

# ***Overview of Water Quality Modeling and CE- QUAL-W2***



# ***What is a Model?***

- **Attempts to make sense of the apparent chaos around us**
- **Organized description of system behavior**



# ***Why Use a Model?***

- **Allows for a deeper understanding of system behavior**
- **Attempt to make management decisions as objective as possible**
- **Allows for a cost effective determination of the impacts of management decisions**



# *Types of Models*

- **Conceptual**
- **Physical**
- **Mathematical**
  - **statistical**
  - **mechanistic**
    - **analytical**
    - **numerical**



# ***Mechanistic Numerical Models***

- **Generally classified based on simplifying assumptions**
  - **steady state**
  - **dynamic**



# ***Dynamic Mechanistic Models***

- **Hydrodynamic/Water Quality**
  - **1D vertical**
  - **1D longitudinal**
  - **2D longitudinal/lateral**
  - **2D longitudinal/vertical**
  - **3D**



# ***Which Model Should be Used?***

- **The model that provides the necessary answers for the least cost**
- **The simplest model necessary to accurately describe system behavior, and no simpler**



# **CE-QUAL-W2**

- **Under continuous development since mid 70's**
- **Originally developed by Edinger and Buchak - LARM**
- **Addition of water quality routines at WES resulted in CE-QUAL-W2 V1.0**
- **V2 resulted in a more accurate and easier to use model**
- **V3 resulted in a more accurate, easier to use, and more widely applicable model**



# ***Capabilities***

- **Hydrodynamic**
  - **computes water surface elevations, horizontal/vertical velocities, and temperature**
  - **multiple waterbodies/ branches with different bottom slopes**
  - **hydraulic structures including weirs, gates, spillways, pipes, and pumps**



