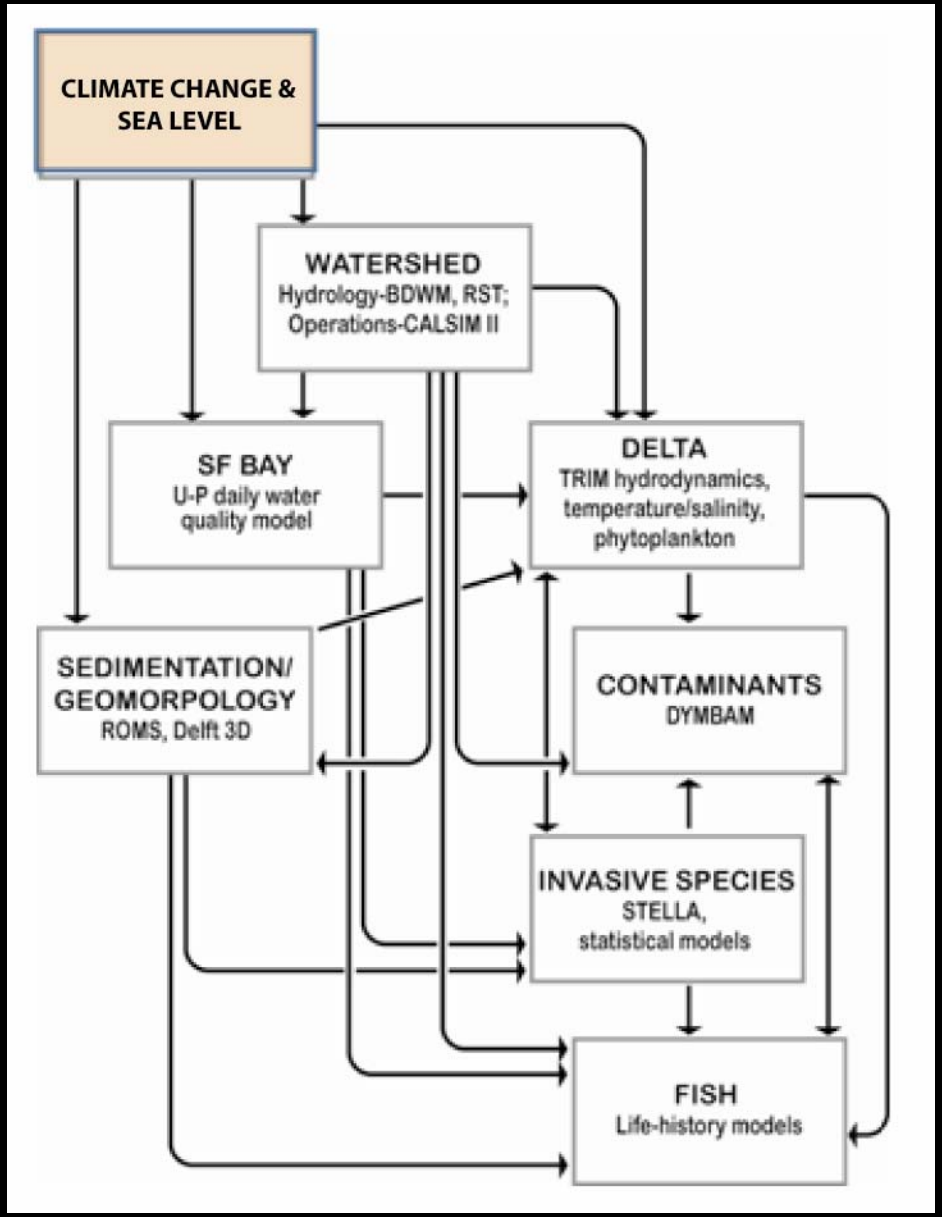
The CASCaDE Project—Overview & climate-change scenarios

Michael Dettinger & Daniel Cayan, USGS, La Jolla

Computational
Assessments of
Scenarios of
Change in the
Delta
Ecosystem



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EXTERNAL DRIVERS of DELTA CHANGE

- Subsidence
- Invasive species
- Population growth & urbanization
- Earthquakes
- Climate change
- Sea level rise

Pelagic organism decline

Less reliable water supplies

Deteriorating water quality

Threats to agriculture, communities & infrastructure corridors

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Delta Visions, Past & present

1. *Environmental Water Account & other system reoperations*
2. *Habitat-restoration island breaches*
3. *Screened diversions at Clifton*
4. *South Delta flow barriers*
5. *Channel deepening*
6. *In-Delta storage*
7. *Through-Delta conveyances*
8. *Downstream surface-water storage*
9. *Ground-water banking*
10. *Tearing down some dams…Enlarging others*
11. *Statewide water conservation efforts*
12. *Coequal water supply & ecosystem goals*
13. *Dual conveyance facilities*
14. *Re-governance of the Delta*
15. *Limit suburbanization!*
16. *Armored levees where needed (human life), abandoned levees for ecosystems & over-toppable levees for agriculture*
17. *Variable flow regimes & geomorphology*
18. *Leaky peripheral canal & variable salinity Delta*
19. *Carbon/peat farming*

…and more

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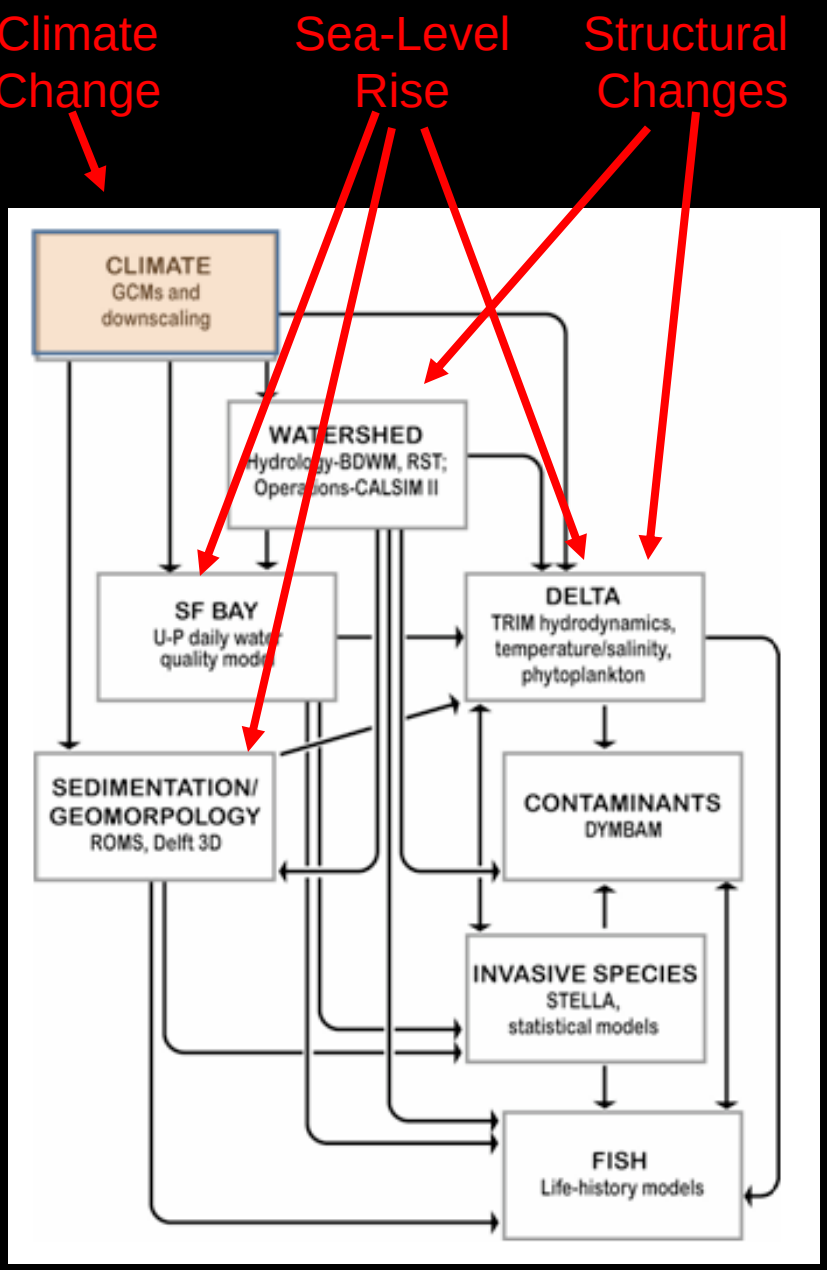
Models can expand on our understanding of individual processes & responses to inform decisionmaking by:

