Preparing for the Effects of Climate Change on Reservoirs and Lakes

S. Geoffrey Schladow
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Municipal Water Quality Investigations (MWQI) Technical Advisory Committee, April 29, 2015

From: State of California|California Department of Water Resources, 2015. *California's Most Significant Droughts: Comparing Historical and Recent Conditions.*

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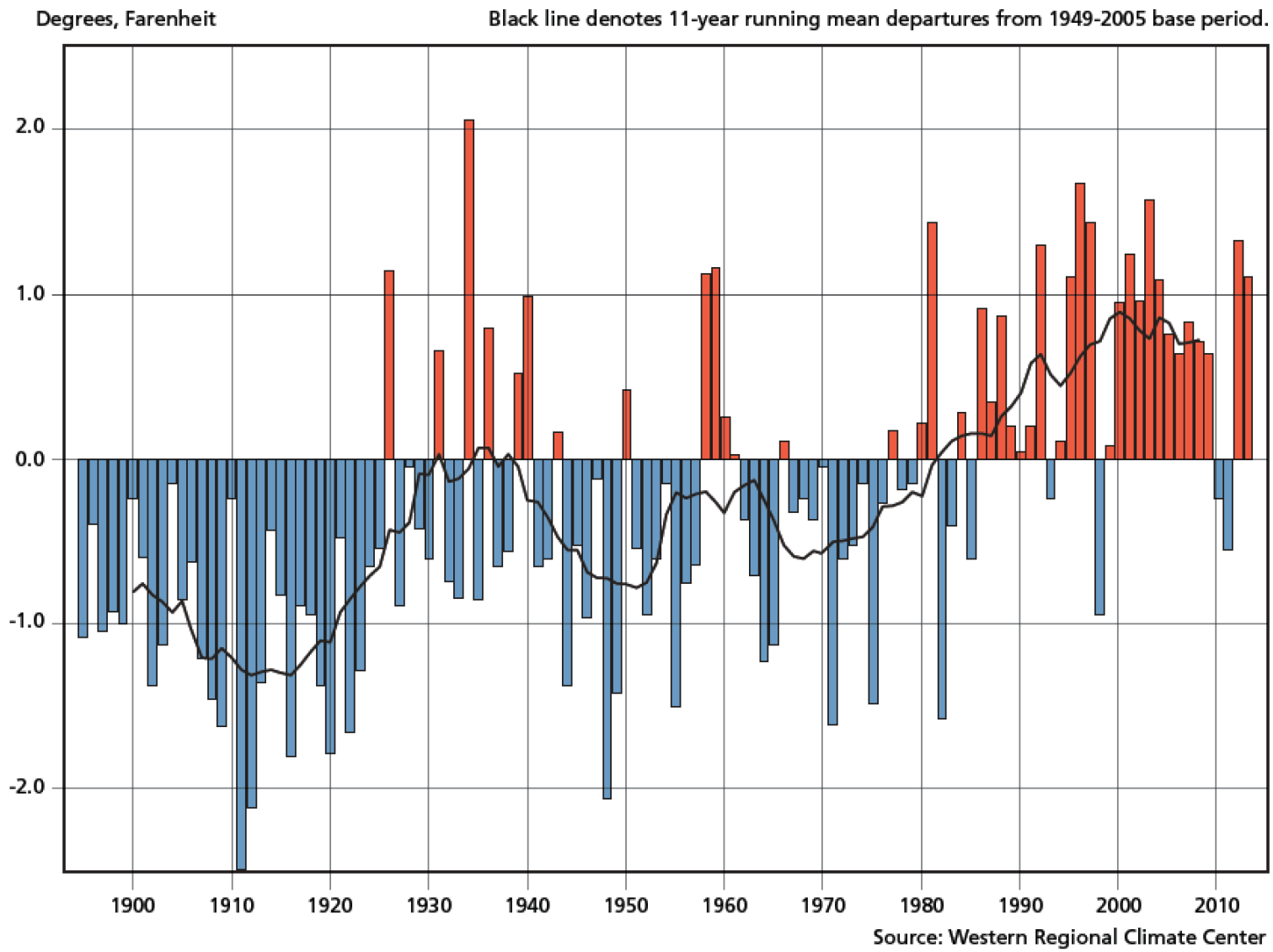
THE CLIMATE IS CHANGING



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From: State of California|California Department of Water Resources, 2015.
California's Most Significant Droughts: Comparing Historical and Recent Conditions.

