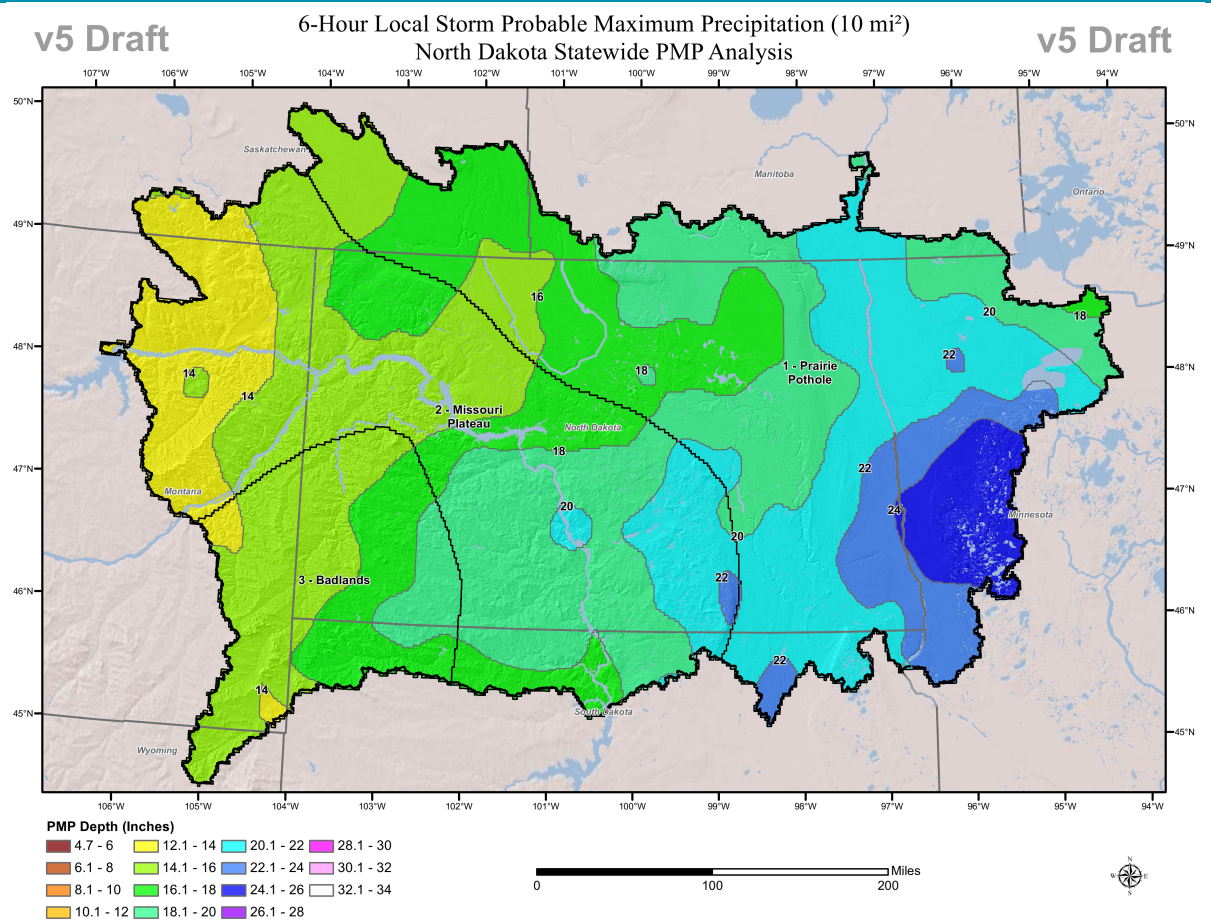
Probable Maximum Precipitation – Cool Season