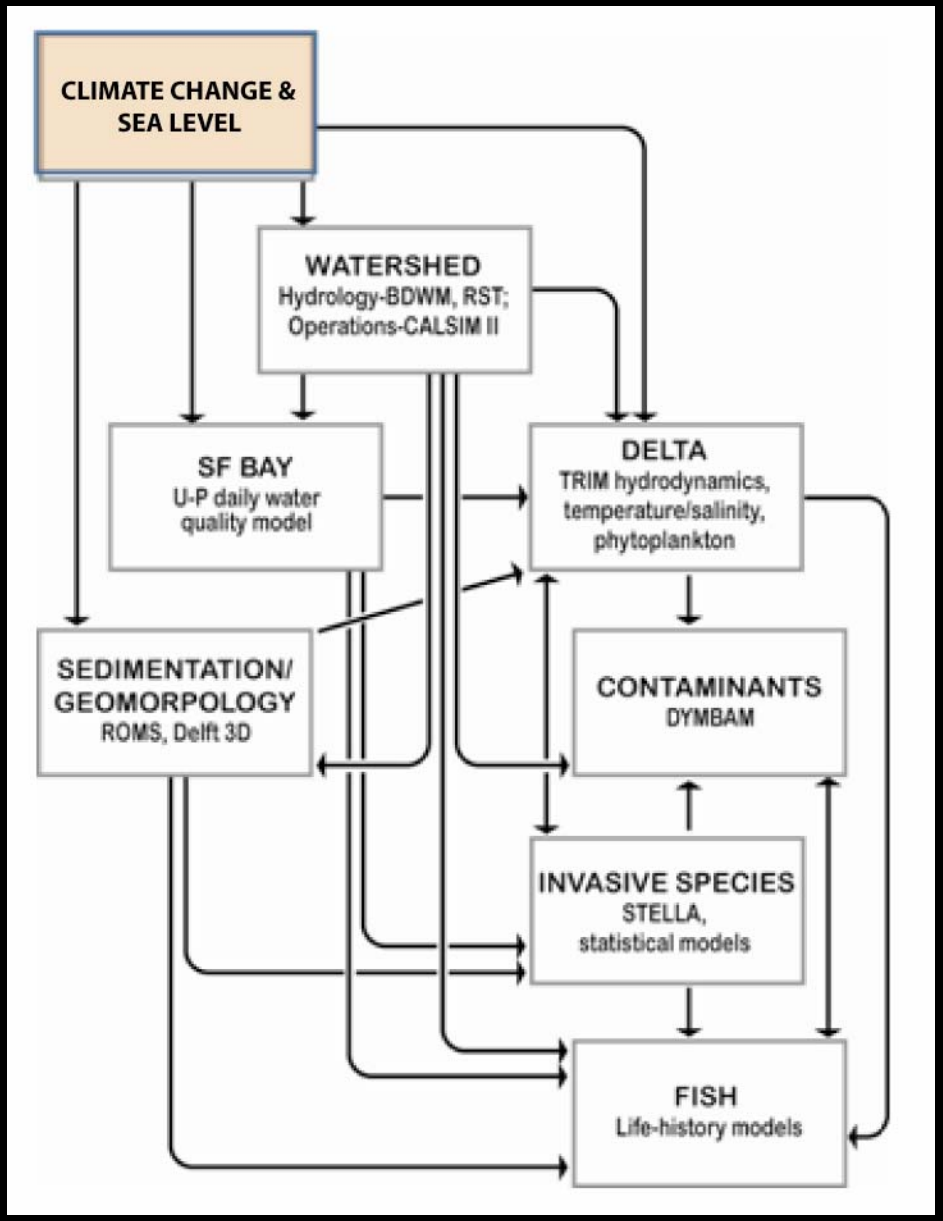
- Integrating & interrelating all processes
- Characterizing responses to simultaneous forcings
- Highlighting critical sensitivities

CASCaDE is building a 'cascade' of such models



CASCaDE

Climate scenarios



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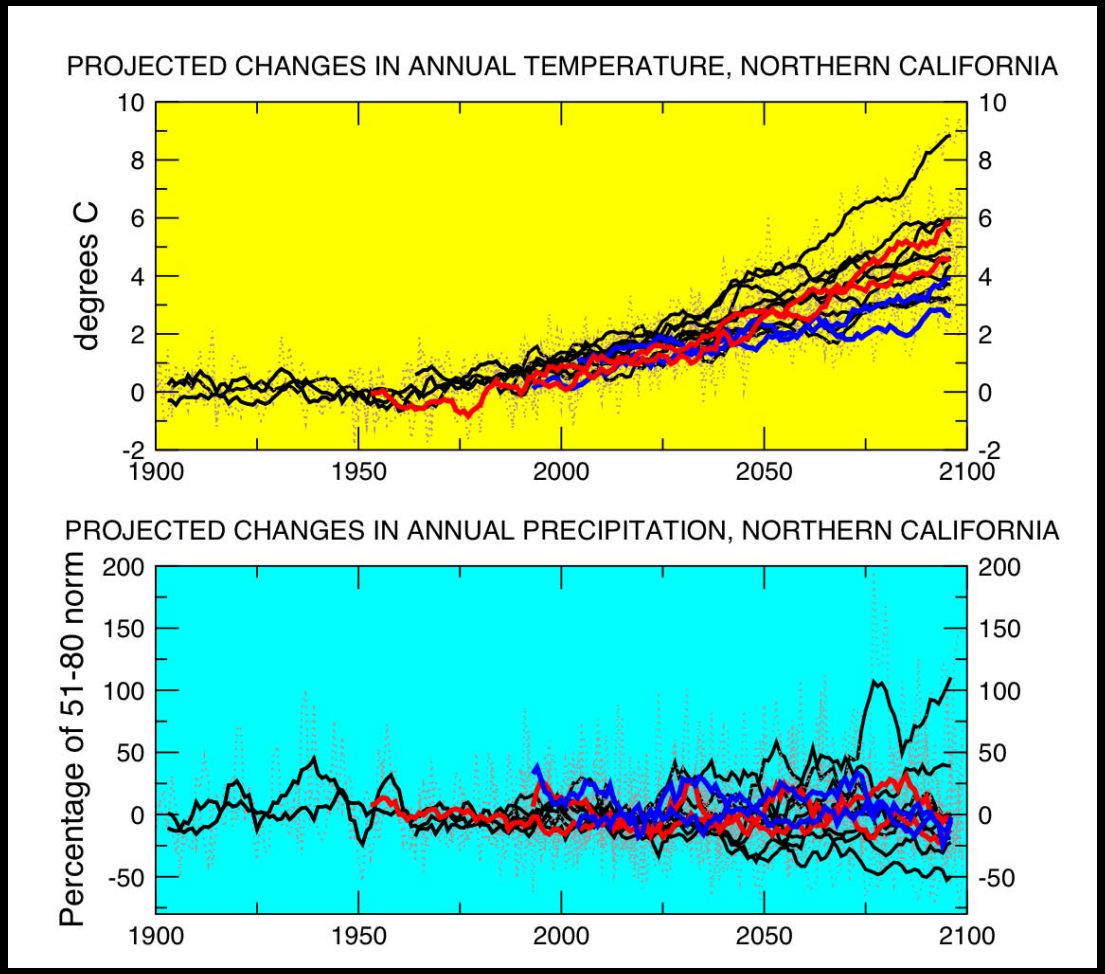
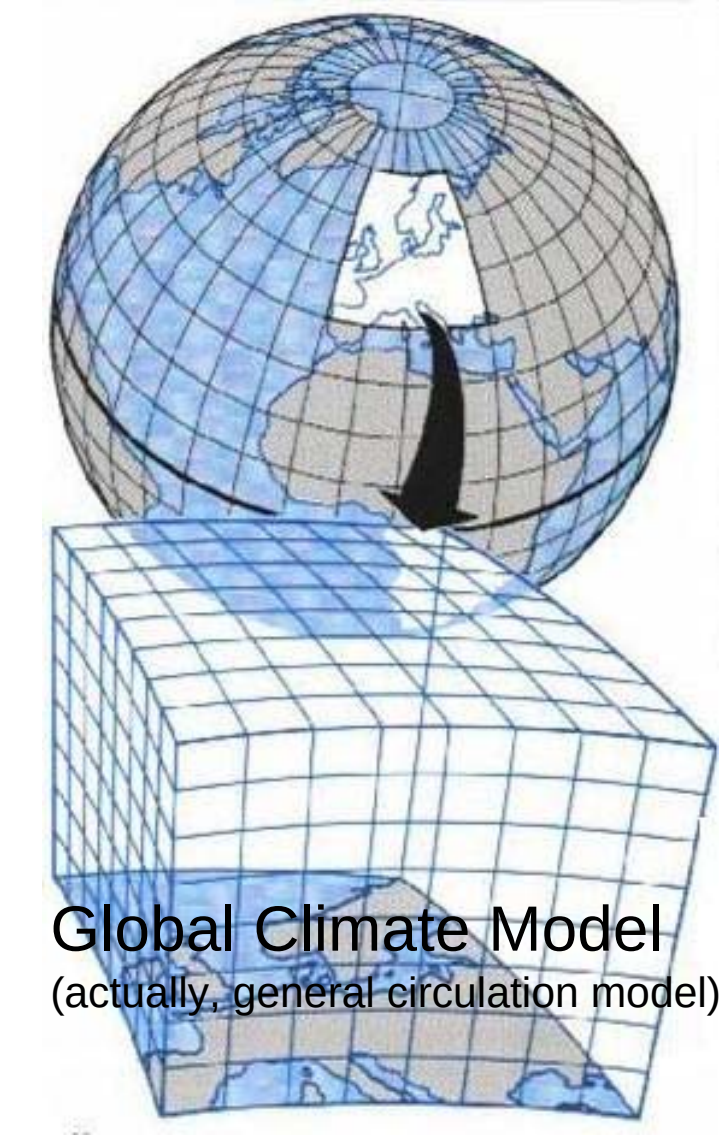
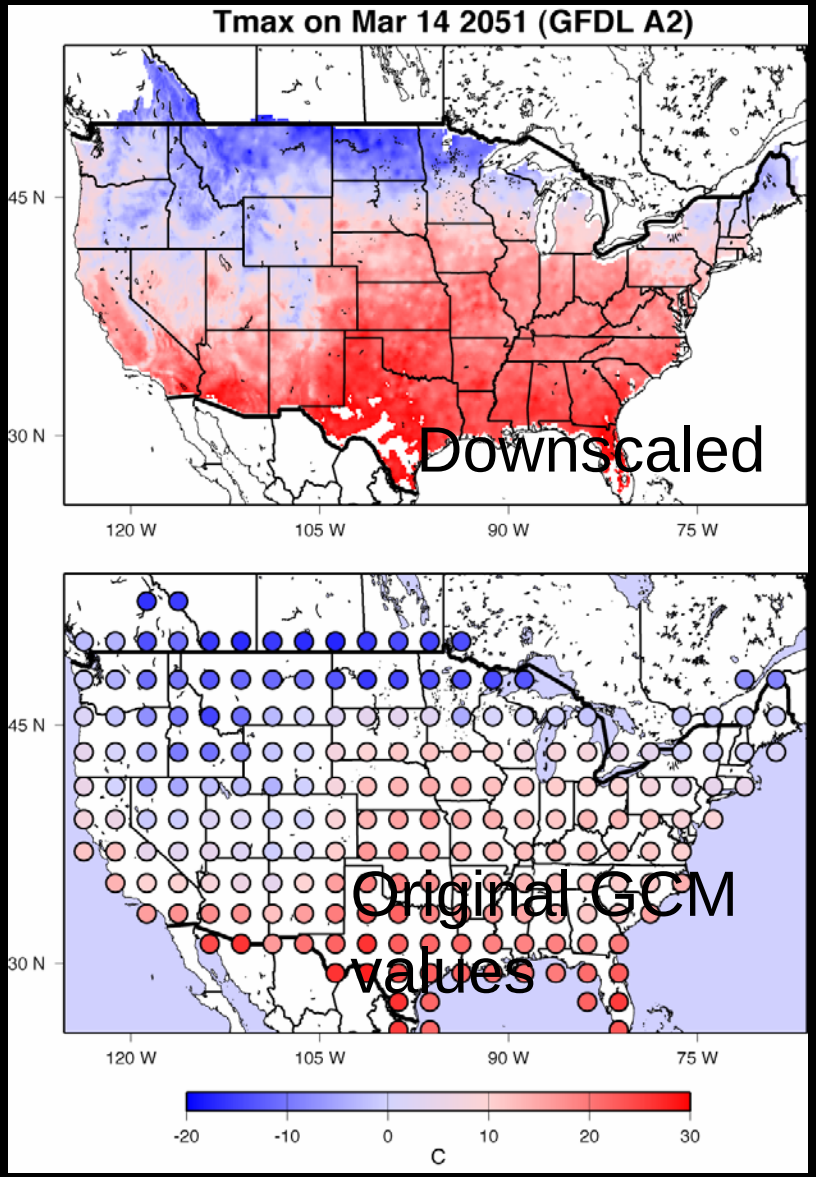
From amongst 100+ recent climate-change projections, we have chosen four scenarios to address in CASCaDE:



