

Combining hydrological modeling and remote sensing observations to enable data-driven decision making for Devils Lake flood mitigation in a changing climate

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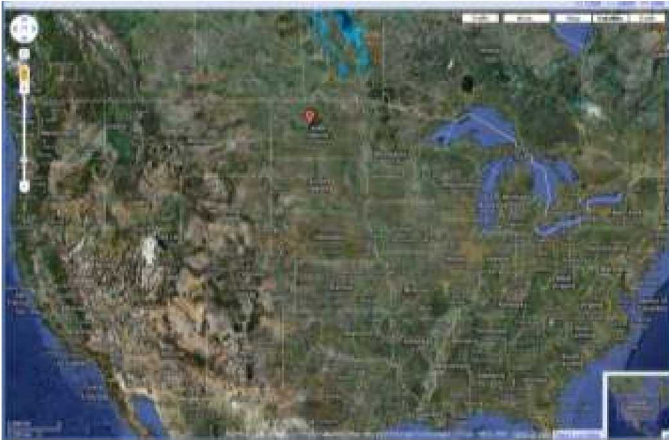
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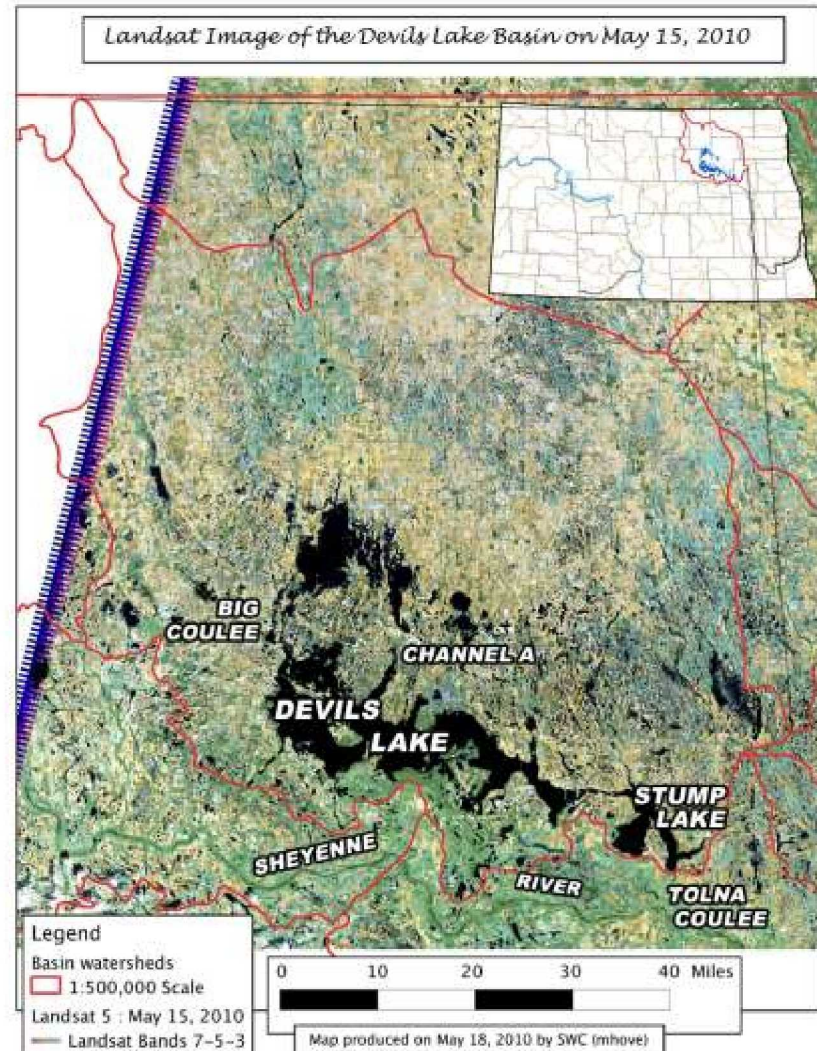
Funding support through NASA

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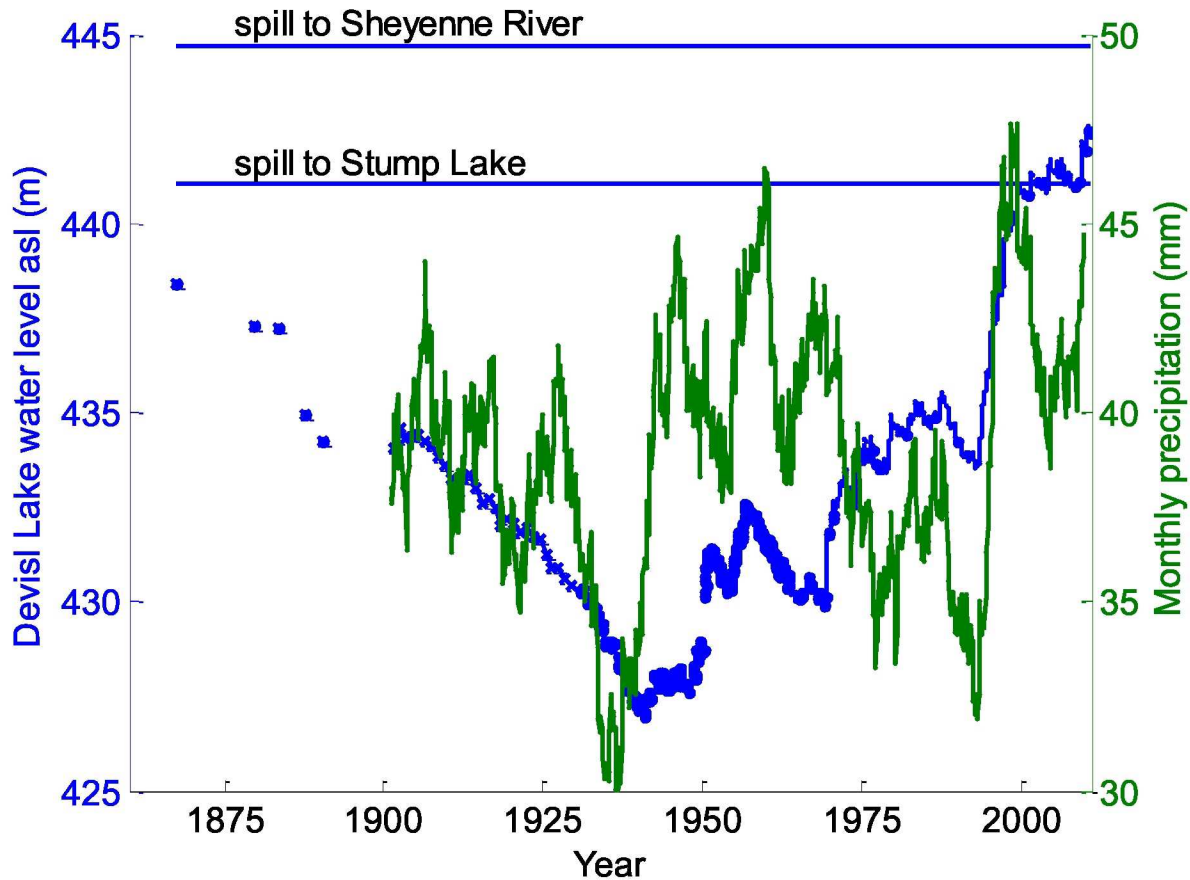
Devils Lake

