Climate variability and groundwater recharge in southwest Wisconsin

Madeline Gotkowitz[1]
Doug Joachim[2]
Steve Vavrus[3]
Steve Loheide[2]
Ken Bradbury[1]

[1] Wisconsin Geological and Natural History Survey, Madison, WI
[2] Dept. of Civil and Environmental Engineering, UW – Madison, Madison, WI
[3] Gaylord Nelson Institute of Environmental Study, UW- Madison, Madison, WI

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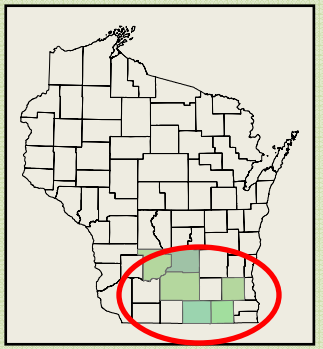
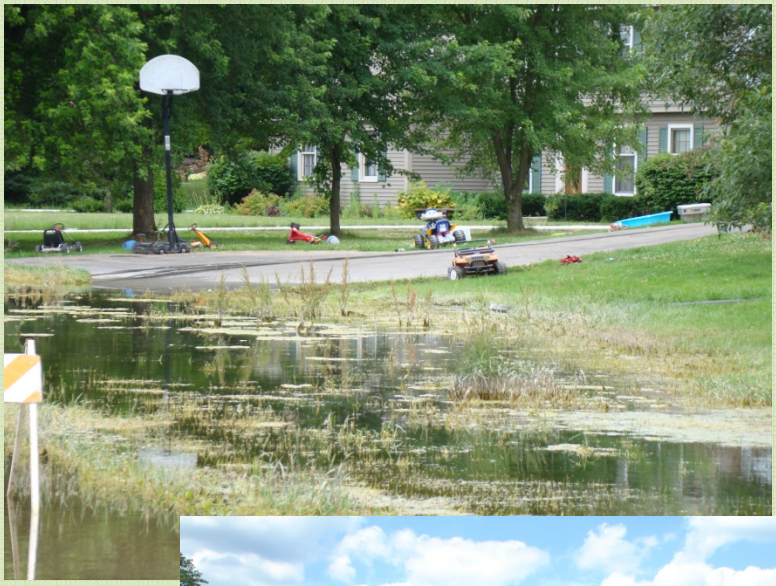
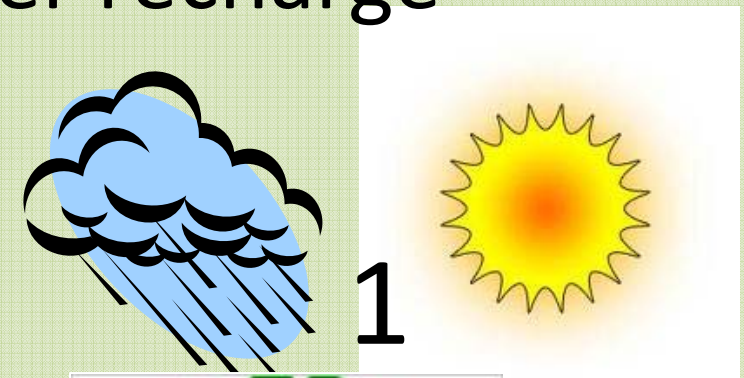
Motivation: *water table rise* caused long-lasting flooding in 2008





A series of models simulate future climate conditions and groundwater recharge

1) Daily precipitation and temperature estimates from 8 down-scaled global circulation models (GCMs)
   (Serbin & Kucharik, 2009.)
2) Soil water balance model (SWB) estimates daily runoff and infiltration over a 30-meter grid
3) Three-dimensional, transient MODFLOW simulates the groundwater system, water table elevation



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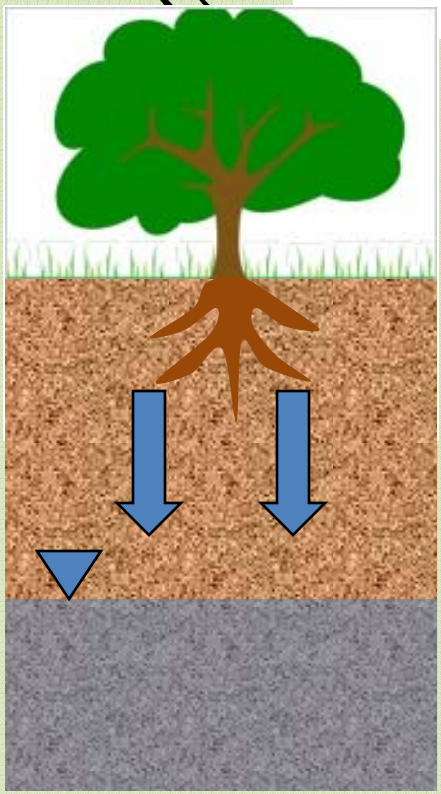