- **GFDL-B1: Medium warmer and drier**
- **GFDL-A2: Much warmer and drier**
- **PCM-B1: Not so much warmer with little ppt change**
- **PCM-A2: Medium warmer with little ppt change**

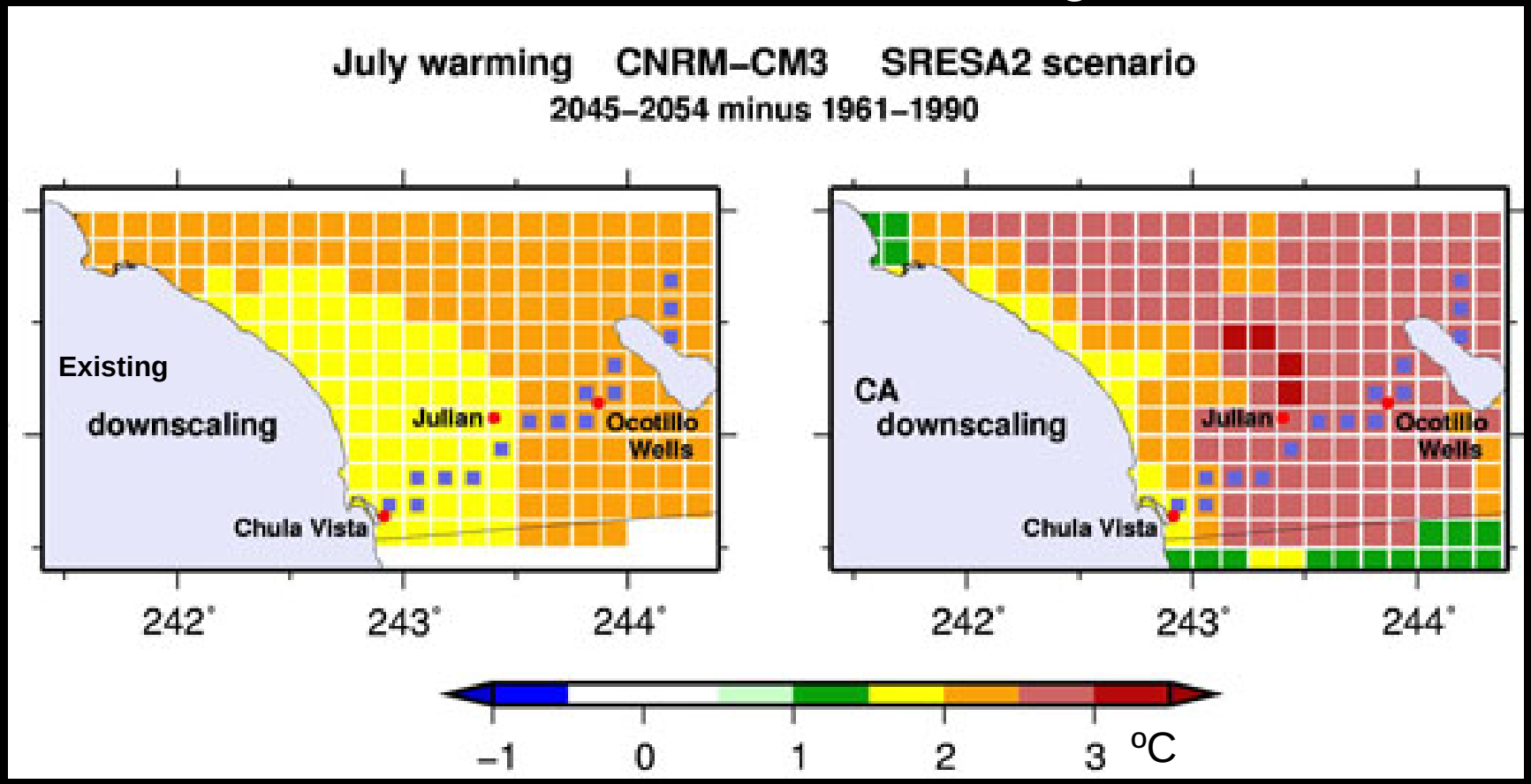
Most of Task 1 has been about downscaling



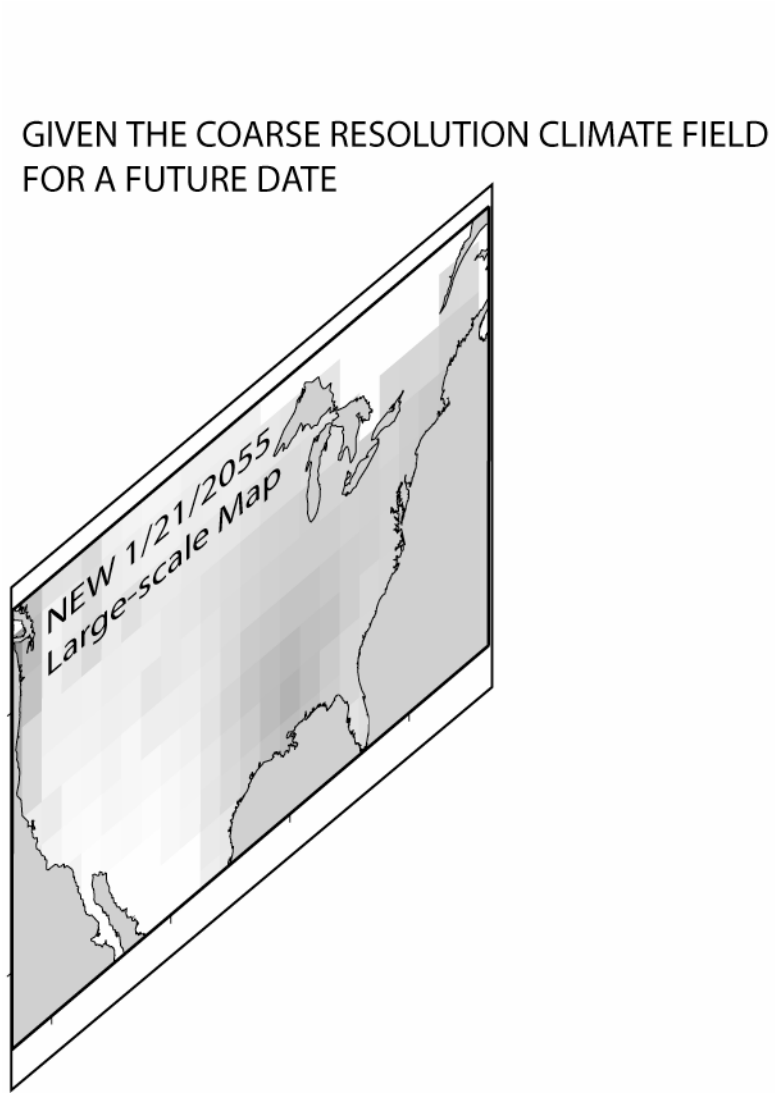


CASCaDE NEEDED A NEW DOWNSCALING METHOD

- Needed to synchronize with GCM weather *(e.g., to compound storm surge effects w/flood effects in the Delta)*
- More realistic near-coastal climate change