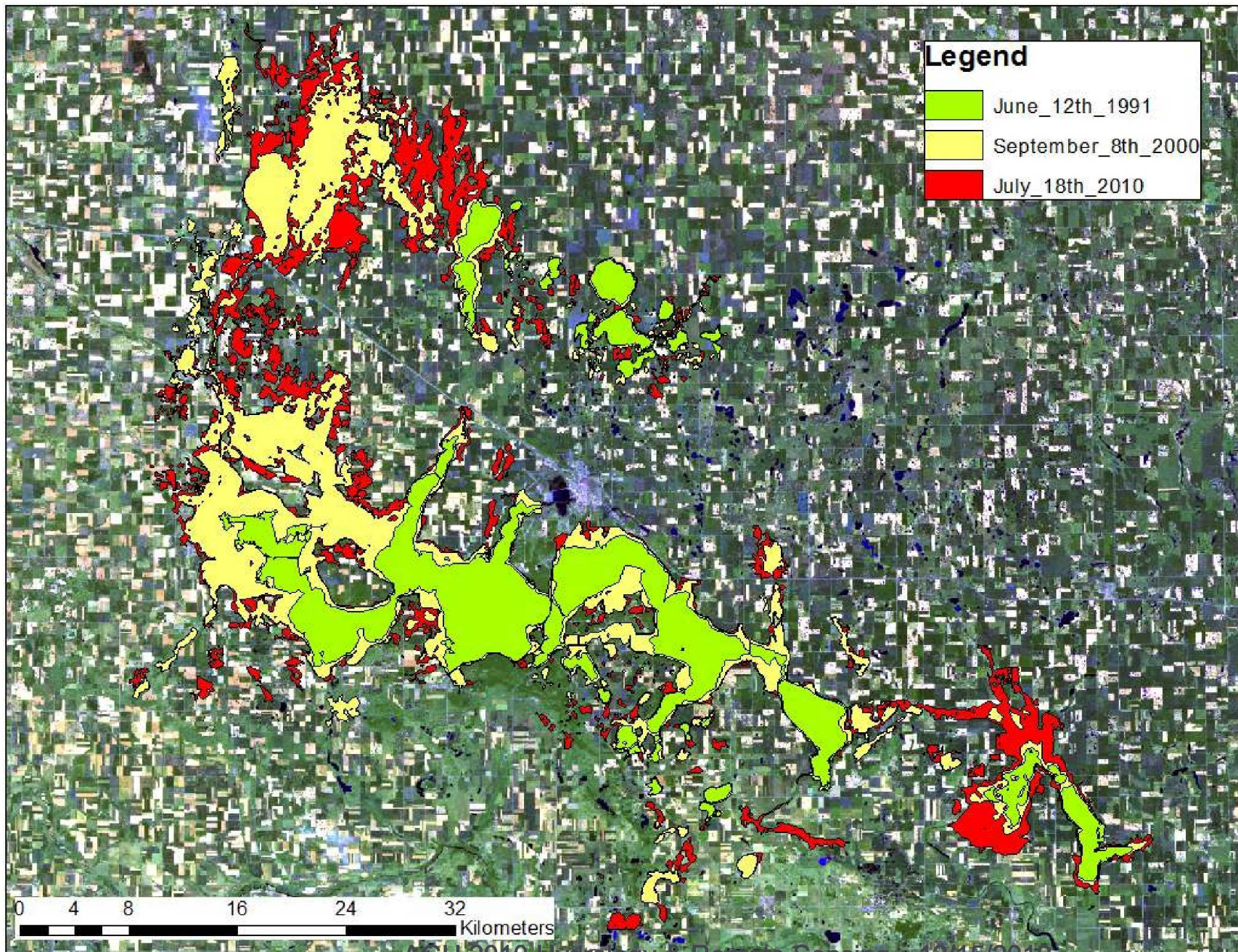


- Northeastern North Dakota
- Terminal lake of nearly 10,000 km² (3,800 mi²) drainage basin