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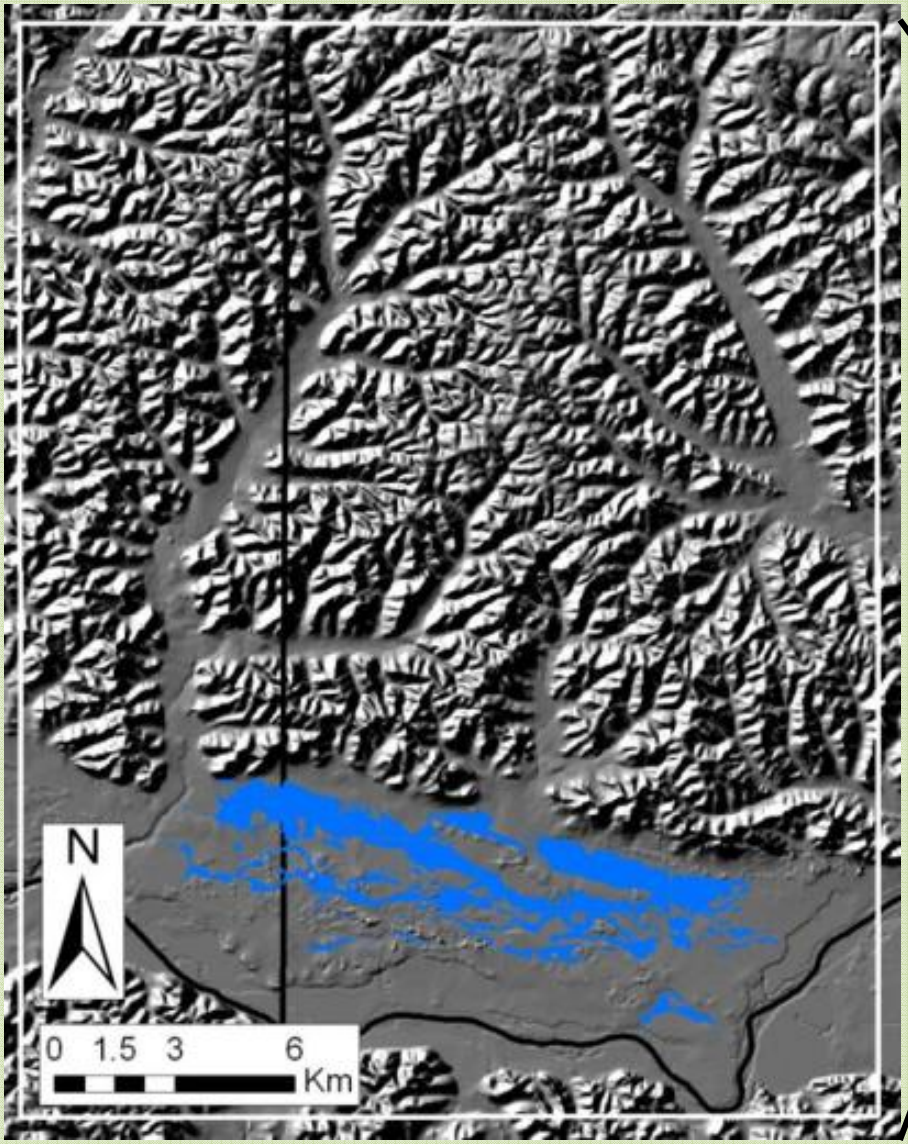