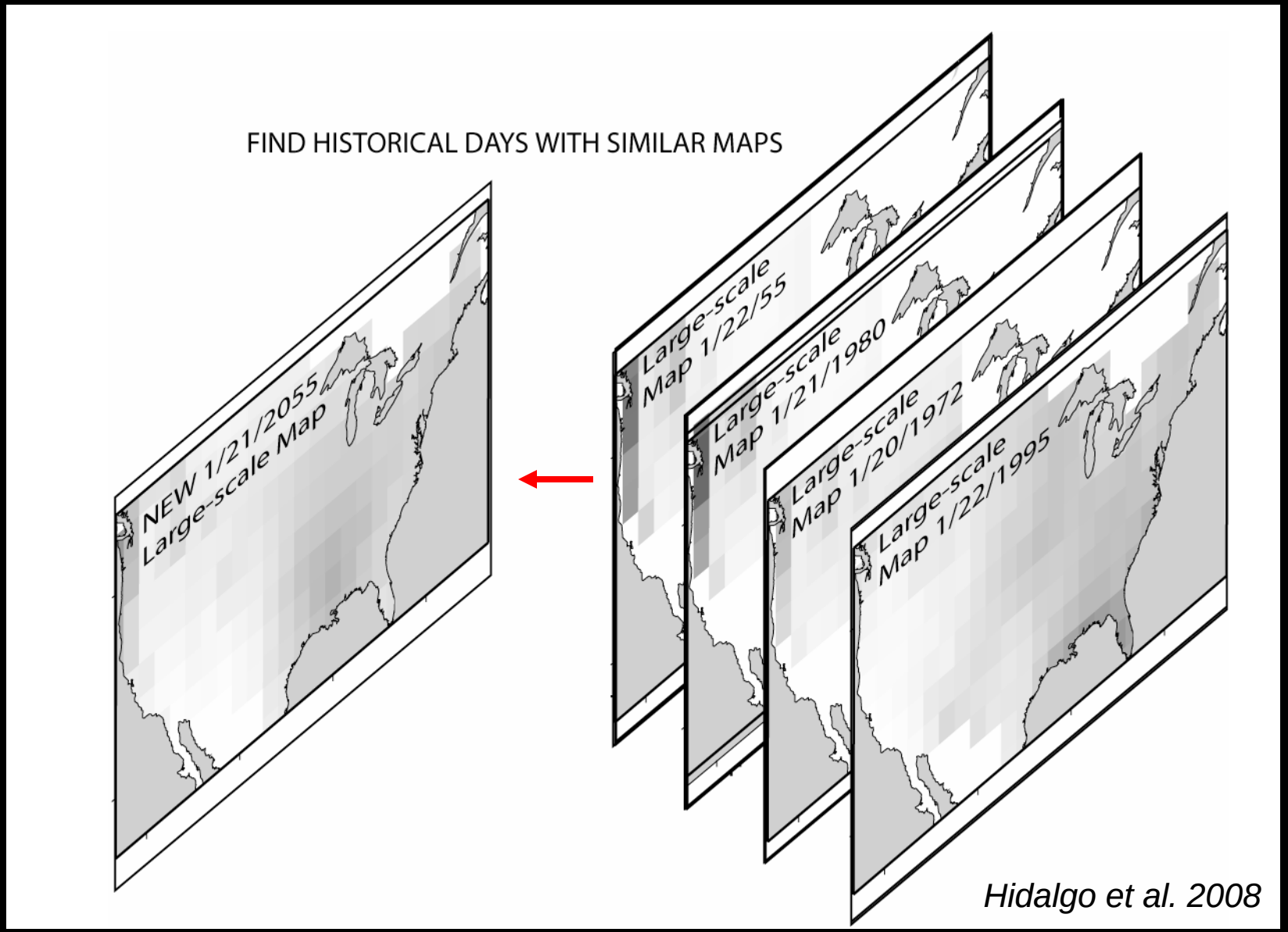


The constructed-analogs method



Hidalgo et al. 2008

http://www.energy.ca.gov/2007publications/CEC-500-2007-123/CEC-500-2007-123.PDF



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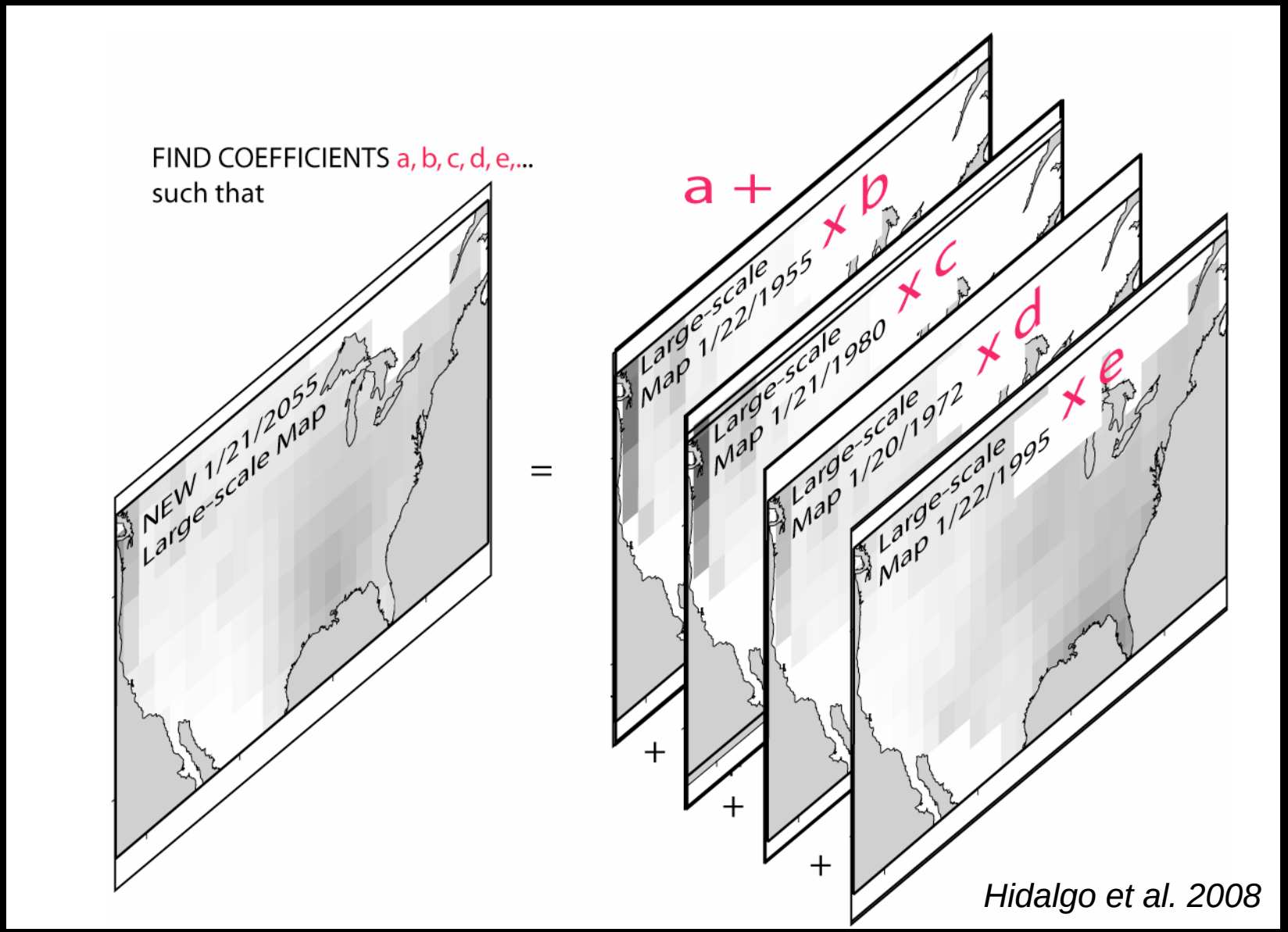

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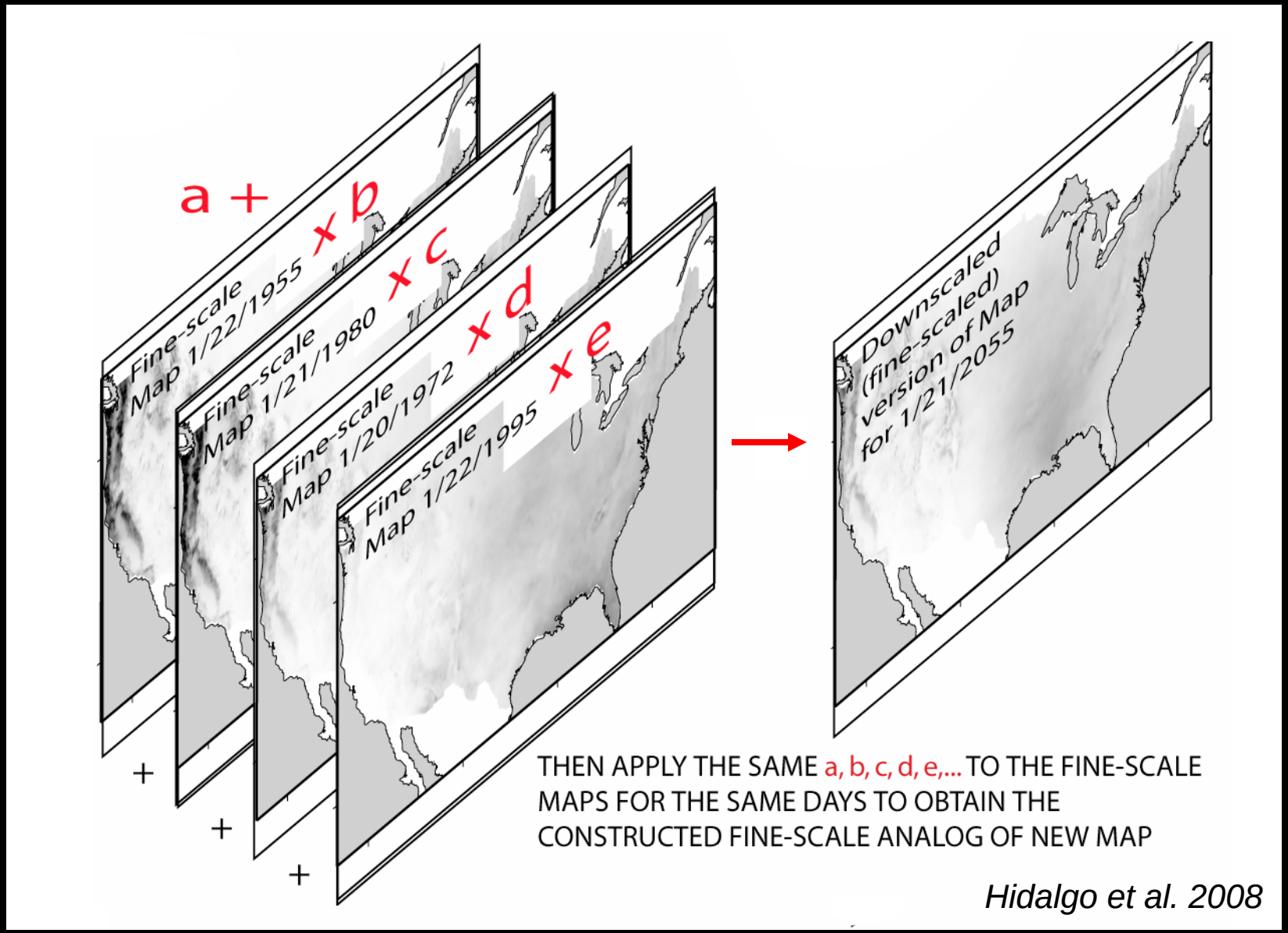