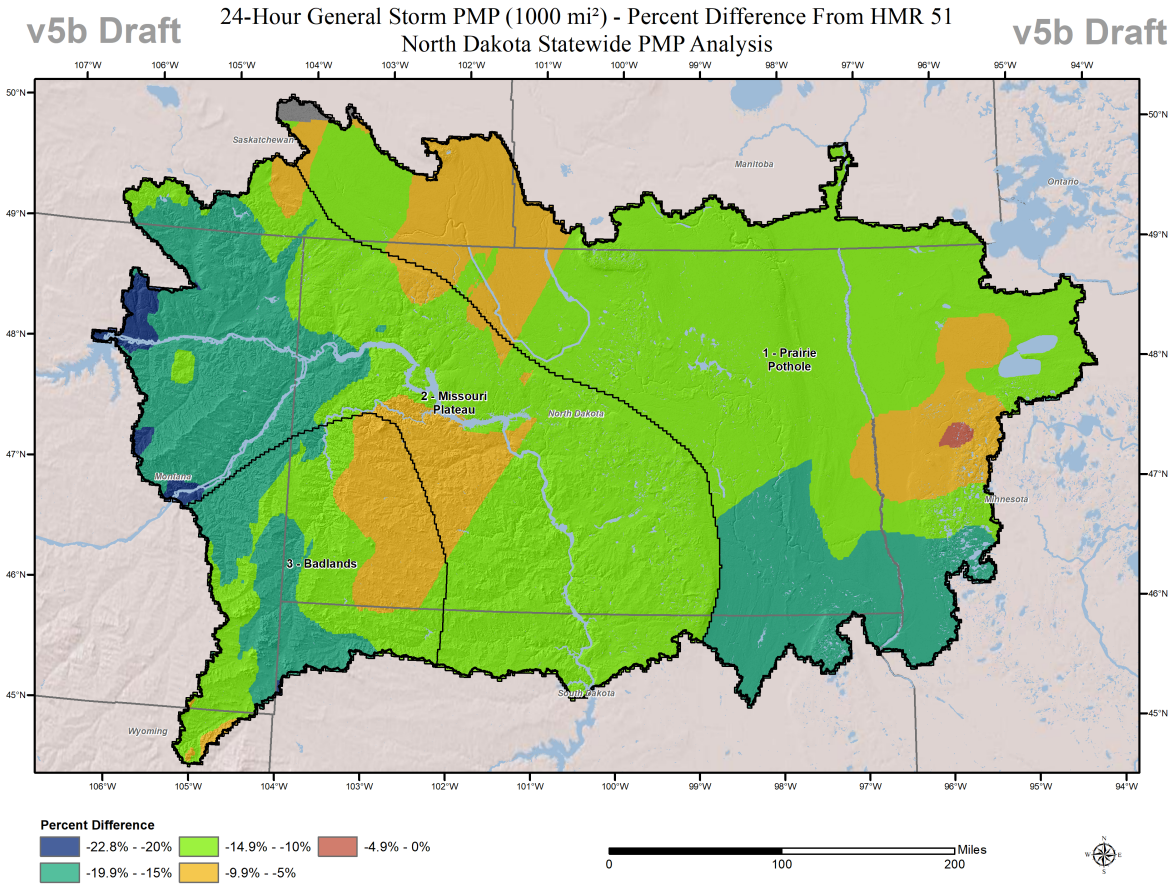
Probable Maximum Precipitation – General Storm