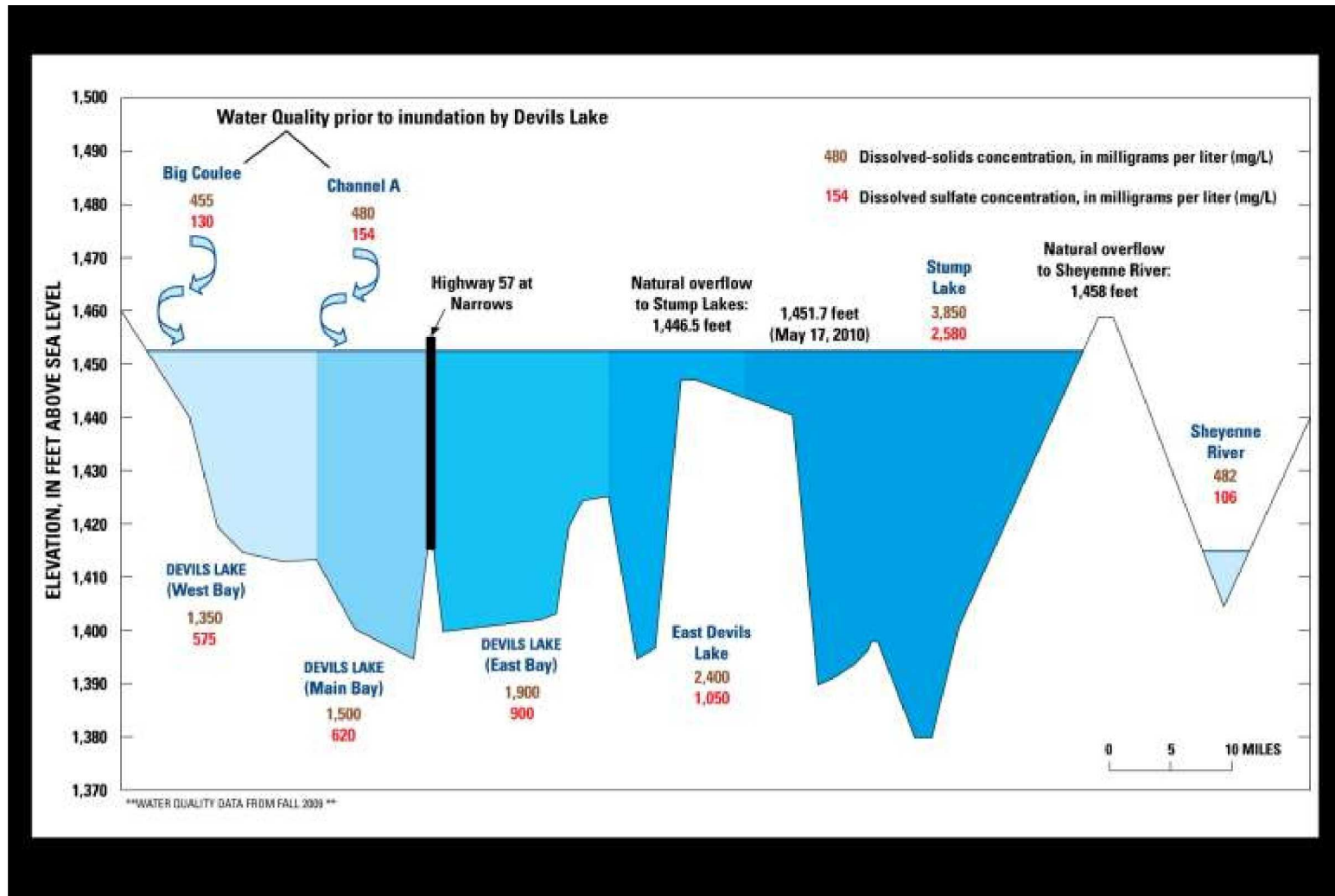


Rising water: \$1 billion in flood mitigation

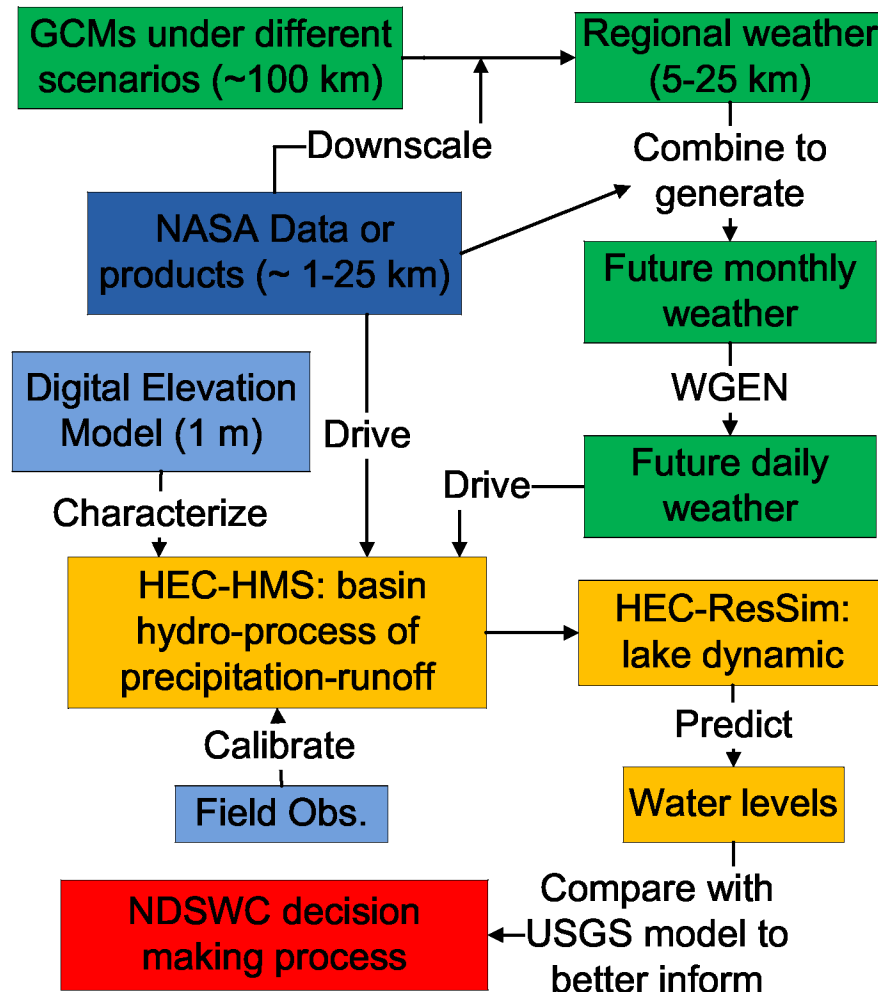




Poor water quality: environmental concern



Combine satellite observations, hydrological model and climate change



Stakeholders:

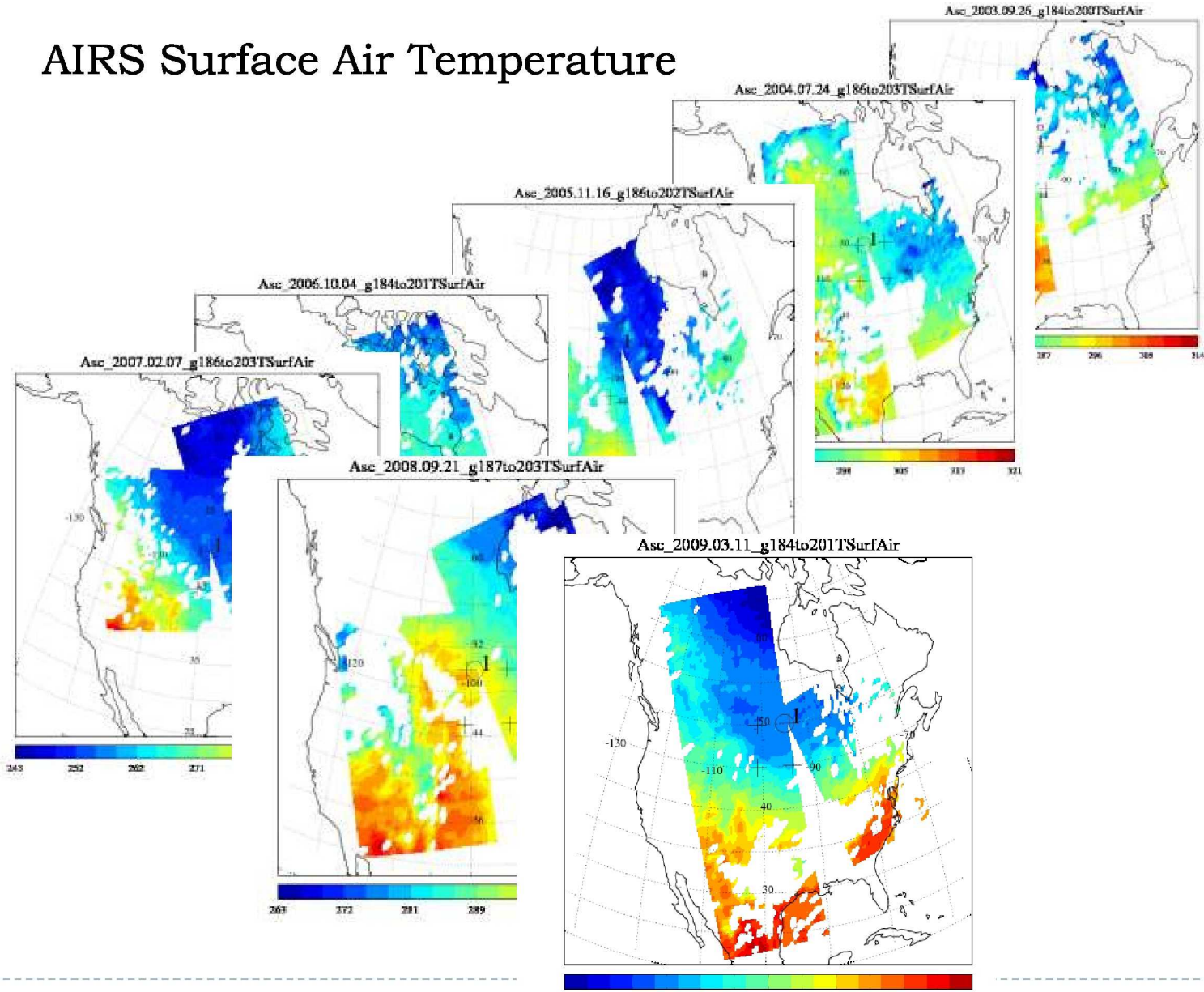
- The Devils Lake Basin Joint Water Resource Board
- North Dakota State Water Commission (NDSWC)
- The People to Save the Sheyenne River