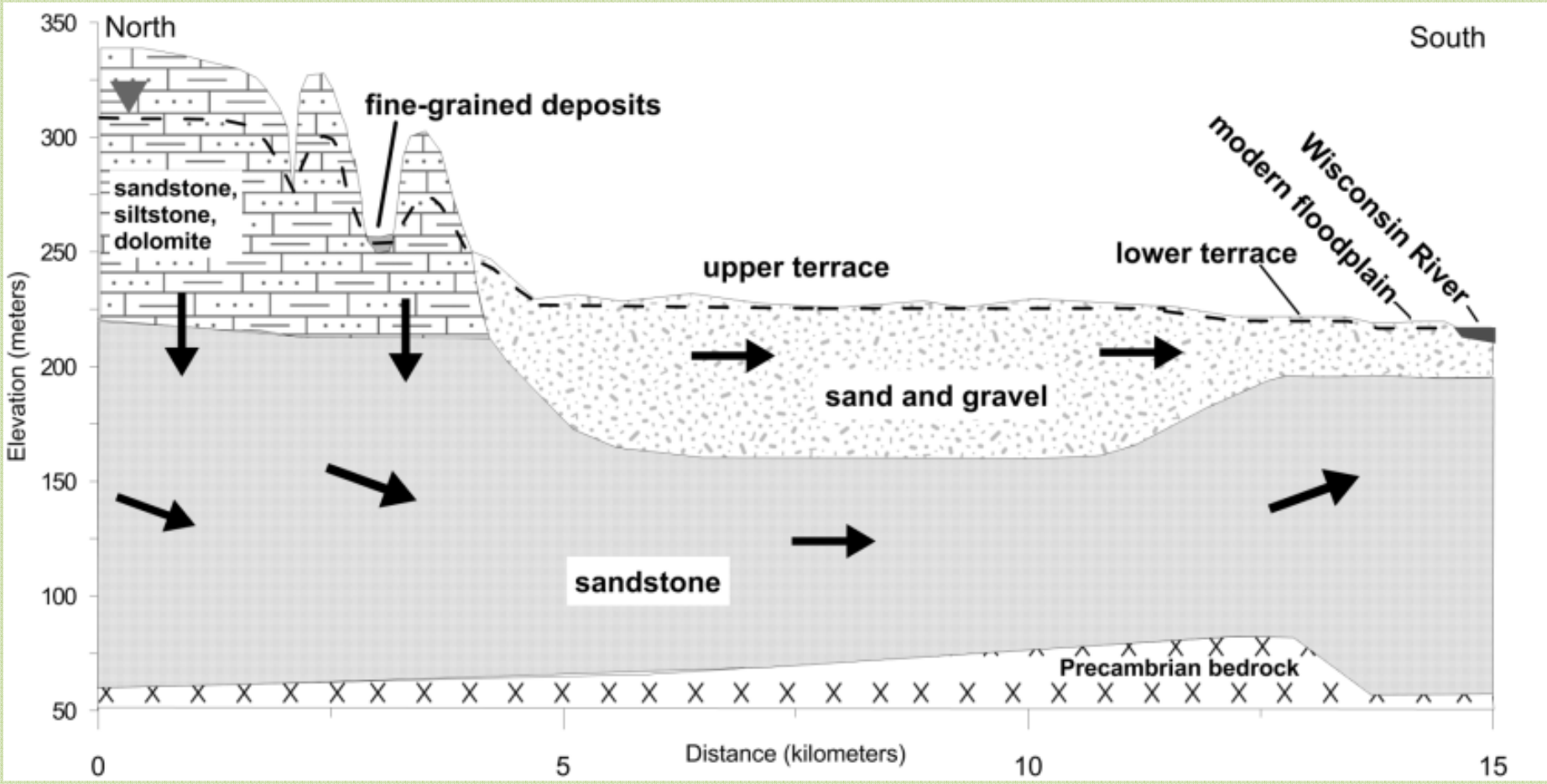
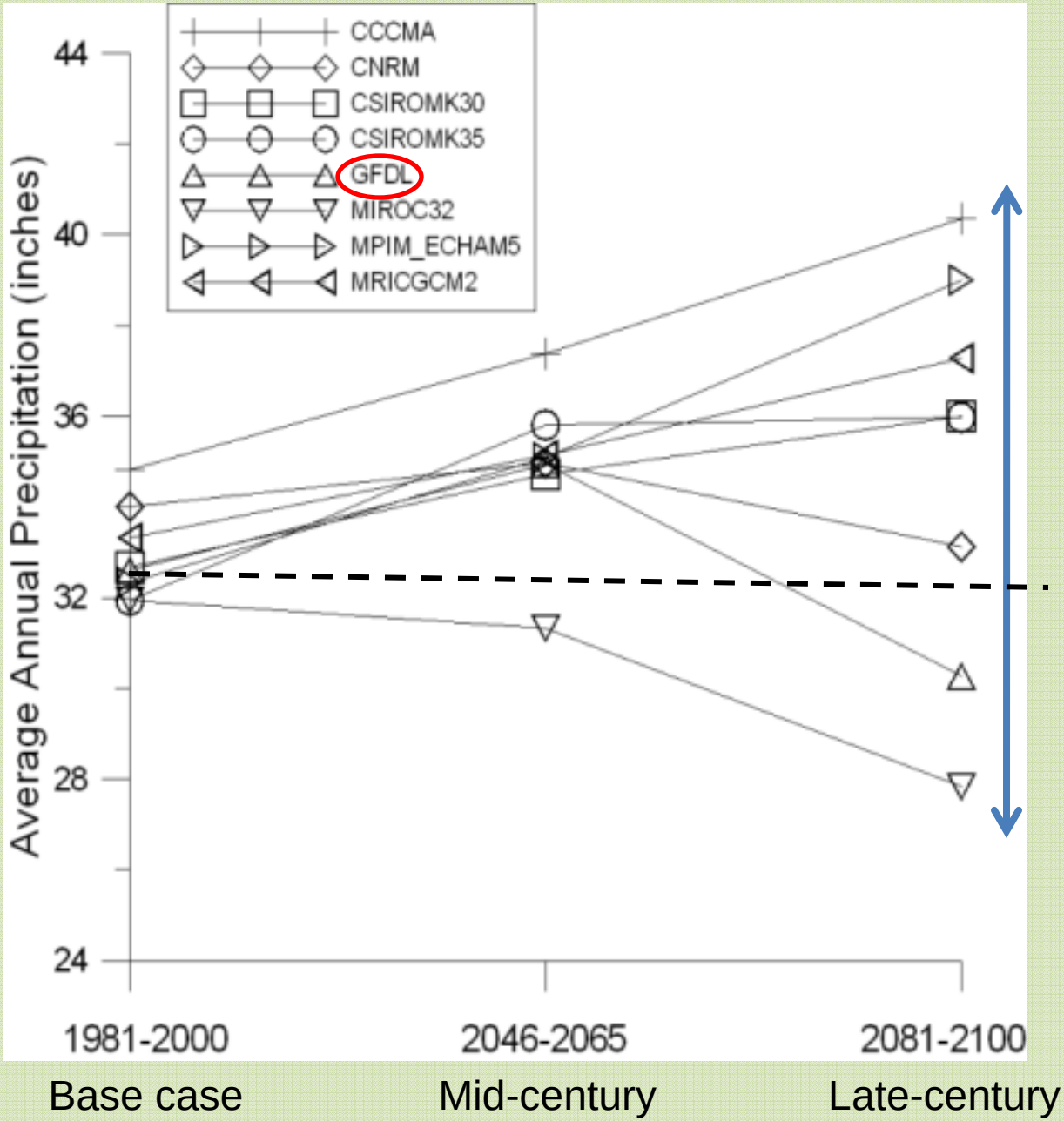
Spring Green, Wisconsin