# ***Capabilities***

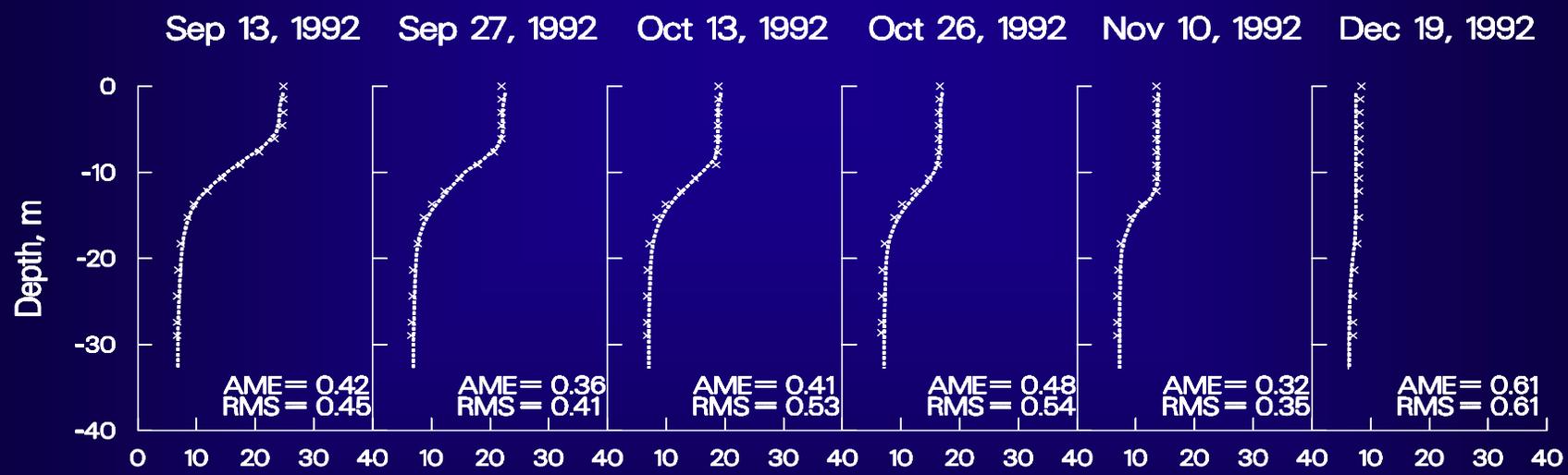
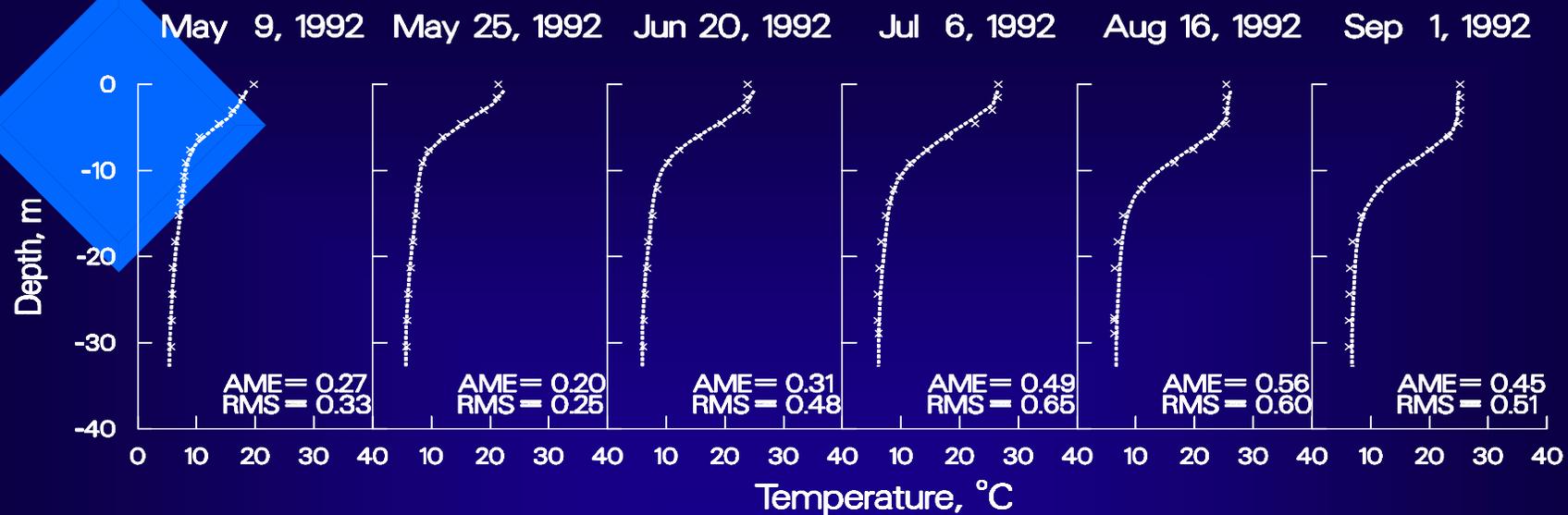
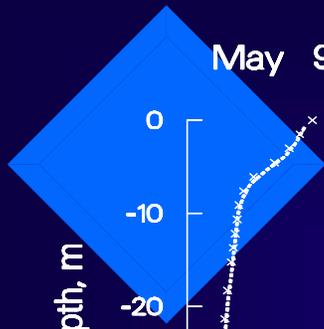
- **Water quality**
  - **Algal/nutrient/DO**
  - **Multiple CBOD groups**



# **CE-QUAL-W2 Usage**

- **2D, longitudinal/vertical hydrodynamic and water quality model of choice for**
  - **USACE**
  - **USGS**
  - **USBR**
  - **USEPA**
  - **TVA**
- **> 400 applications worldwide**
- **> 10 PhD and 50 Master's thesis'**
- **> 150 presentations by numerous researchers**
- **> 15 journal articles**