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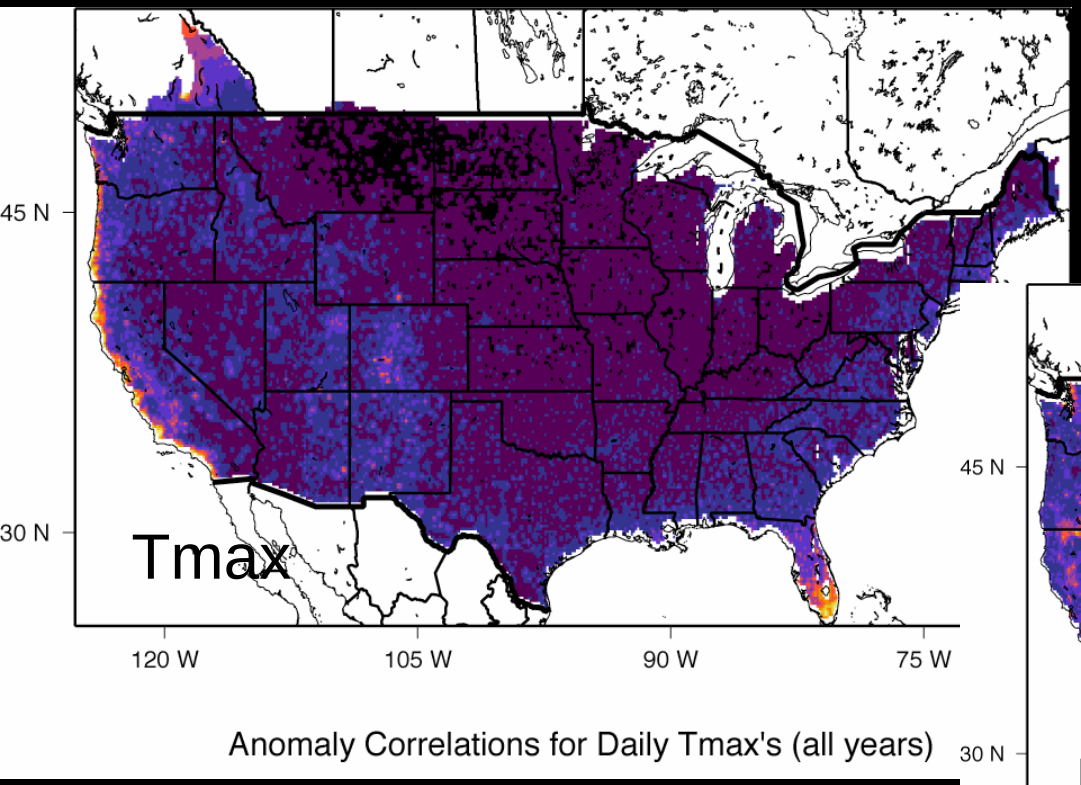
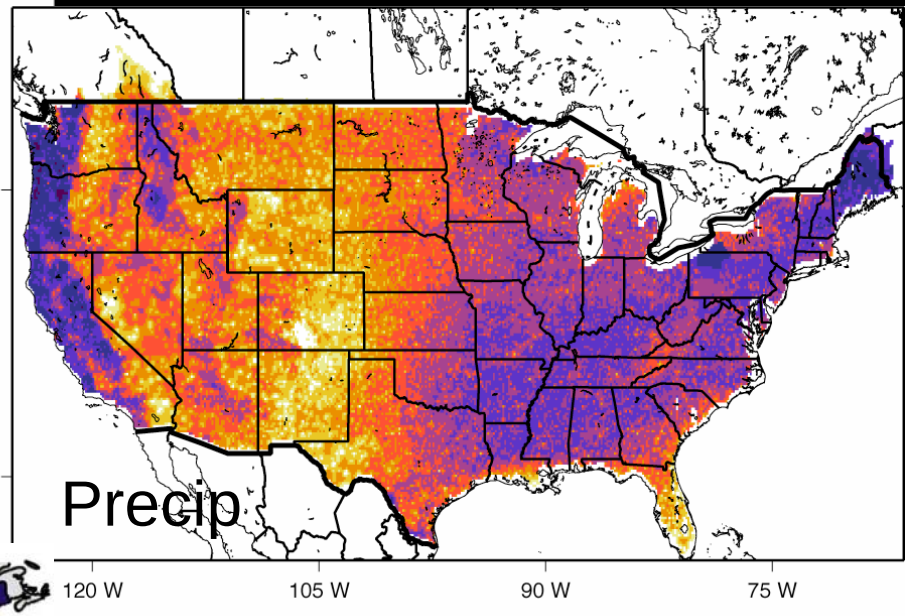
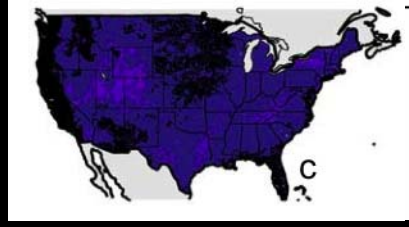
Skill of downscaling as indicated by application of method to historical OBSERVATIONS





Precip Skill at monthly average scale



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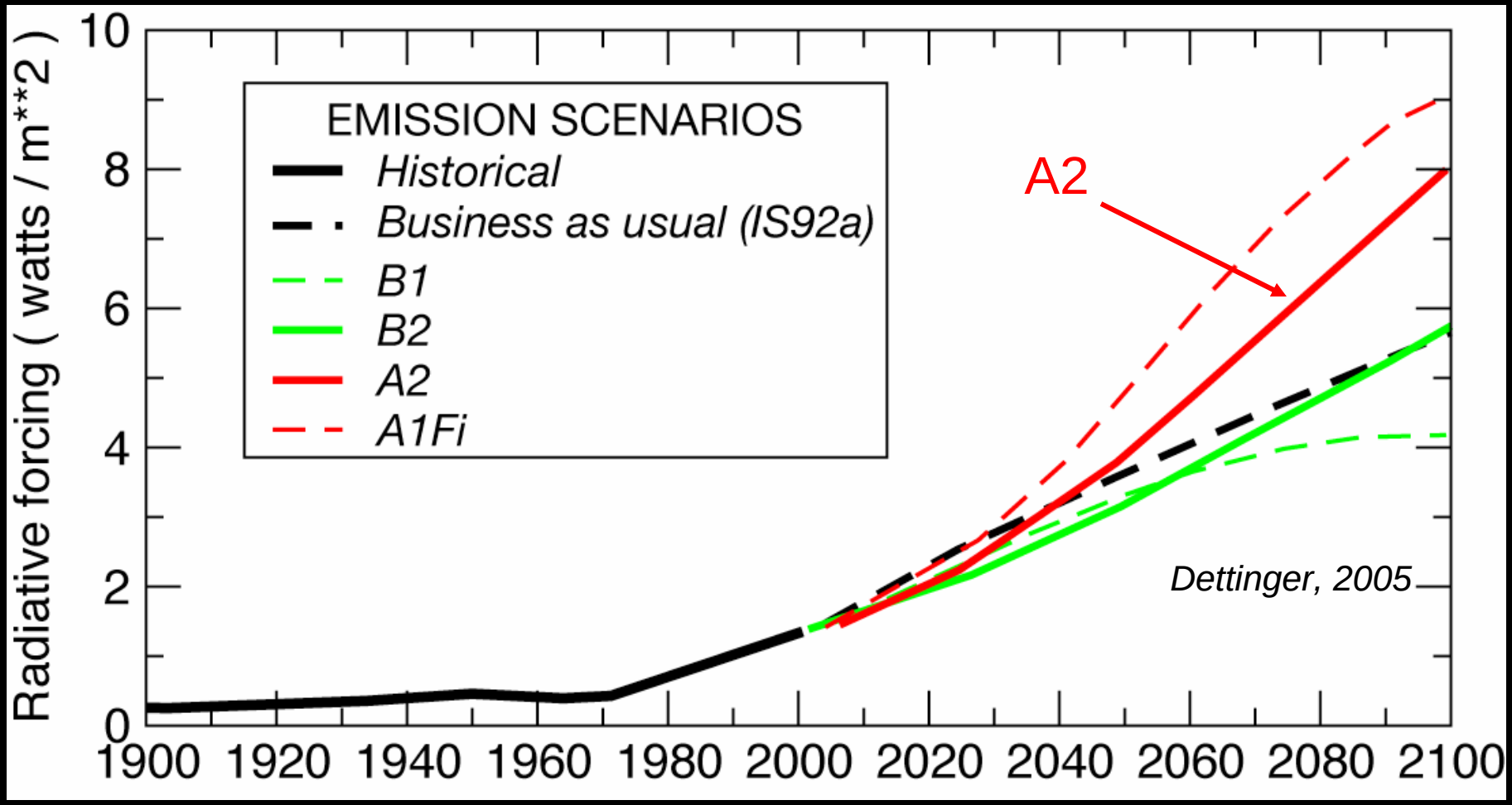
What do some of our constructed-analogs downscaled climate changes look like?