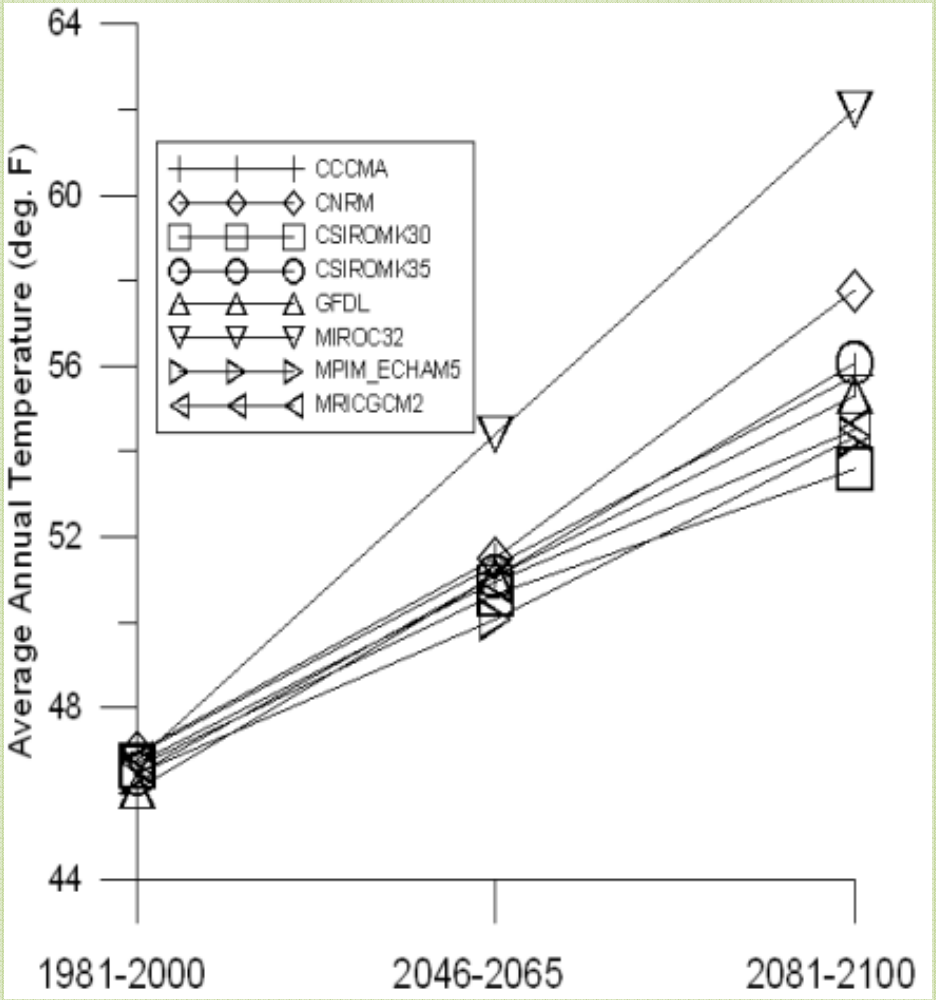
Hydrogeologic conceptual model



GCM results:
12-inch range
in annual
average
precipitation



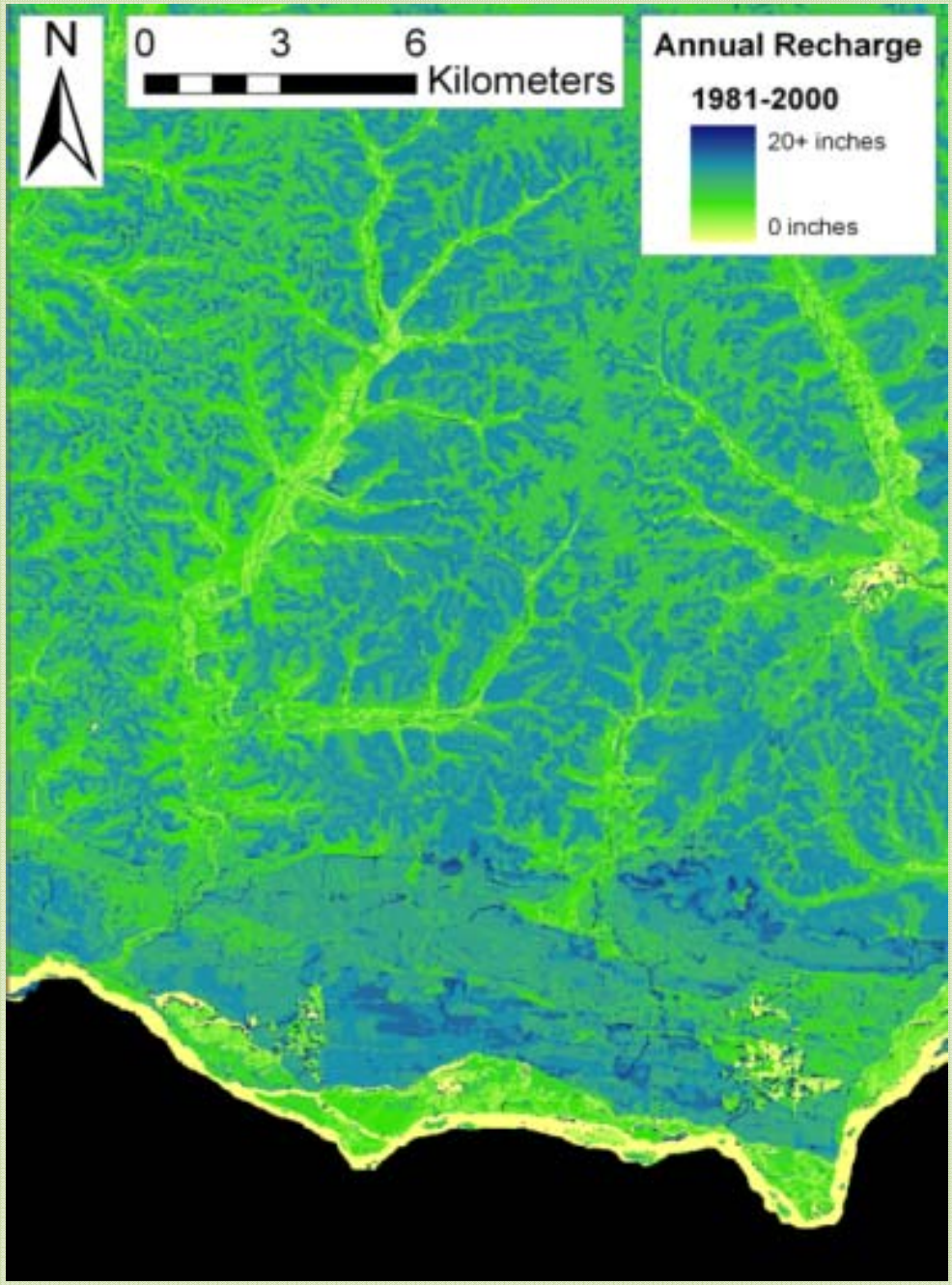
GCMs predict at least 6° increase in average annual temperature