Satellite data products

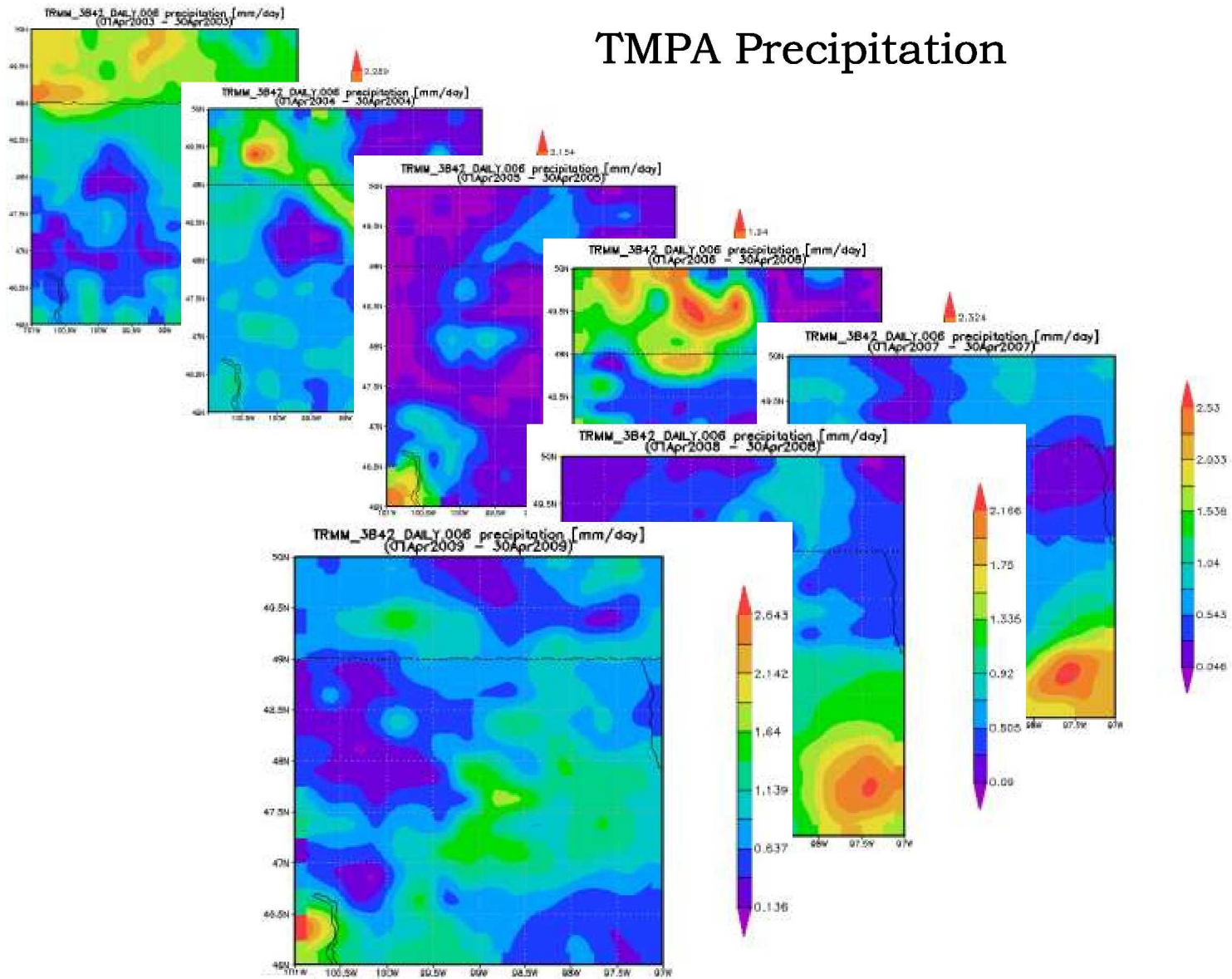
Instrument/Parameter	Spatial Resolution	Spatial Coverage	Temporal Resolution	Temporal Coverage
Aqua AMSR-E Soil Moisture	25 km	Global	Daily	2002-Present
TMPA Precipitation	¼ deg	Global 50N-50S	Daily	1998-Present
Aqua AIRS Surface Air Temperature	45 km	Global	Instantaneous day & night	2002-Present