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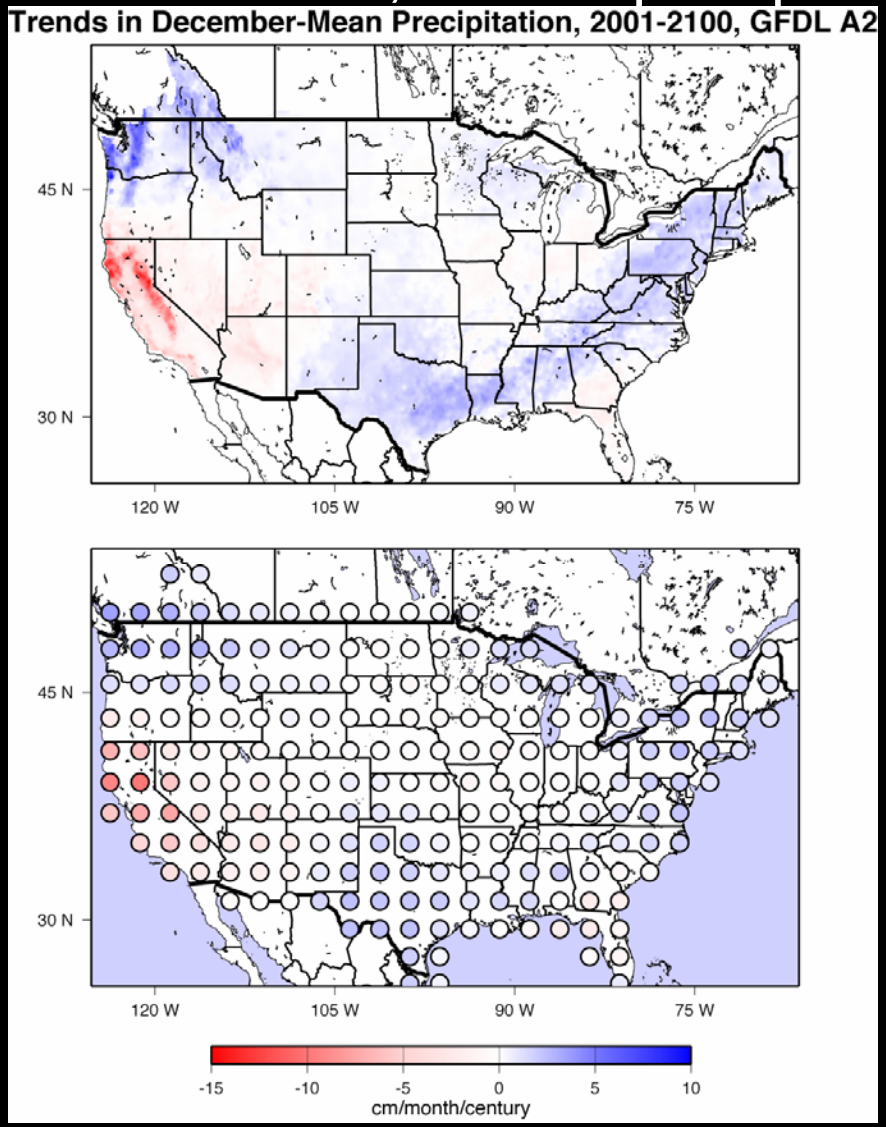
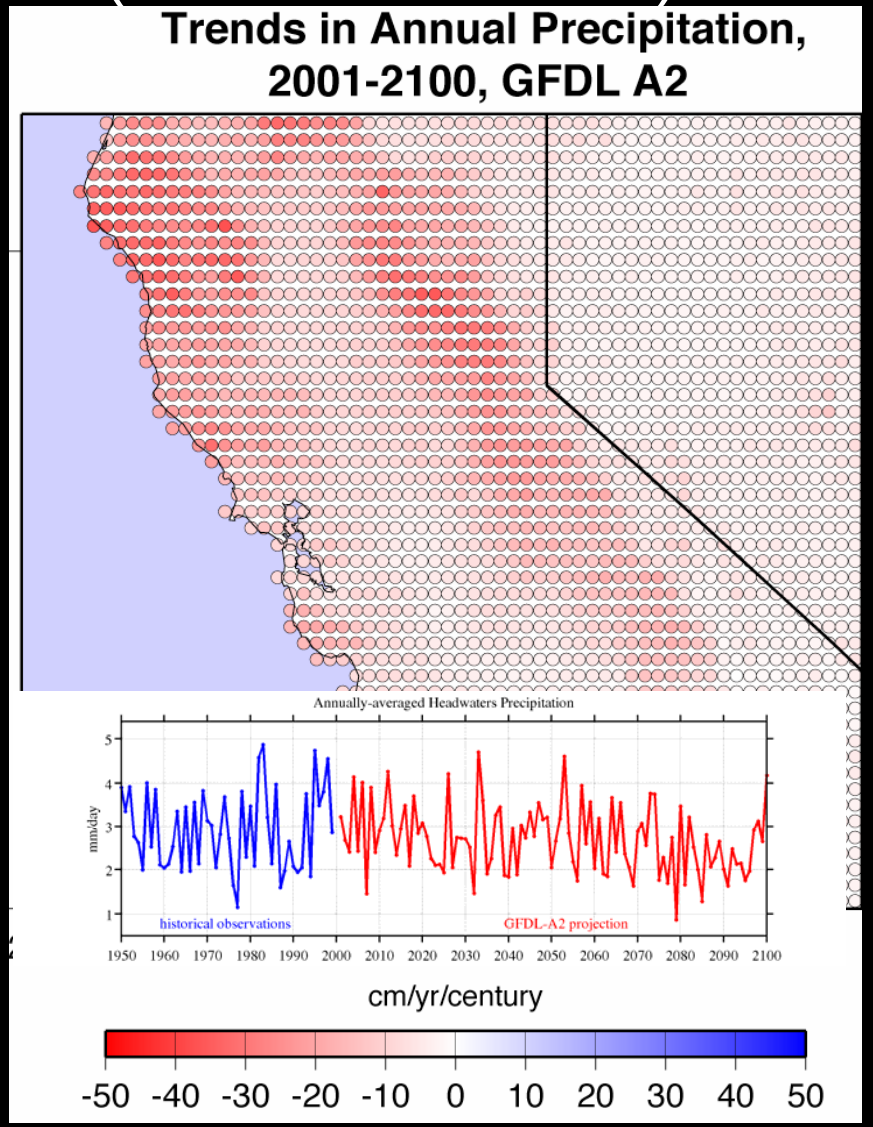
Trends, annual precipitation (GFDL-A2 scenario)





The downscaled CASCaDE scenarios are available at
http://cascade.wr.usgs.gov/data/Task1-climate/

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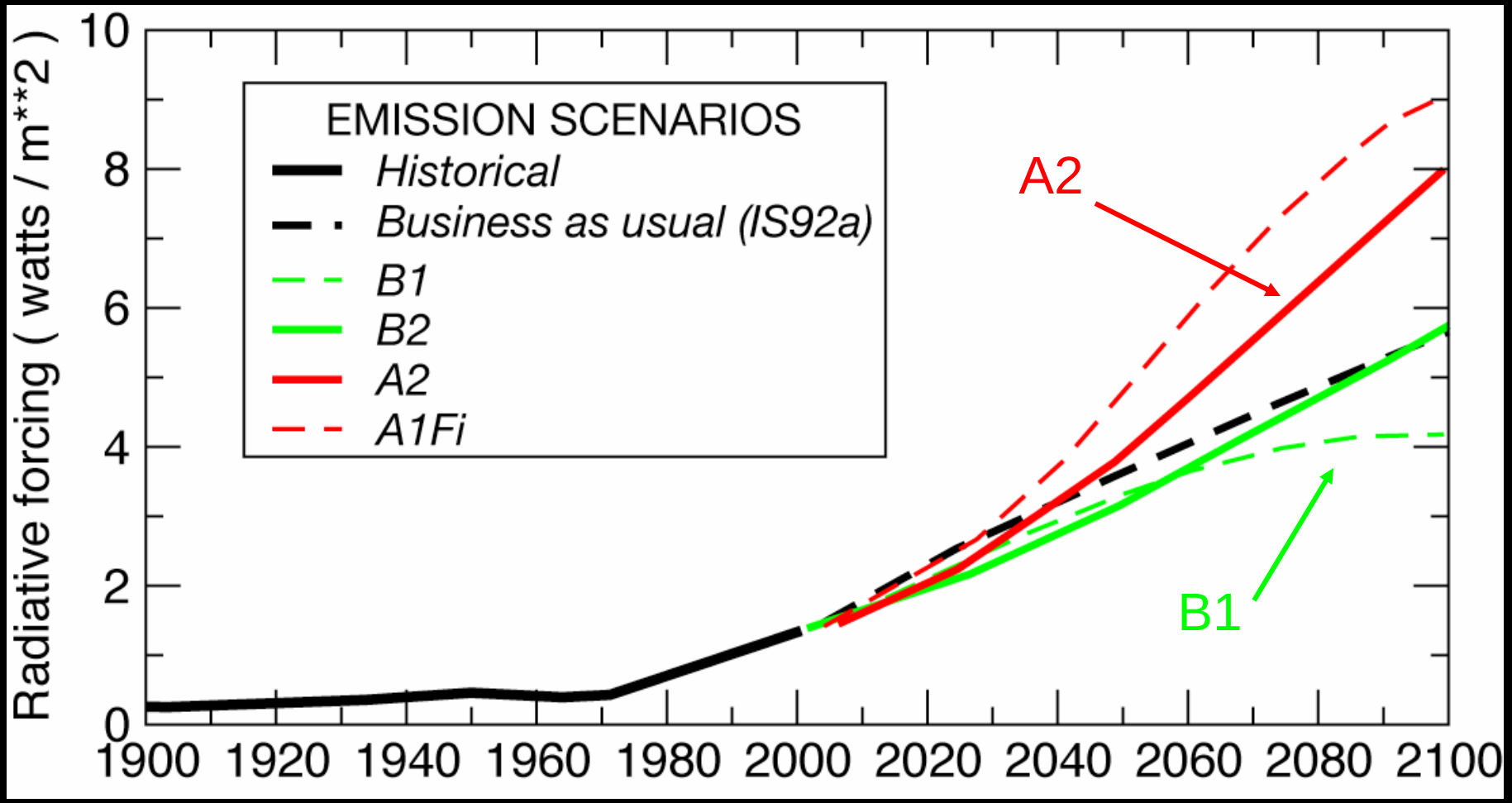
EMISSION SCENARIOS
Historical
Business as usual (IS92a)
B1
B2
A2
A1Fi
A2
B1
Radiative forcing (watts / m**2)
0
2
4
6
8
10
1900
1920
1940
1960
1980
2000
2020
2040
2060
2080
2100