HOW COULD CC IMPACT WATER QUALITY/QUANTITY?

1. MORE AND LESS WATER
2. HYDROLOGY – TIMING & PEAK OF SNOWMELT/RUNOFF
3. WILDFIRES
4. A LONGER "SUMMER" FOR RESERVOIRS AND LAKES
   - DEAD ZONES IN COLD BOTTOM WATERS
   - INTERNAL NUTRIENTS AND HEAVY METALS RELEASE
   - CHANGES IN ALGAL COMMUNITY – CYANOBACTERIA AND HABs.
   - PATHOGENS

A satellite image from NOAA shows an aerial view of Lake Erie's massive 2011 algae bloom.

PHOTOGRAPH BY NASA/EARTH OBSERVATORY

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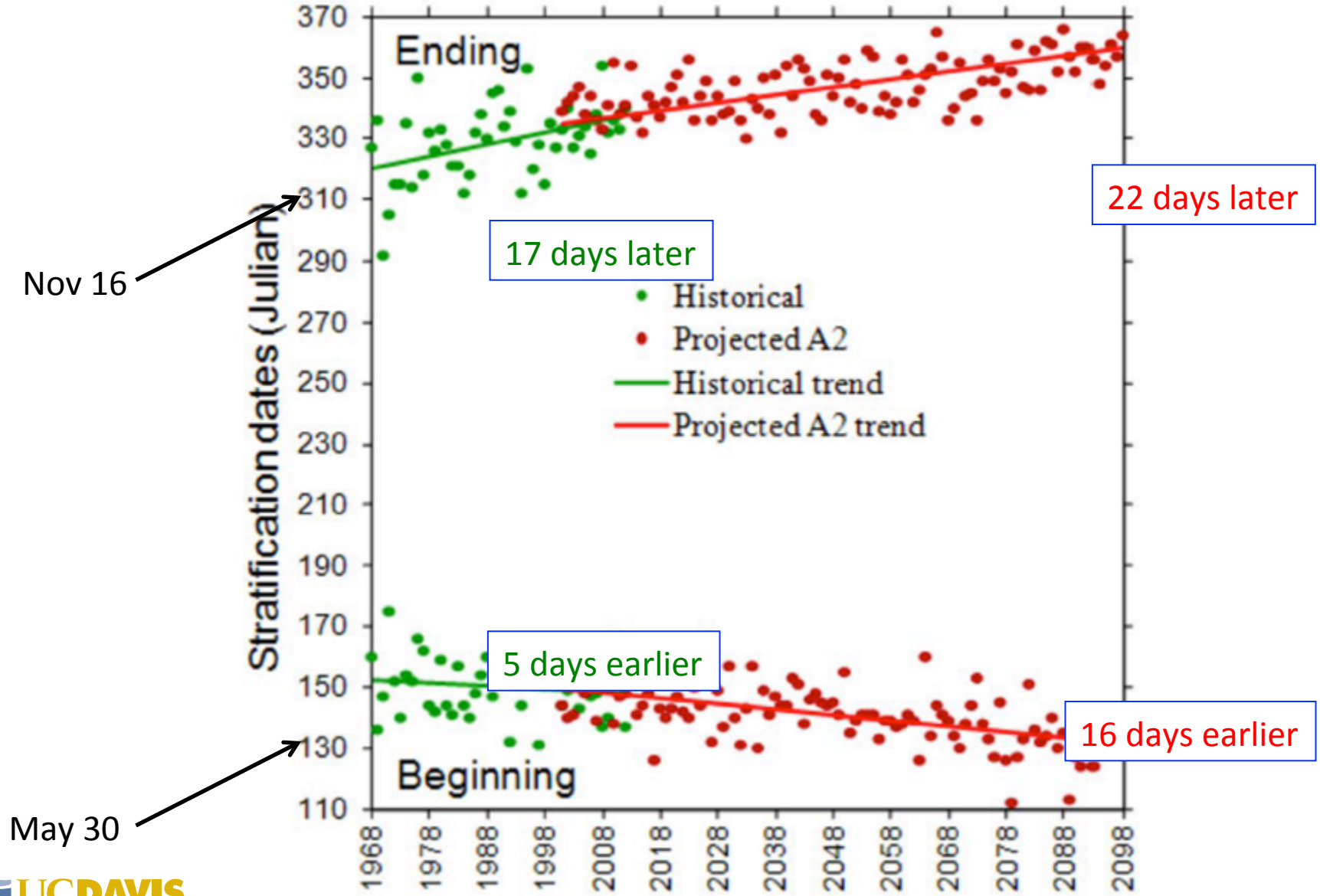
Longer Lake Stability = Longer summer-like conditions