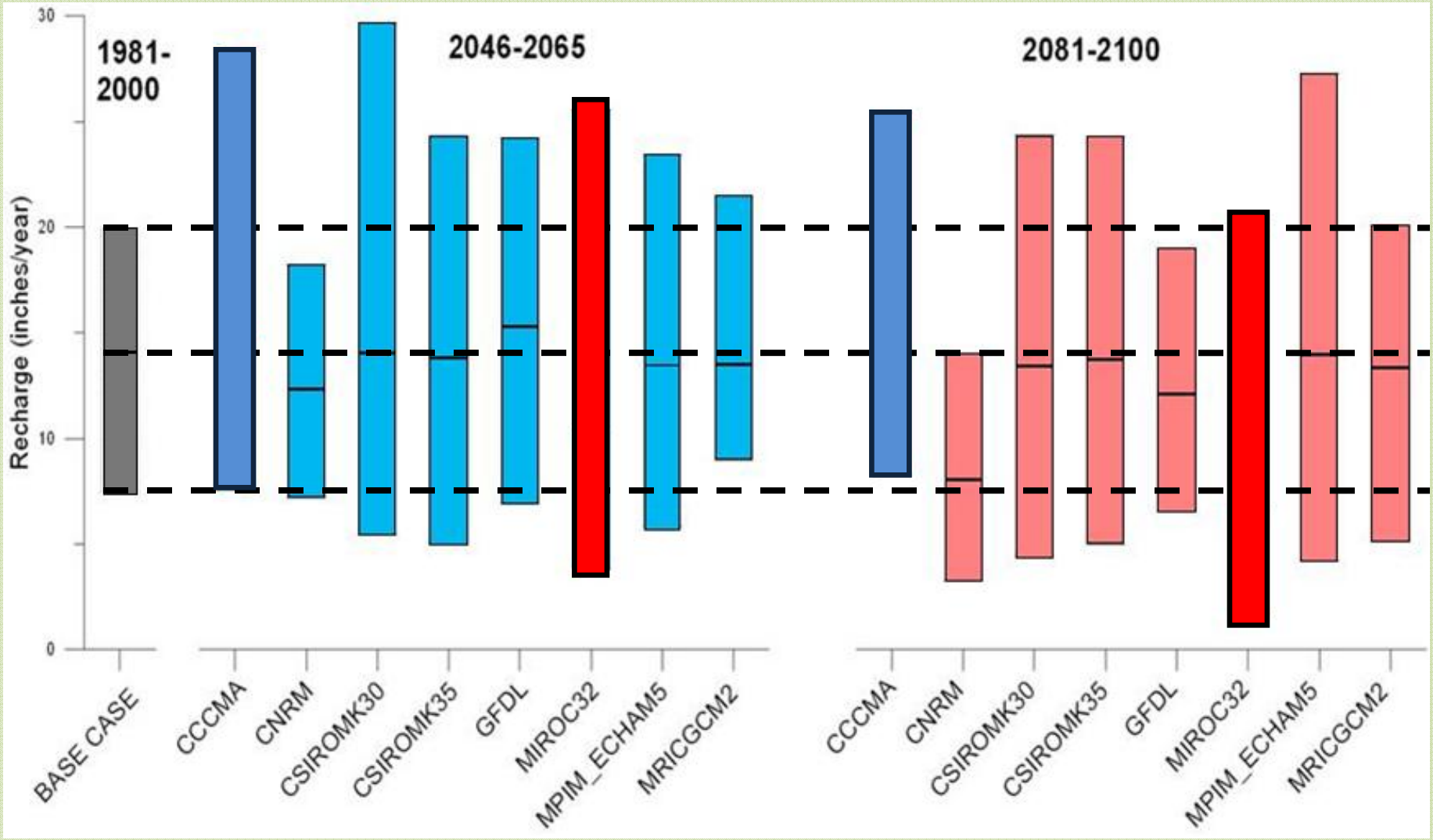
Annual recharge

"Base case" conditions,

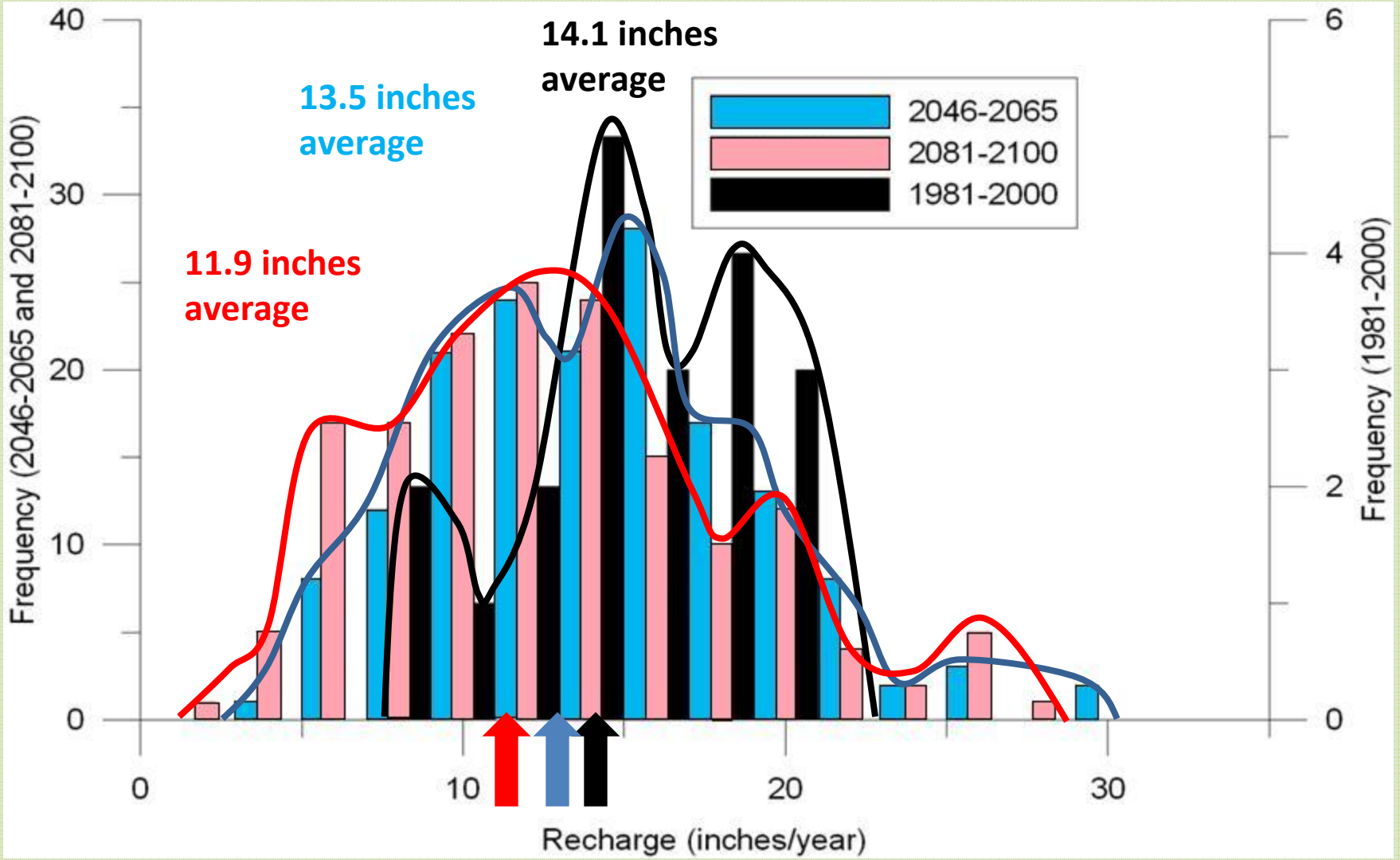
14 inches/year on average, ranging from about 2 to 20 in/yr