TMPA: TRMM Multisatellite Precipitation Analysis

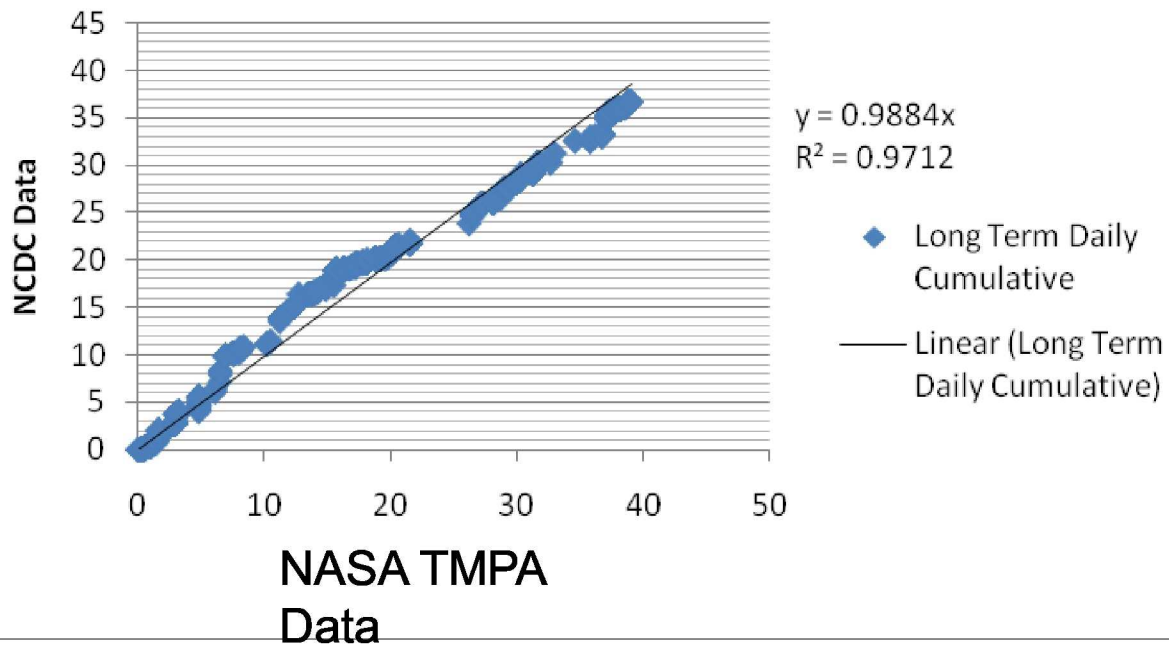
AIRS Surface Air Temperature

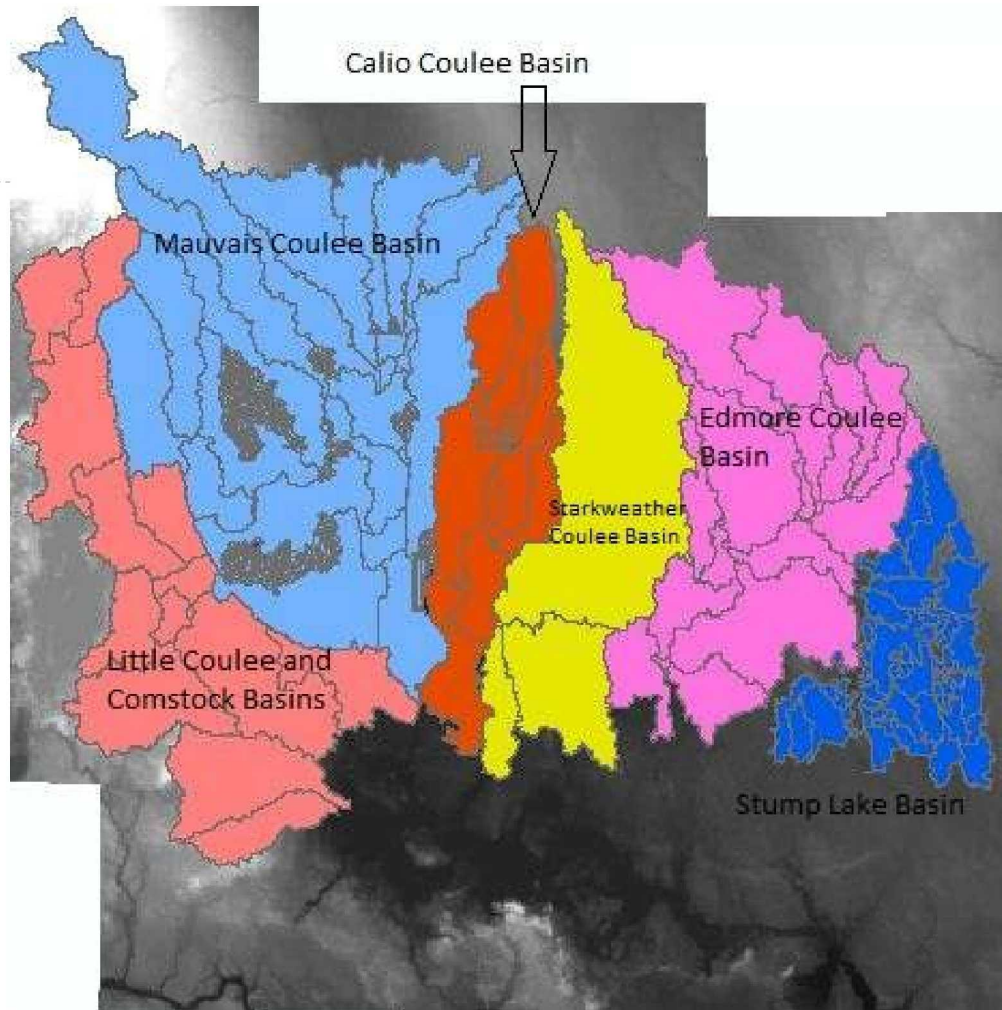


TMPA Precipitation



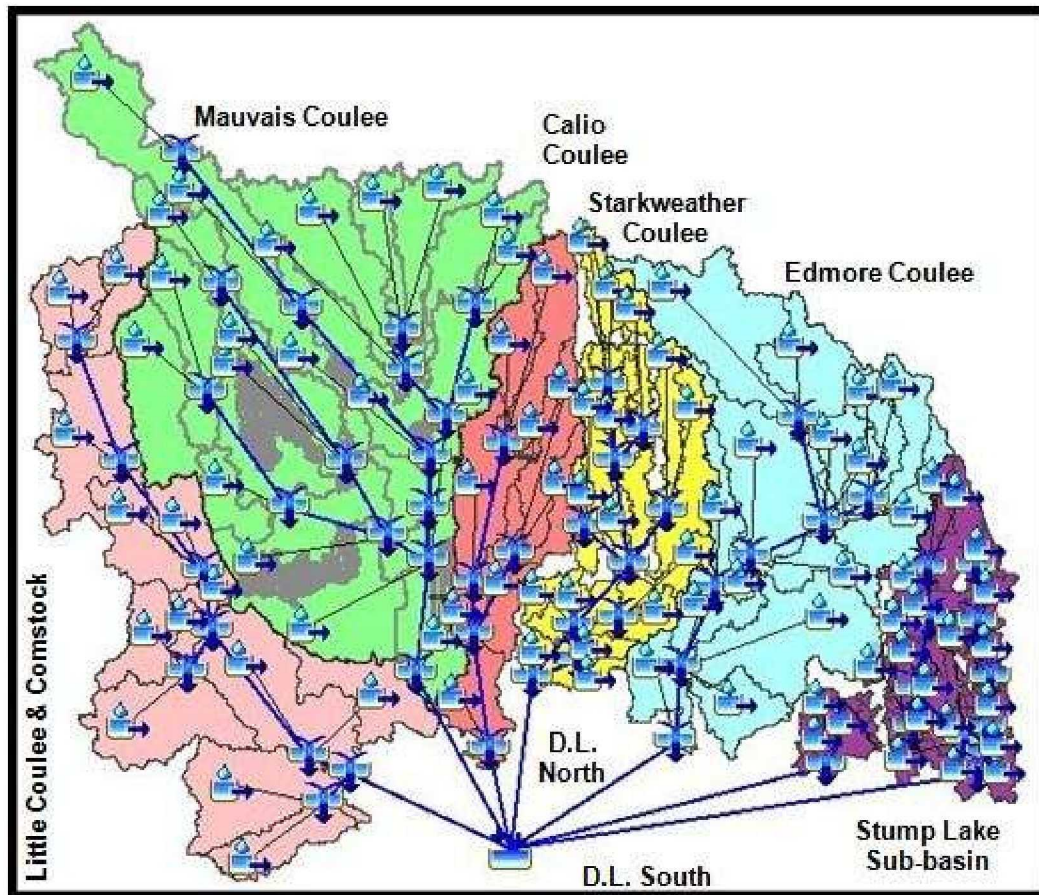
Long Term Daily Cumulative



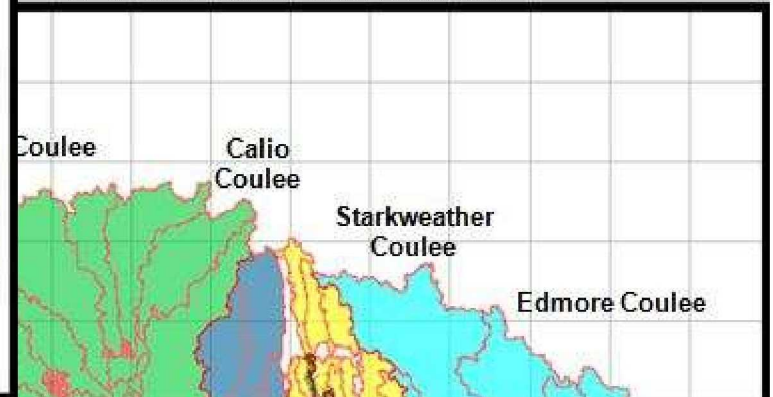


DEM of Devils Lake Watershed

There are 6 major basins delineated using Arc-Hydro