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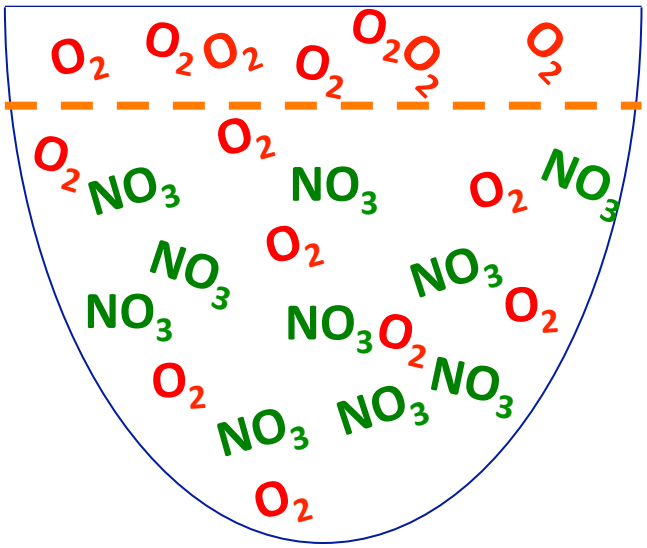
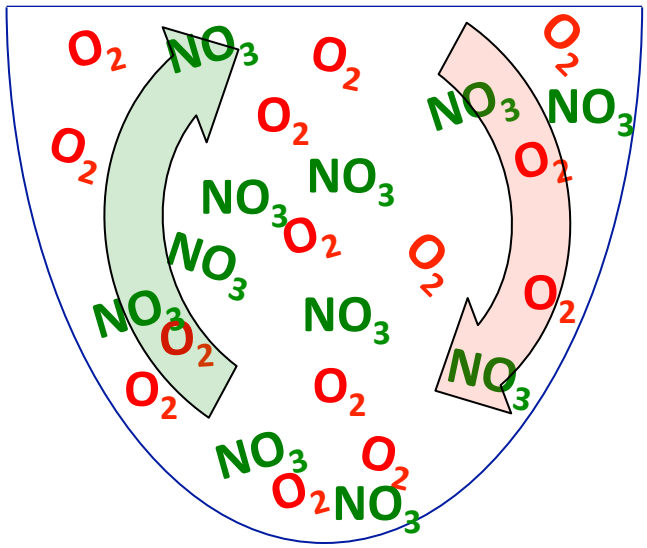
NOW