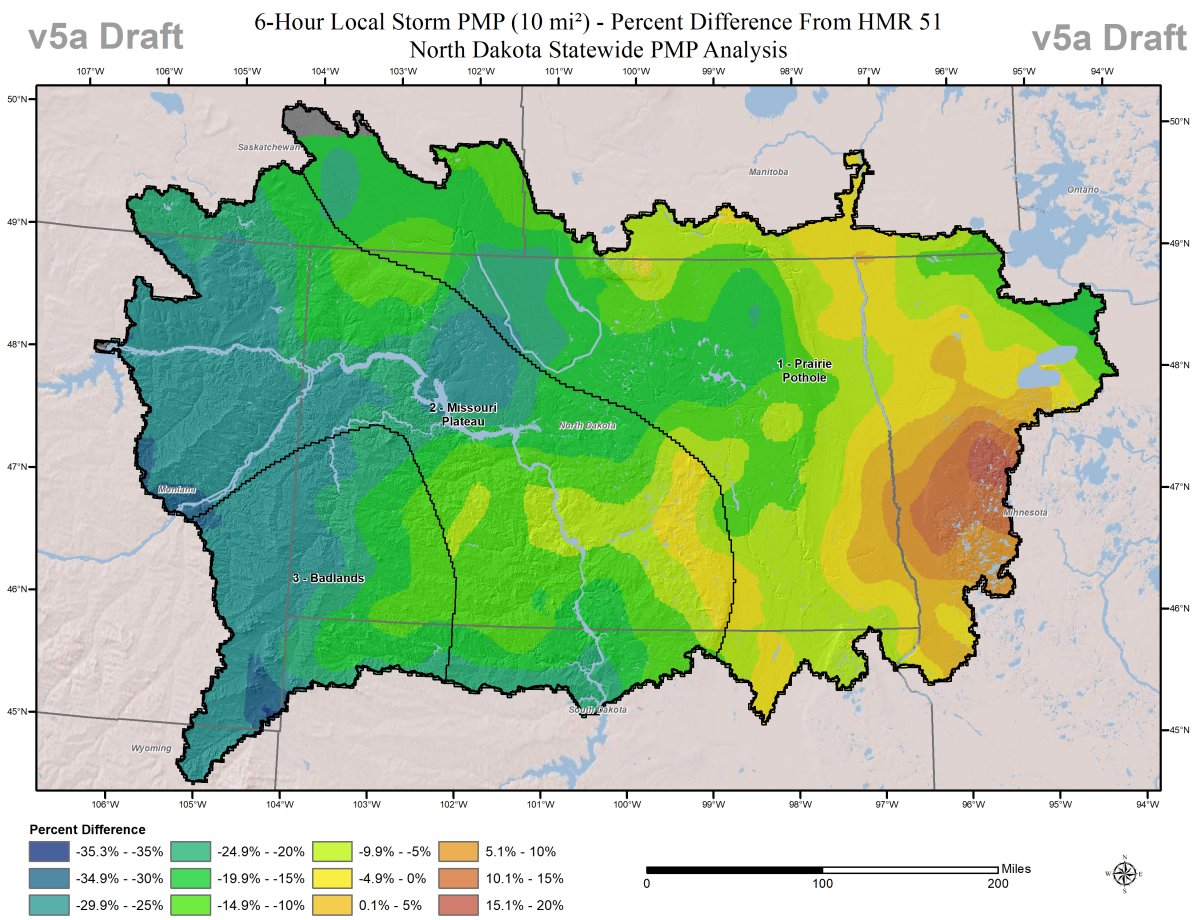
Probable Maximum Precipitation – Local Storm



Probable Maximum Precipitation - Comparisons



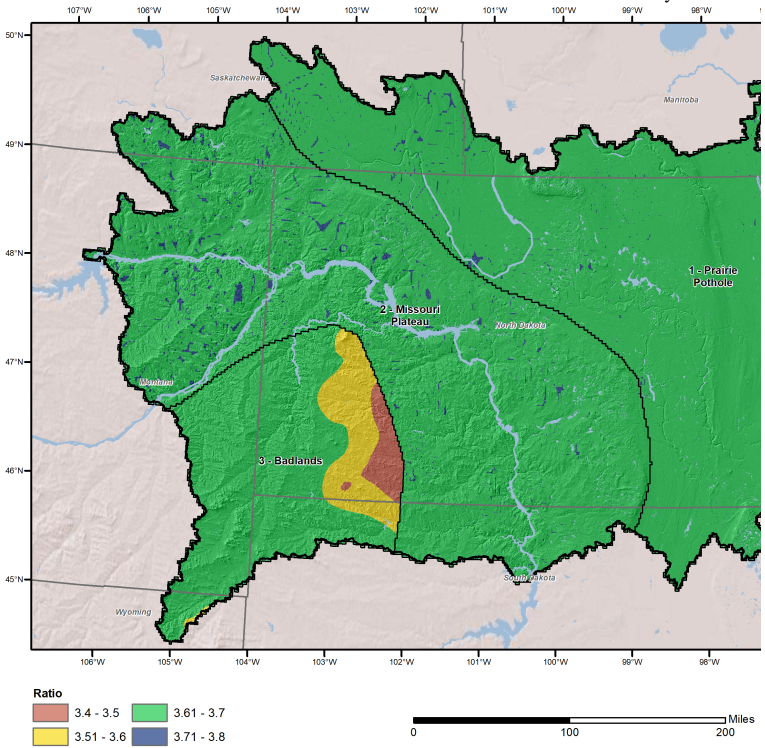
Probable Maximum Precipitation - Comparisons