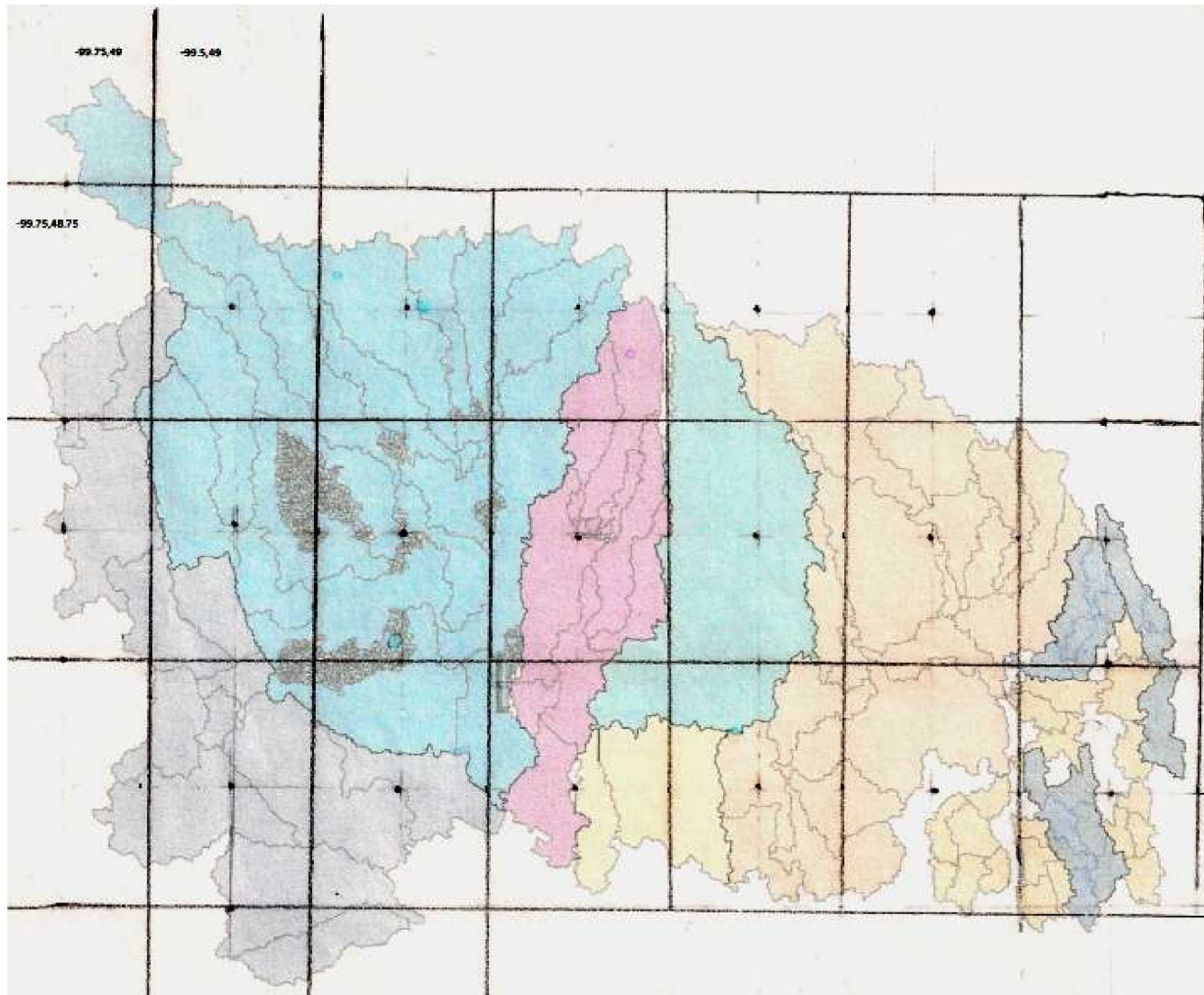


HEC-HMS modeling for each basin. For example, there are 20 sub-basins for Mauvais Coulee Basin. Main parameters: channel lengths, lags, slopes, and routing parameters. Snow melting is critical and modeled.

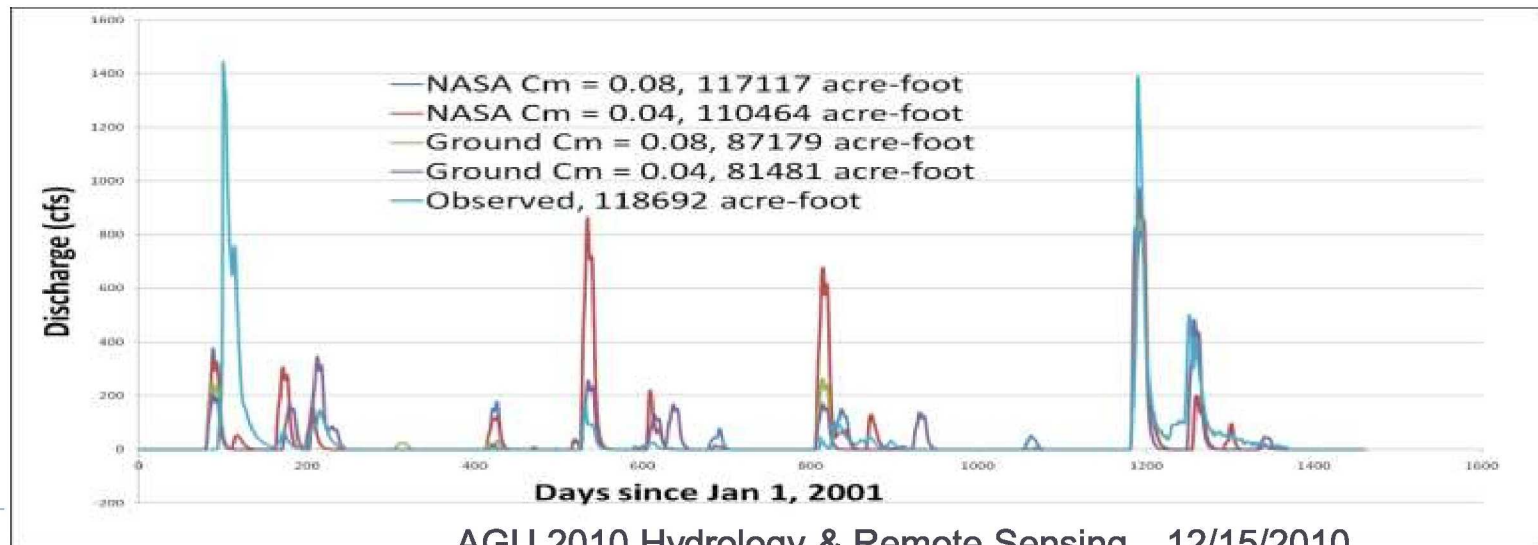
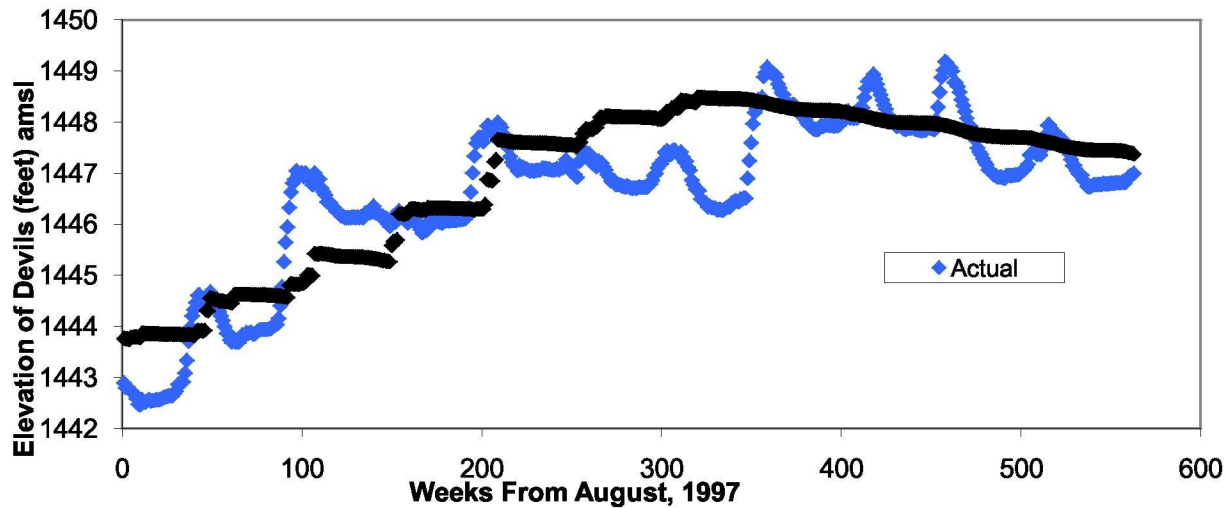