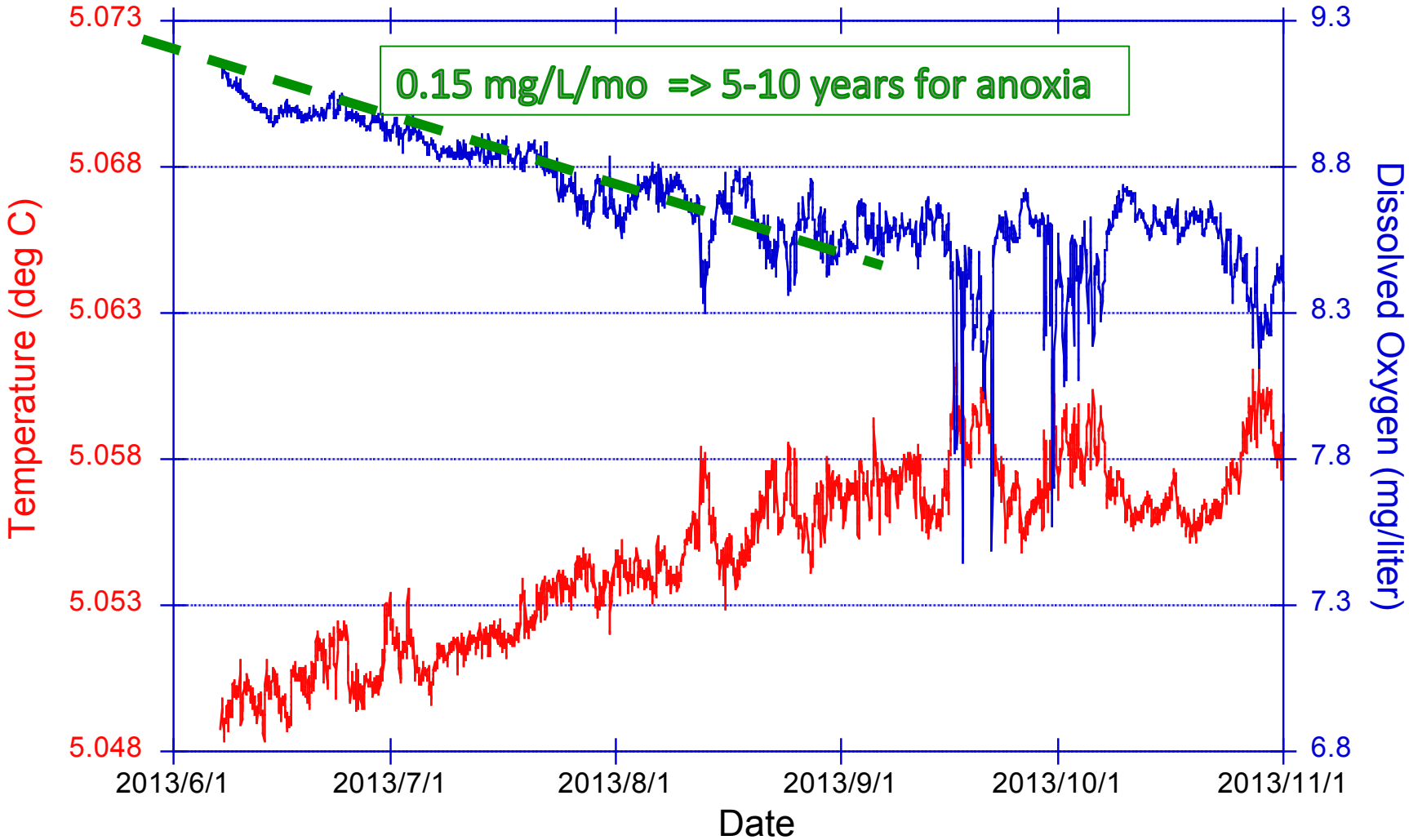
Summer



Winter

We are monitoring declining oxygen at Lake Tahoe