Probable Maximum Precipitation - Comparisons

v5 Draft

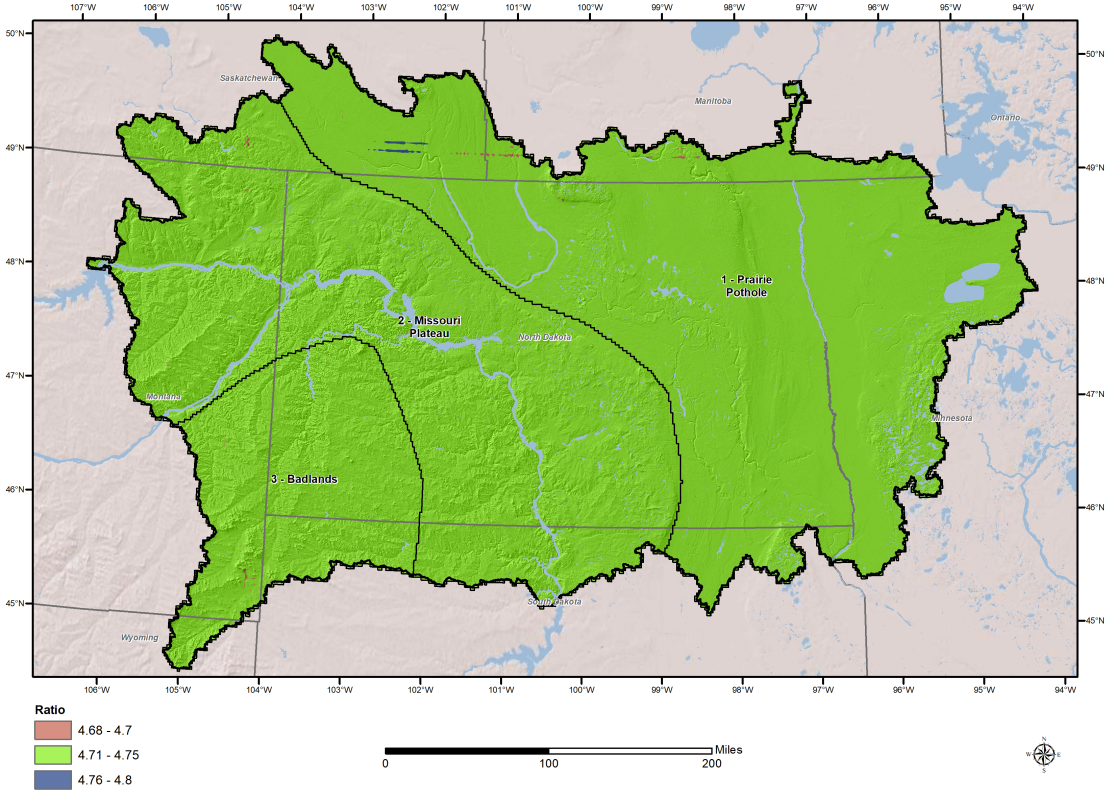
Ratio of 24-Hour 1 square mile PMP to 24-Hour 100-year Precipitation F
North Dakota Statewide PMP Analysis



v5 Draft

Ratio of 6-Hour 1 square mile PMP to 6-Hour 100-year Precipitation Frequency Estimates
North Dakota Statewide PMP Analysis

v5 Draft



Probable Maximum Precipitation - Major Tasks

- Draft/Final Report
  - A Draft submitted for review
  - Review comments will be incorporated into a comprehensive report as appropriate
  - An appendix will be provided with all storm details and calculations used to determine the PMP values throughout the region
  - Maps of PMP values will be provided both in the report as well as in GIS format

  Not started yet, but will follow documentation from other studies
- Review Meetings Present and review the approach and procedures to be used as well as work completed
  - Pre-meeting packages will be provided to reviewers prior to each meeting