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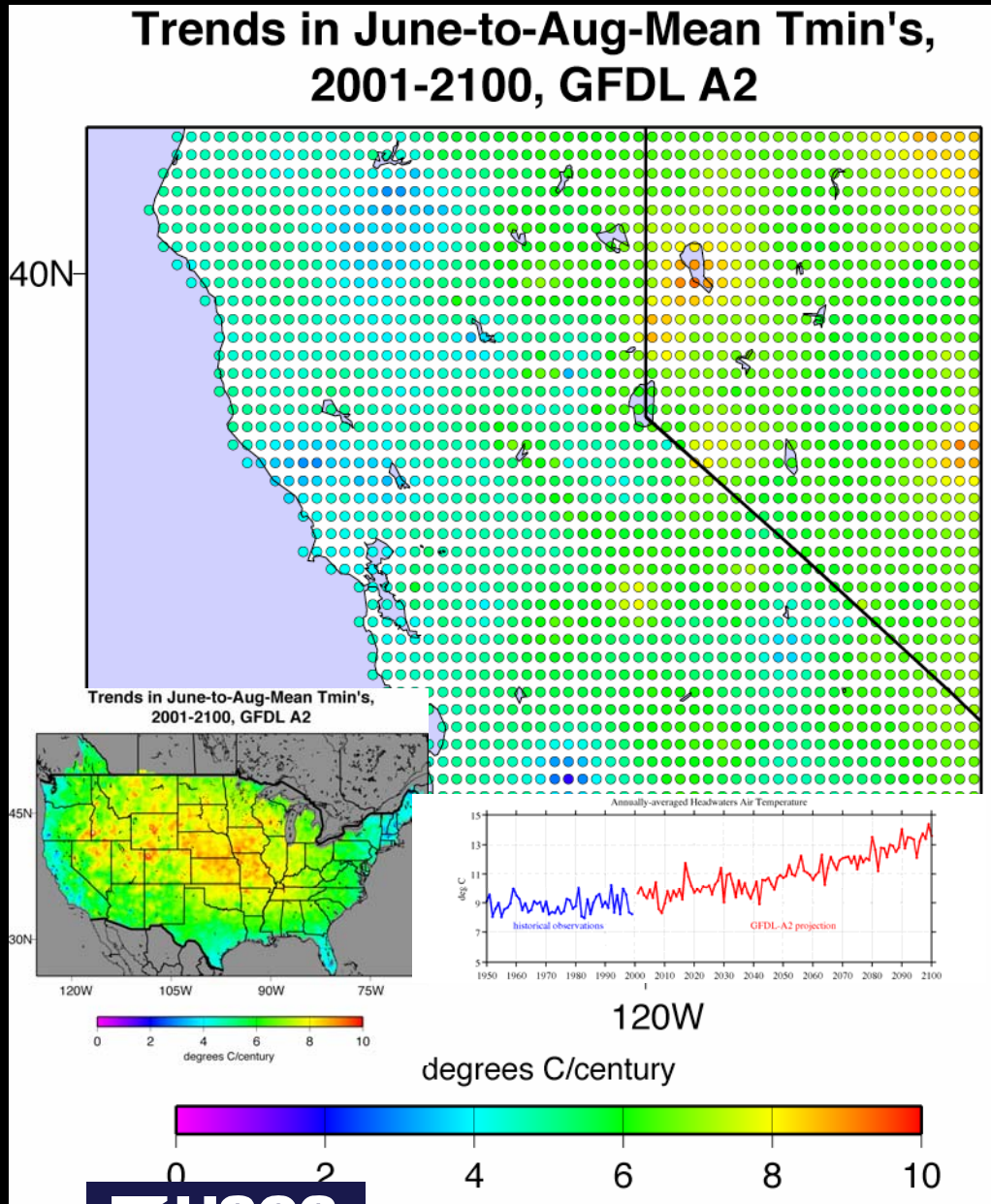
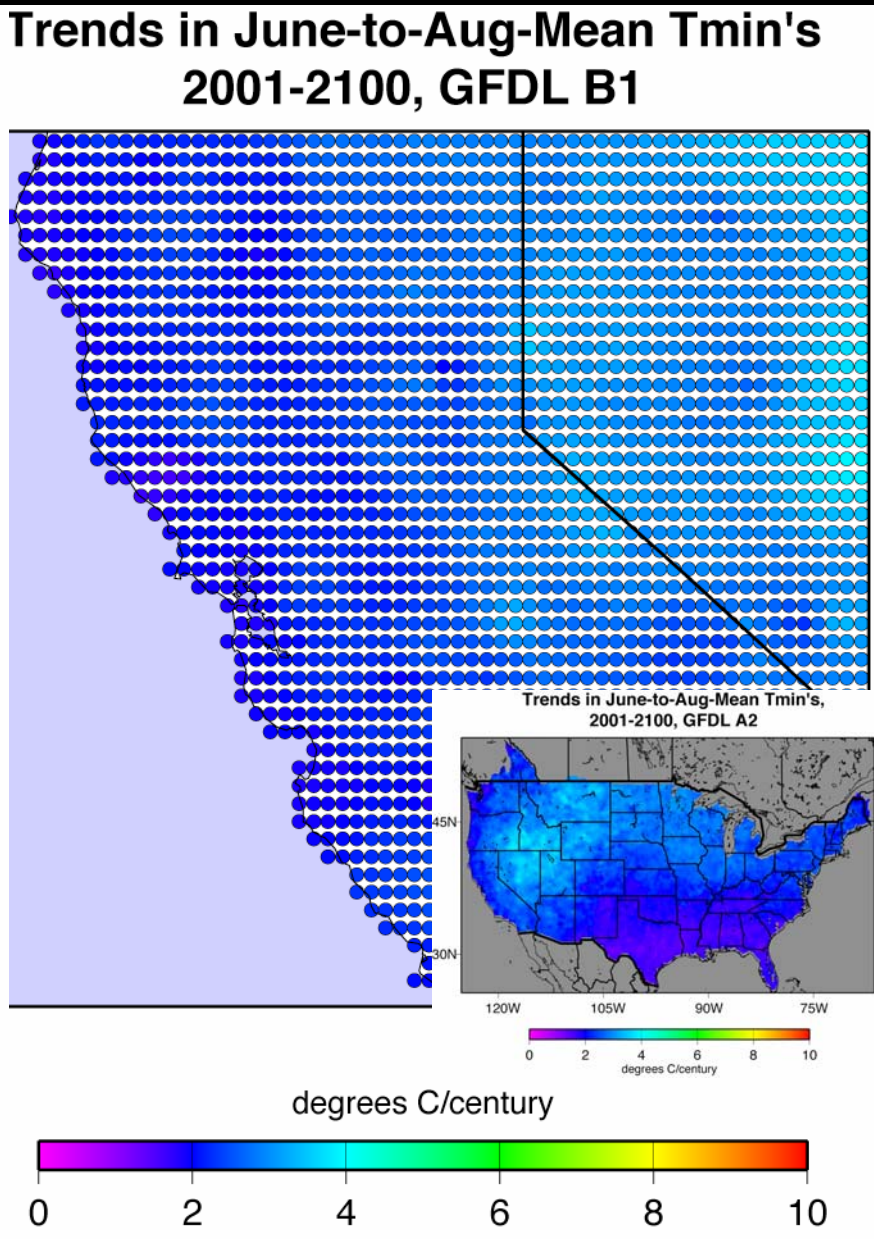
A2 Tmin Trends