Lake Bottom Conditions



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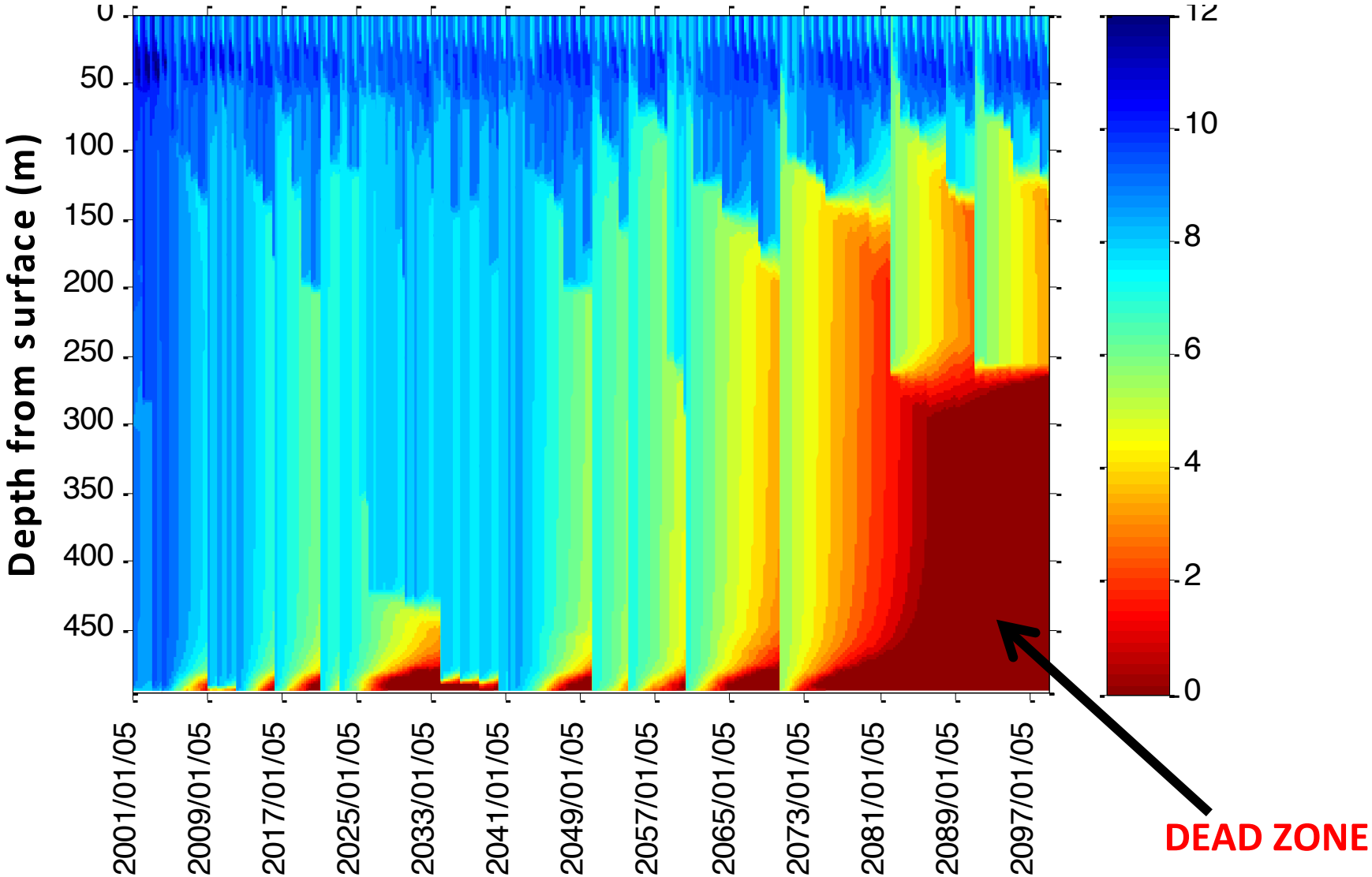