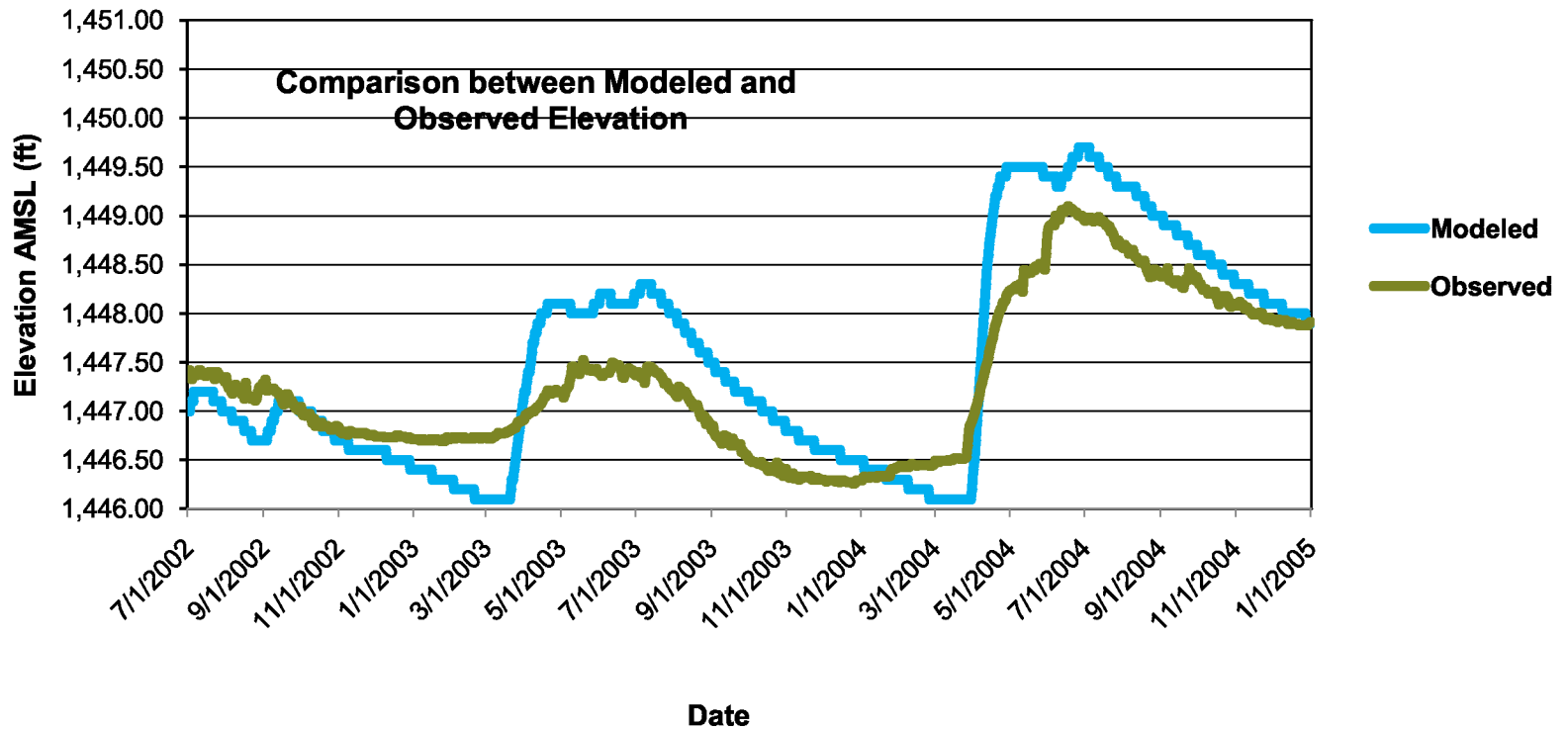
HEC-ResSim model: inflows from basins, precipitation, pumping schedule, evaporation, seepage rate, and eventual spill rate.