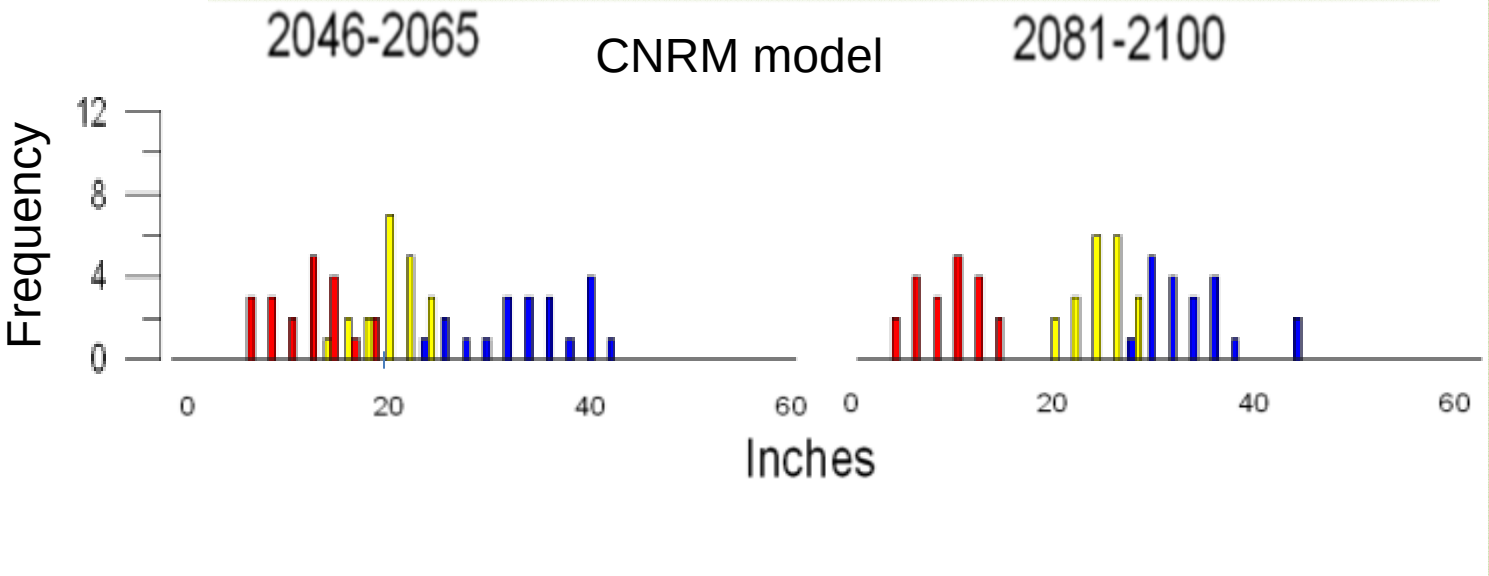
Simulated Recharge



Frequency of annual recharge



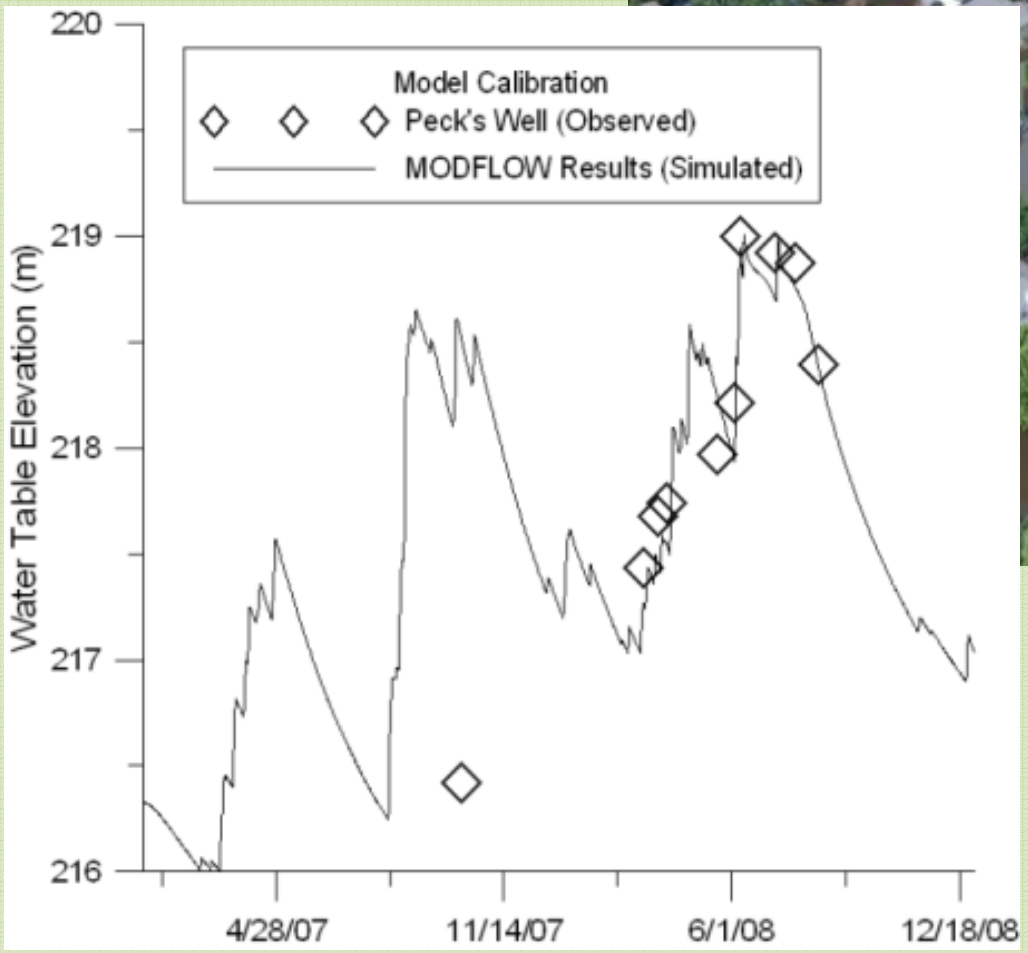
Simulated temperature increases, driving up ET