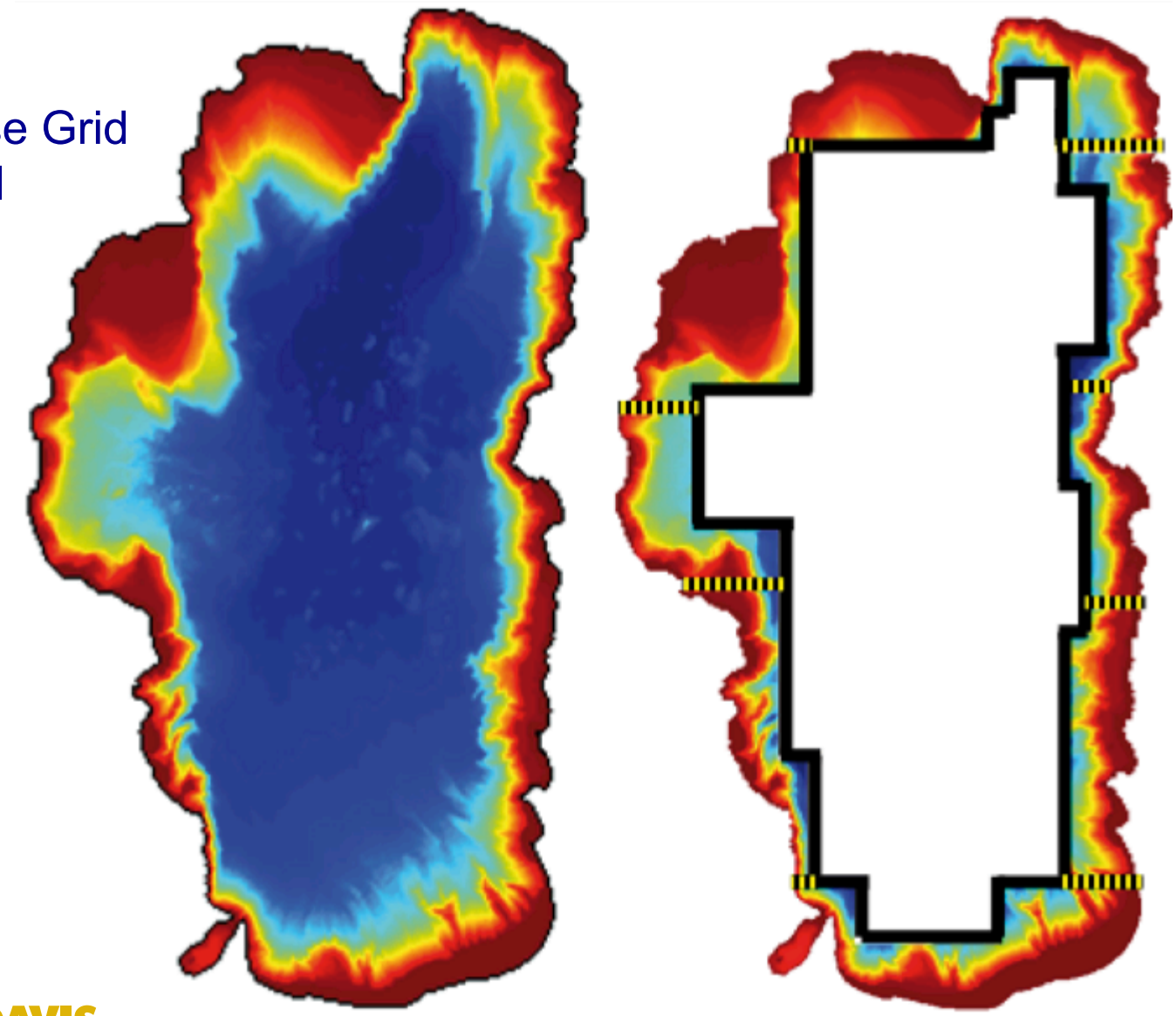
1D model of the future impacts at Lake Tahoe