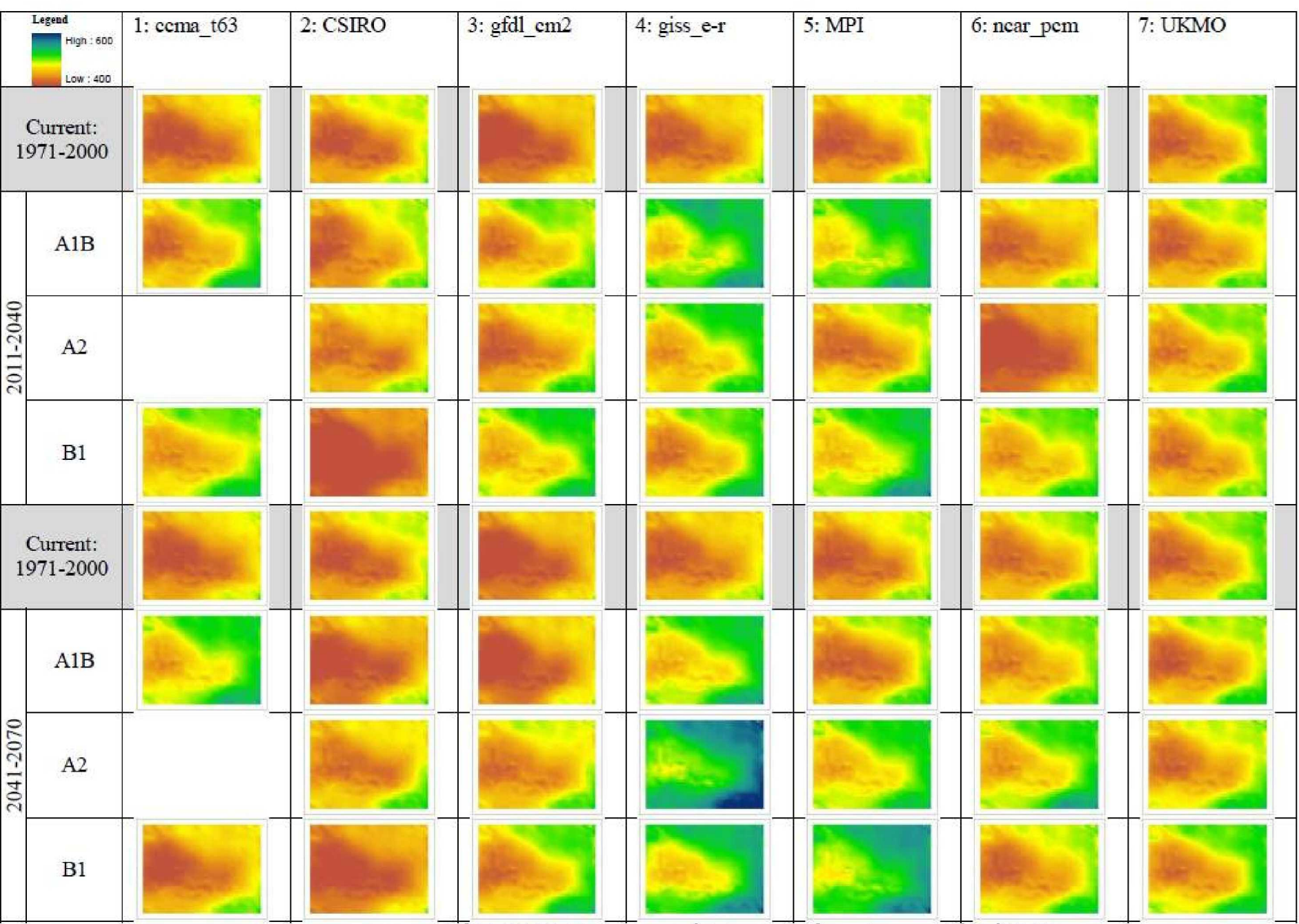


Advantages of the use of satellite data and distributed hydrological model

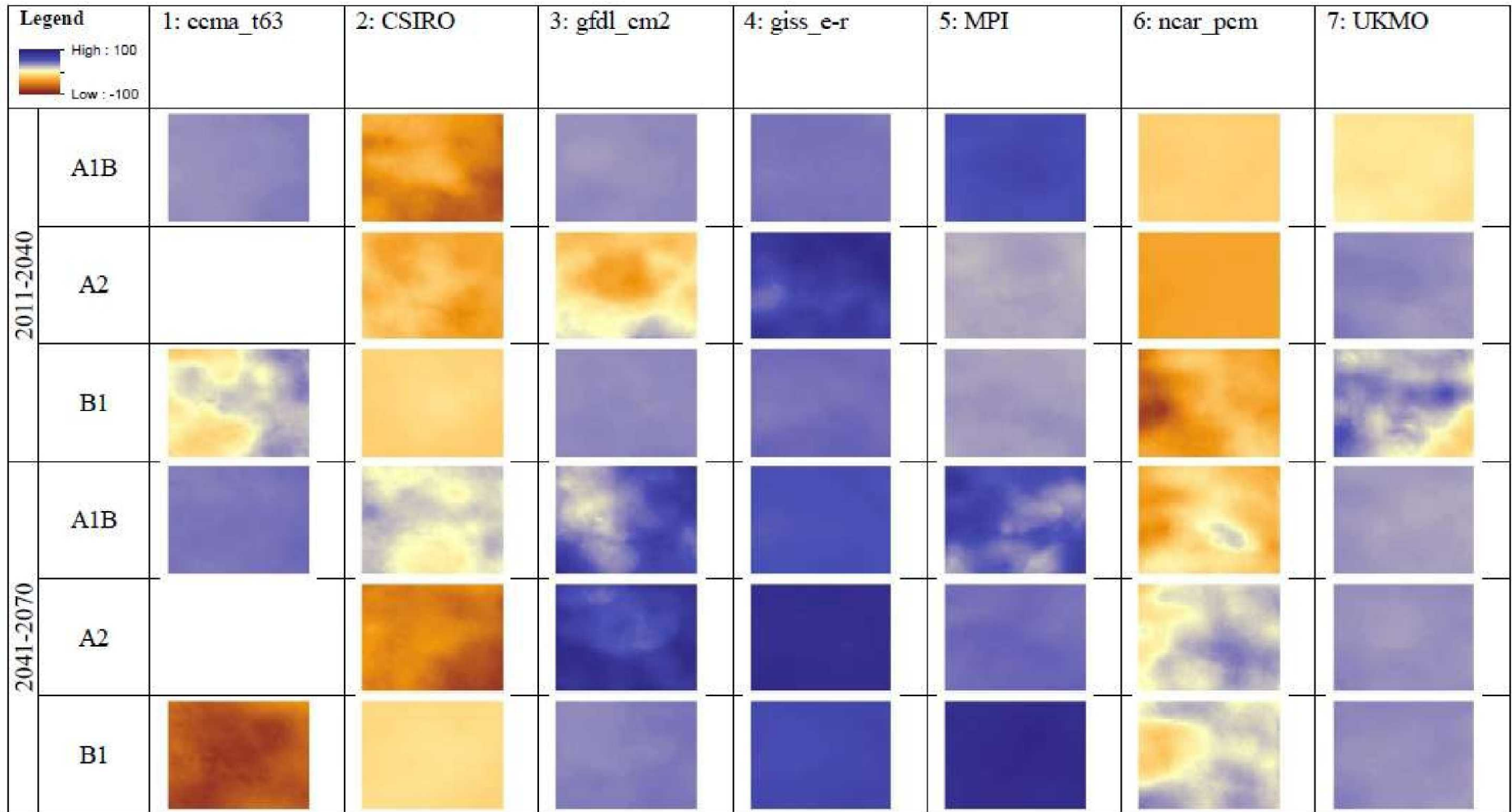




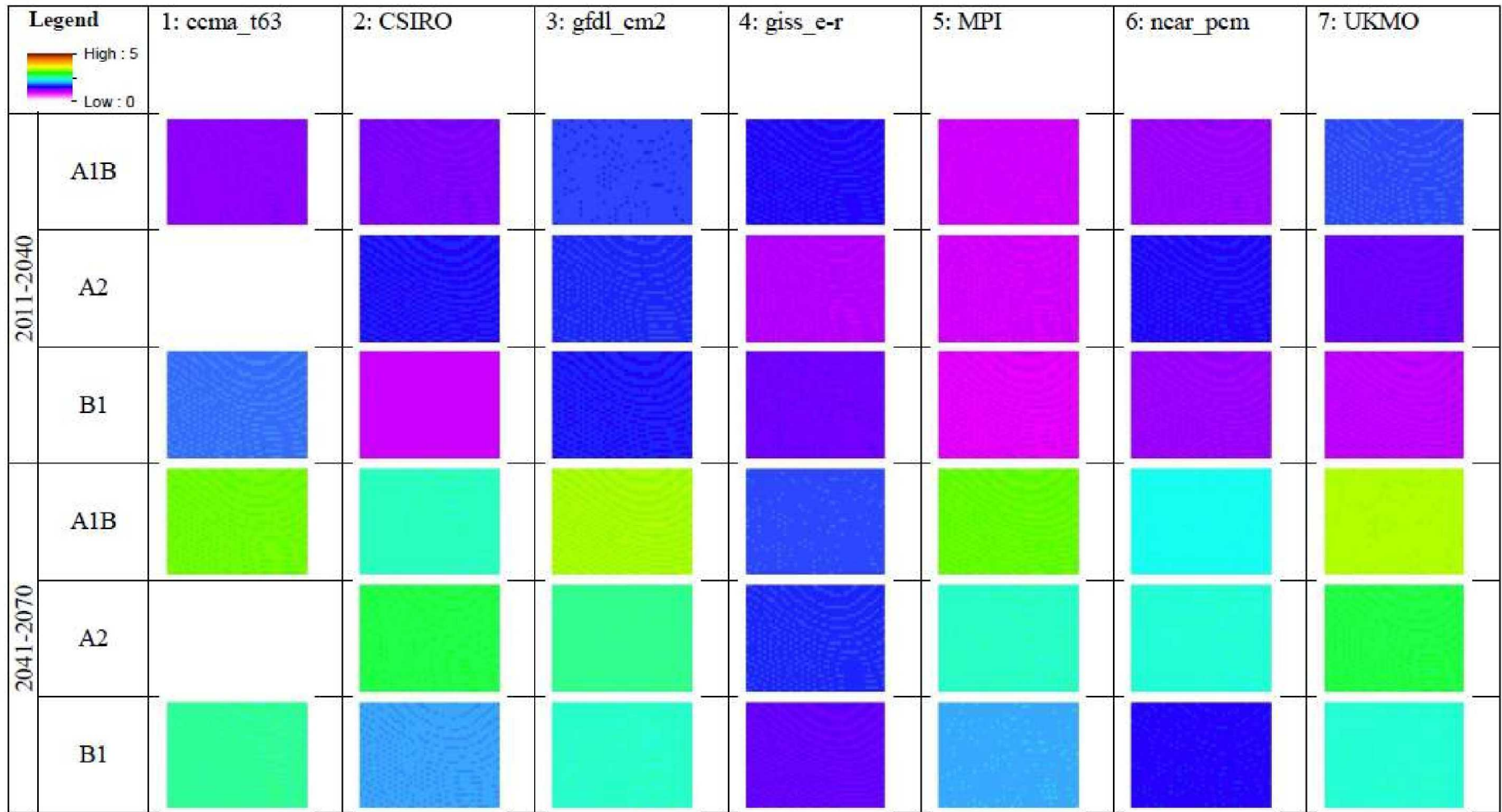
The difference might be due to uncertainty in modeling the seasonal lake evaporation



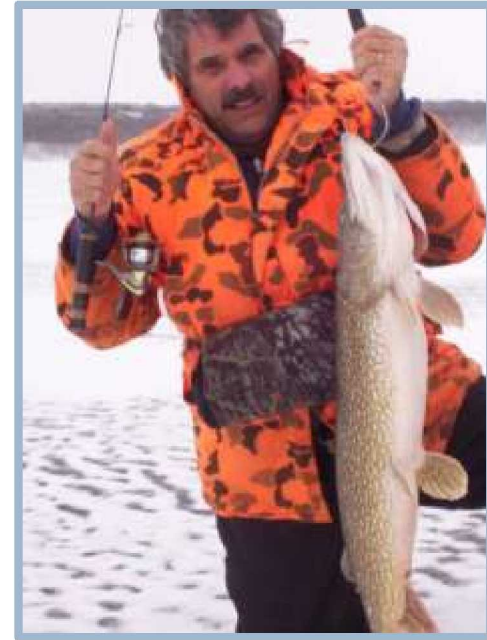
Differential precipitations predicted by different GCMs under different scenarios



Increases of temperature predicted by different GCMs under different scenarios



A bright side of flooding



The shallow, extensive shoreline of the lake provides habitat for walleye, perch, and northern pike