B1 Tmin Trends





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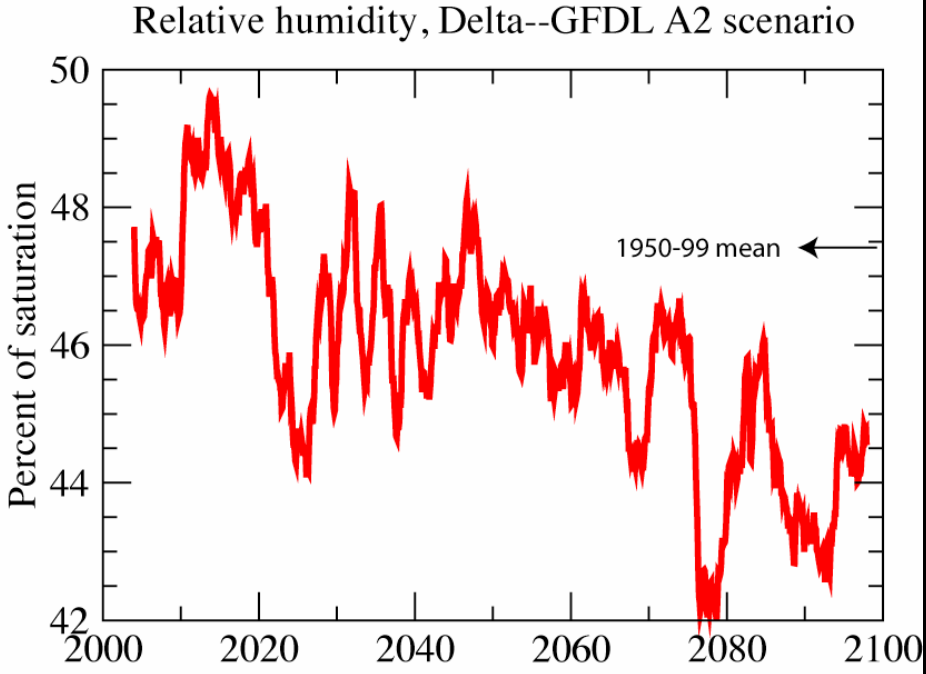
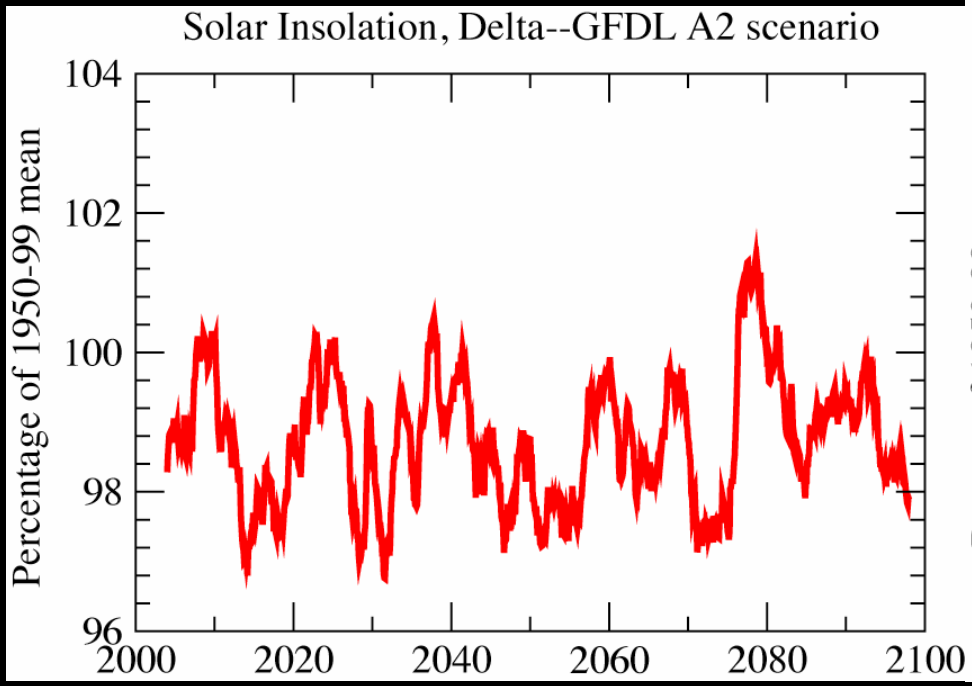
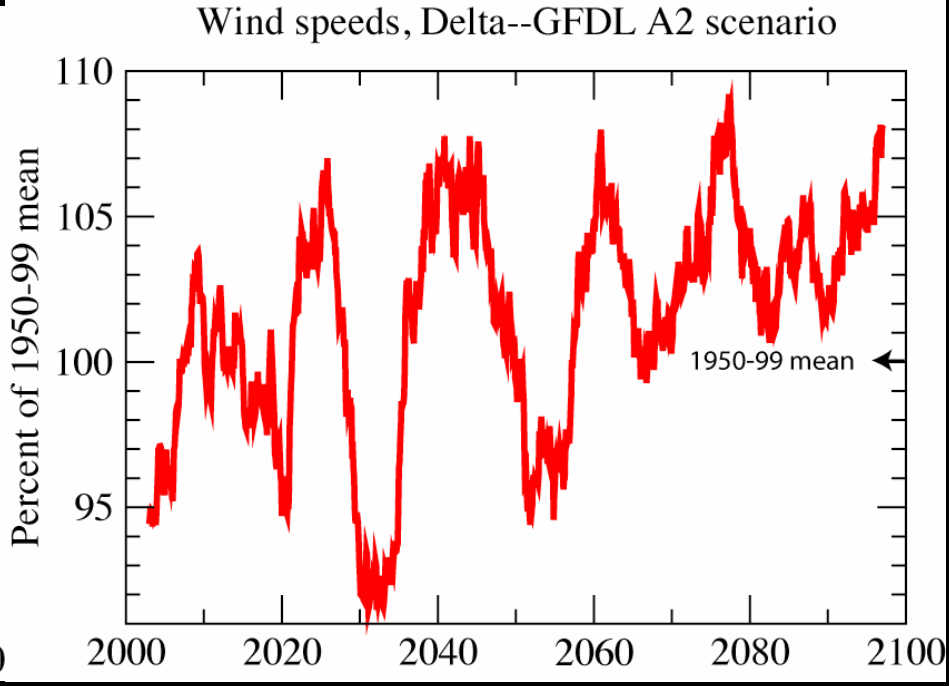
Still working on downscaling:

- Solar insolation
- Humidities
- Surface winds





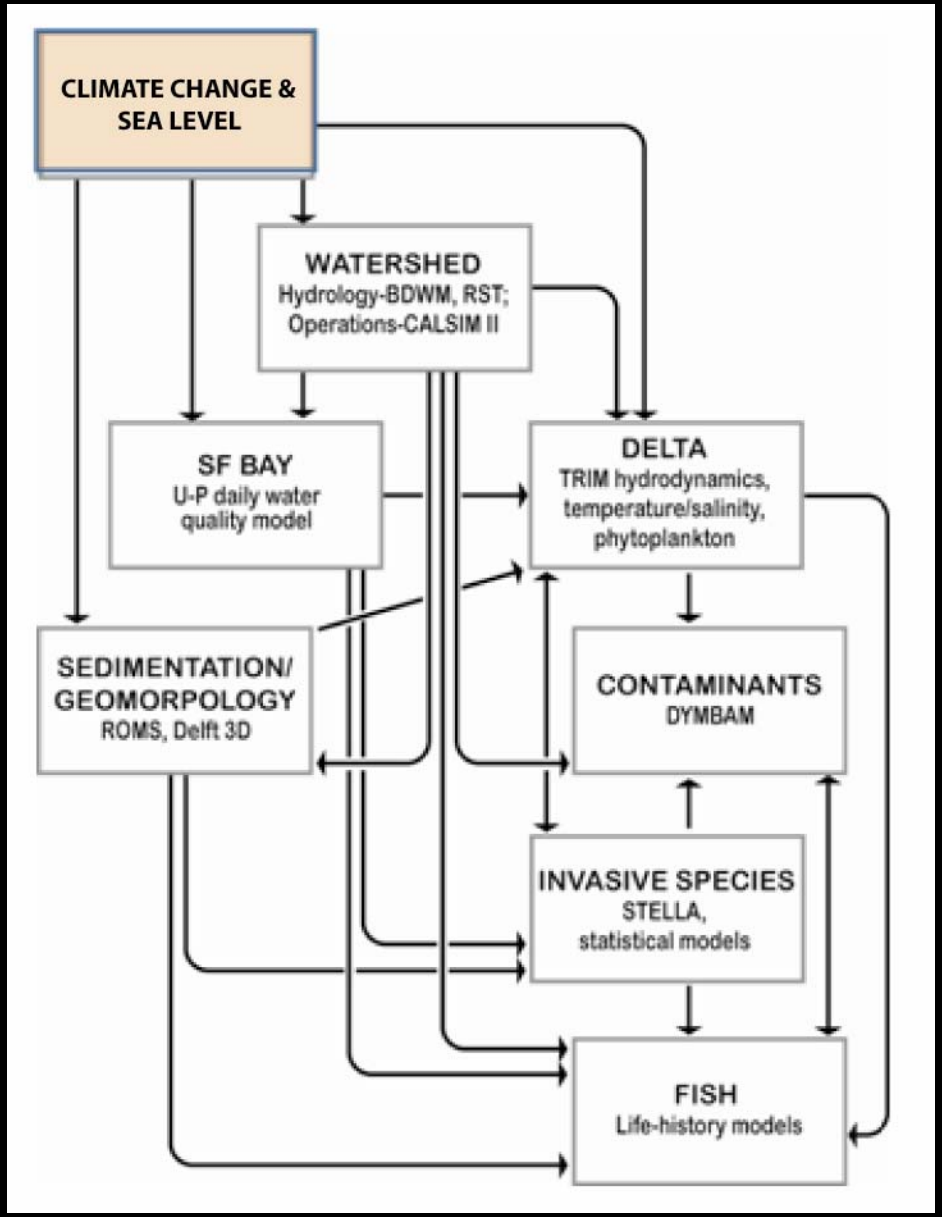


Results thus far:

New downscaled daily temperature & precipitation fields, 1950-2100, from four recent climate-change scenarios

Providing:
- *synchronization of daily weather (& thus floods) with sea levels*
- *high resolution of trends in near-coastal environment*

Next up: Sea-level scenarios -- *Dan Cayan*



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CASCaDE Studies sessions

Overview & climate--*Dettinger*
Sea-Level Rise--*Cayan*
Watershed & operations--*Knowles*
Delta Transport Timescales--*Monsen*
Delta Temperatures--*Wagner*

Lunch

Suisun Bay bathymetric change--*Schoellhamer*
San Pablo Bay Bathymetric change--*Wegen*
Phytoplankton & clams--*Lucas*
Selenium & mercury in food webs--*Stewart*
Temperature & fisheries--*Brown*

Plus Poster cluster earlier in the week