New 3D models– Nested Grids Solved in Parallel

Coarse Grid Model



Fine Grid Model

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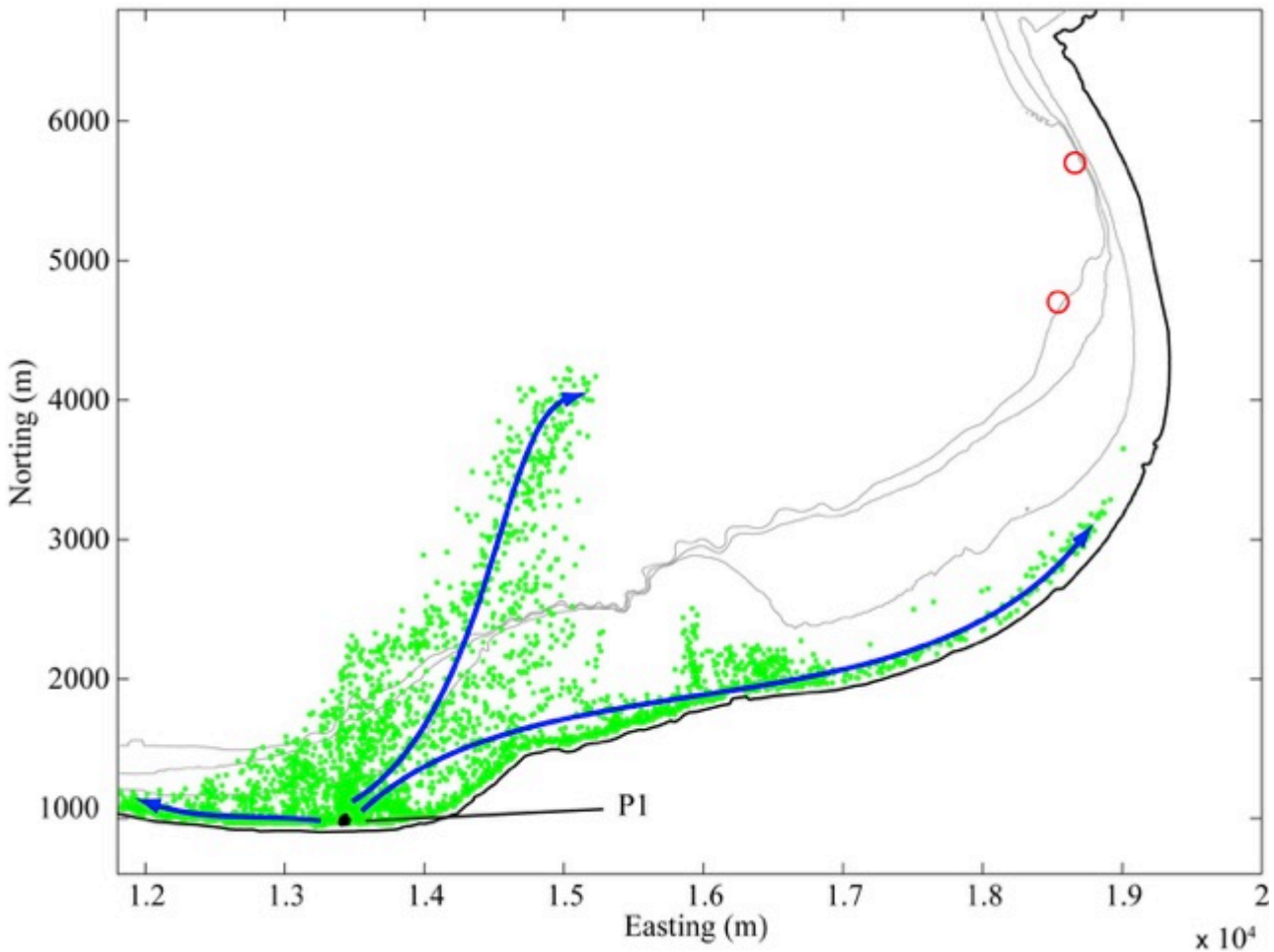
24,000 ‘particles’ released at Tahoe Keys (100/hour every hour for 10 days)

Where did they each travel to in 24 hours?