and decreasing recharge



precipitation
ET
recharge

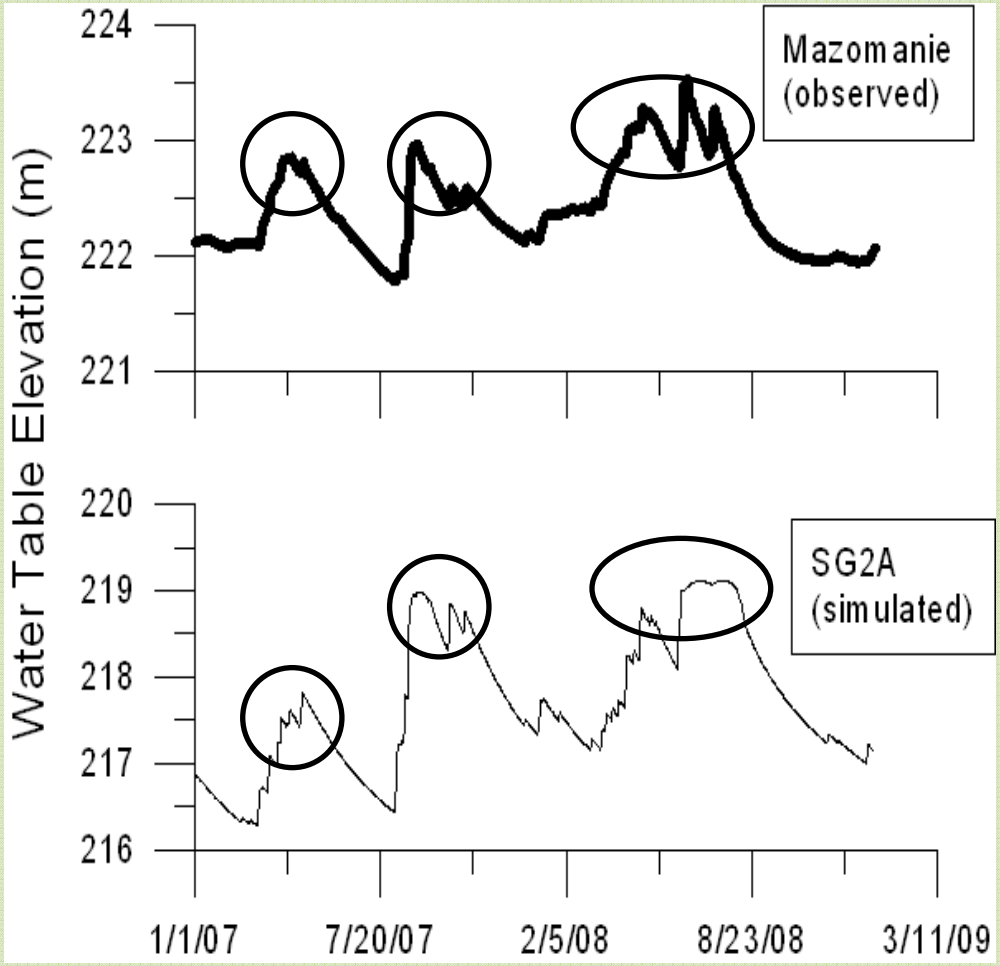
Base case average ET = 17.8 inches /year, increasing to over 21 inches/ year by 2100.