Project Schedule

Task/Month	1.1.1-Review of Existing Information	1.1.2-PMP Event Selection	1.1.3-PMP Event List and Characteristics	1.1.4-Storm Maximization, Transpositioning, Areal Reduction Factors, and Spatial Patterns	1.1.5.1-PMP Snowmelt	1.1.5.2-PMP All Season	1.1.6-Temporal Distribution	1.1.7-Dew Point	1.1.8-Statistical Evaluation of PMP Results	1.1.9-Alternatve Spatial Patterns	1.1.10-Alternative Temporal Patterns	1.2 GIS Tool	1.3 Quality Control	1.4 Deliverables	2.1 Meetings Project Management
Apr-19															
May-19															
Jun-19															
Jul-19															
Aug-19															
Sep-19															
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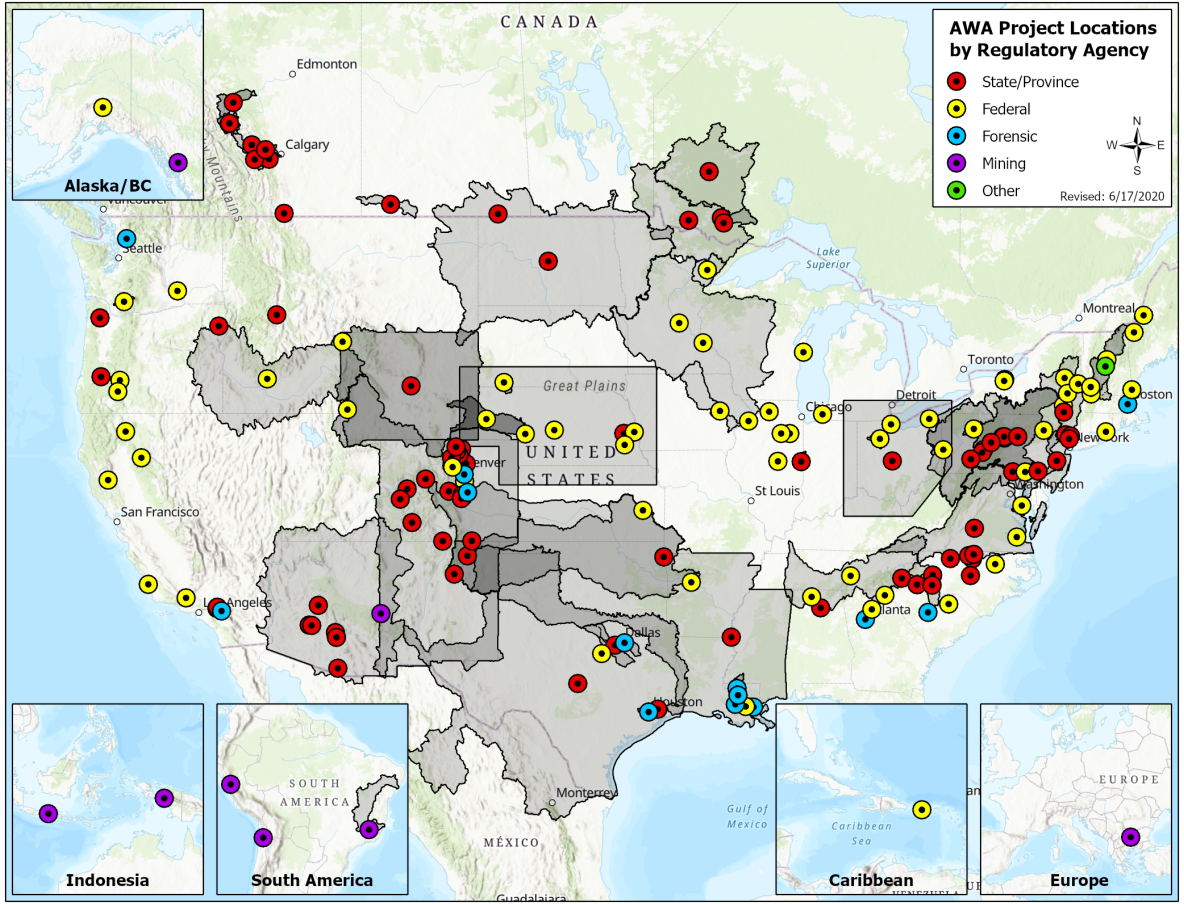
Nov-20															
Dec-20															
Jan-21															
Feb-21															
Mar-21															
Apr-21															

Questions for Review Board-Meeting 3

- Do the PMP results represent reasonable estimations that can be used for PMF/IDF evaluations?
- Does the SWE/Meteorological Time Series climatologies and implementation methods provide the required information for cool-season/rain-on-snow flood runoff development?
- Does the steering committee concur that the suggested alternative spatial pattern application is a reasonable way to provide alternative spatial patterns for PMP development?
- Does the steering committee concur that the suggested alternative temporal patterns provide adequate options for reasonable PMF/IDF development?

AWA Probable Maximum Precipitation Studies