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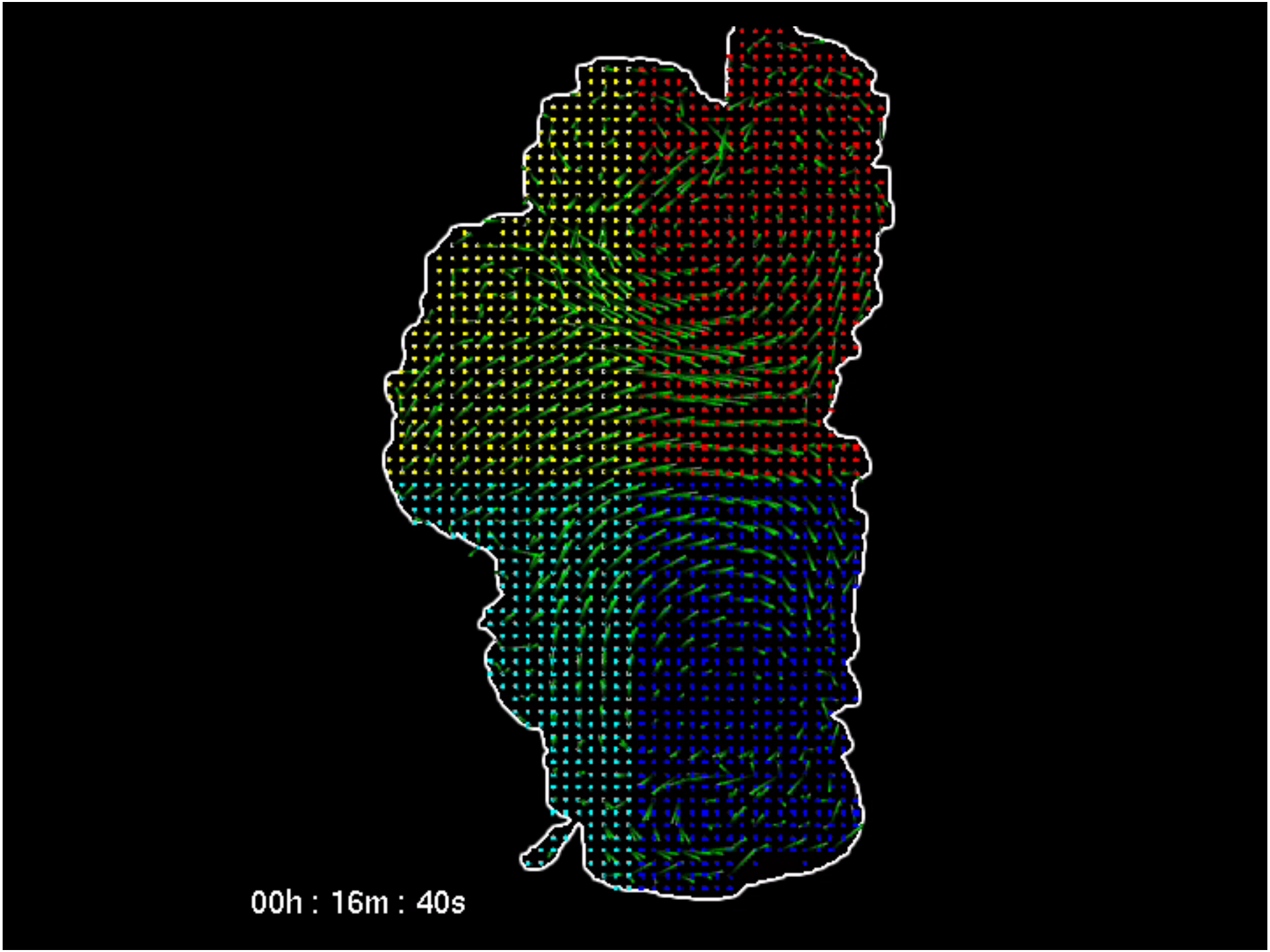
00h : 16m : 40s

IN CONCLUSION

- CLIMATE CHANGE WILL IMPACT CALIFORNIA'S LAKES AND RESERVOIRS
- DISSOLVED OXYGEN, INTERNAL LOADING, HABs and MeHg EMERGING RISKS

- SUGGEST TWO PARALLEL STRATEGIES:
  - MEASUREMENTS - CONTINUOUS TEMPERATURE AND D.O. MONITORING
    - NECESSARY MODEL INPUT VARIABLES
  - MODELING - 1D FOR CURRENT CONDITIONS AND FUTURE CLIMATE
    - 3D AS NECESSARY

- WHERE MODEL RESULTS SUGGEST D.O. IS THE ISSUE:
  - HYPOLIM. OXYGENATION, SELECTIVE WITHDRAWAL, INFLOW CONTROL…..
- WHERE MODEL RESULTS SUGGEST HABs ARE THE ISSUE:
  - 3D MODELING AND NEW ALGAL RESEARCH
- WHERE MODEL RESULTS SUGGEST MeHg ISTHE ISSUE:
  - 1D and 3D MODELING TOOLS ARE AVAILABLE

THANK YOU!

Tahoe Environmental Research Center

Science to Save the Lake

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