Groundwater flow model calibration

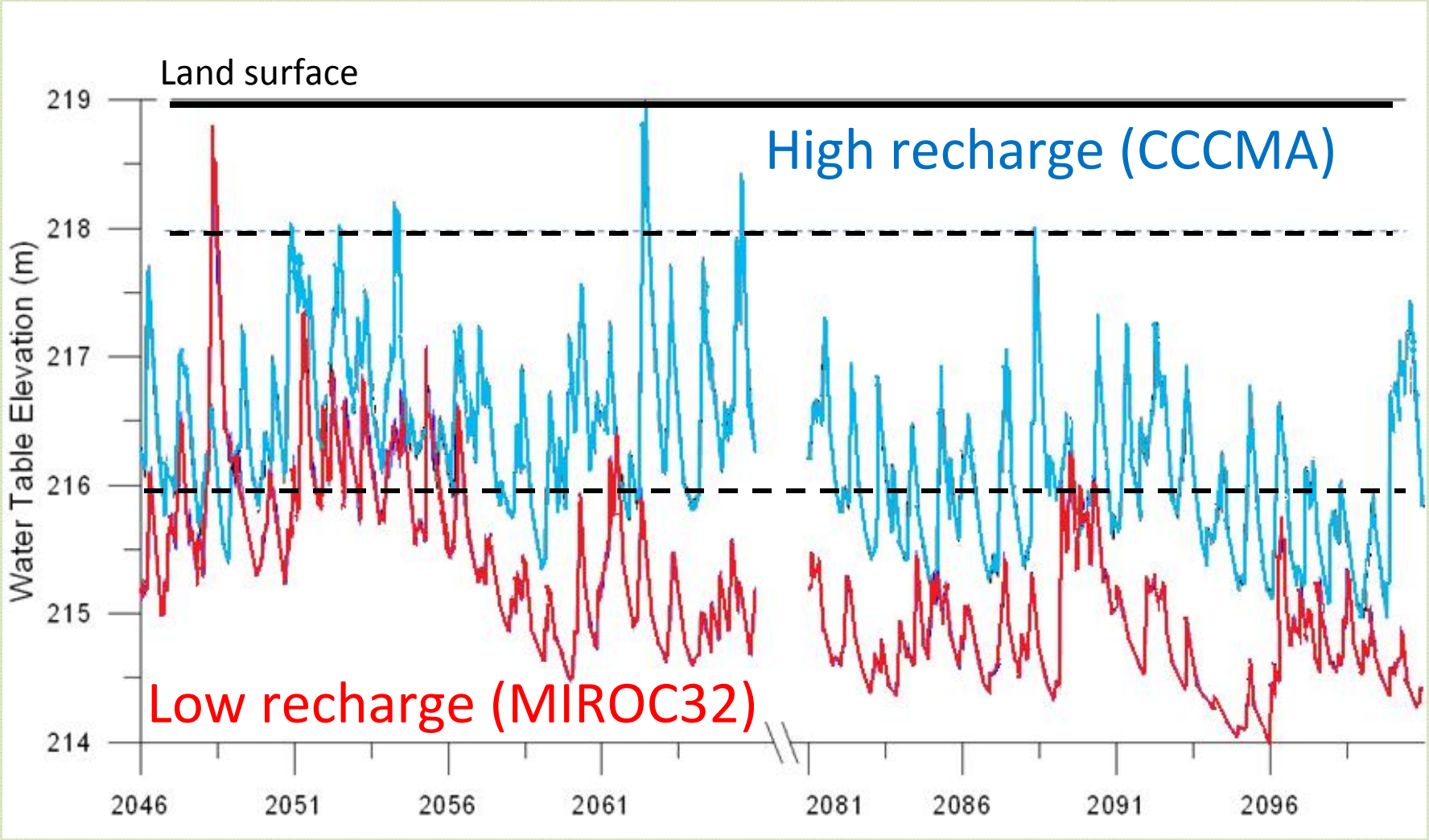


Peck's well, June 2008

Additional observed and simulated water table response, 2008



Simulated water table elevation



Conclusions

- **Simulated average recharge decreases 10%, due to increase in temperature *and ET*.**
- **Variability in simulated recharge is high, and high groundwater conditions occur infrequently.**
- **Current flood mitigation efforts may prove useful to preserve *existing land use*.**