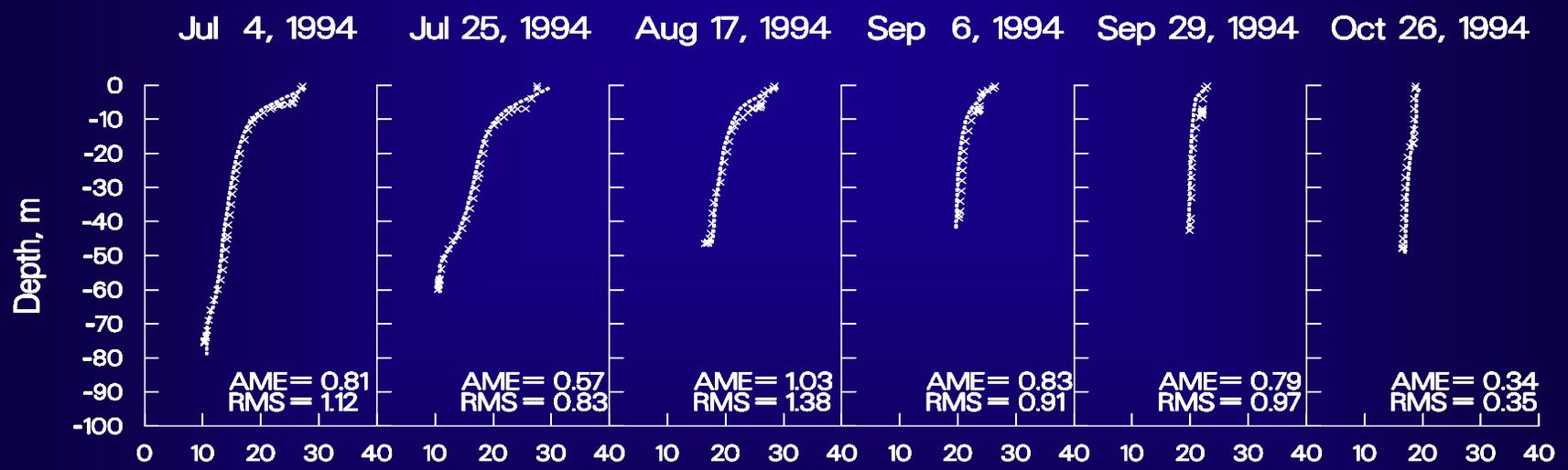
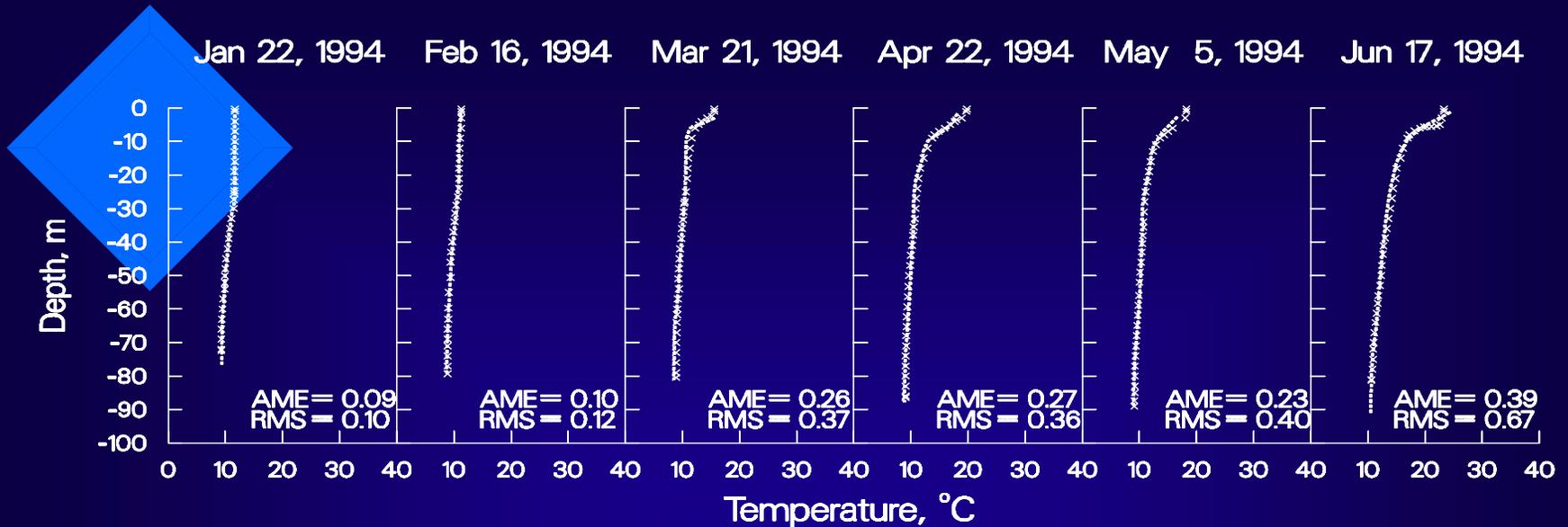




# Paintsville Reservoir

Water Quality and Contaminant Modeling Branch,  
WES

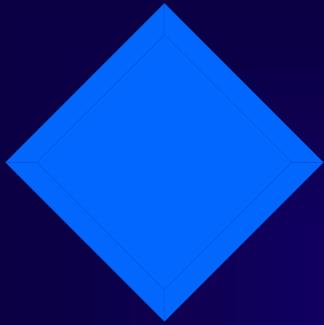




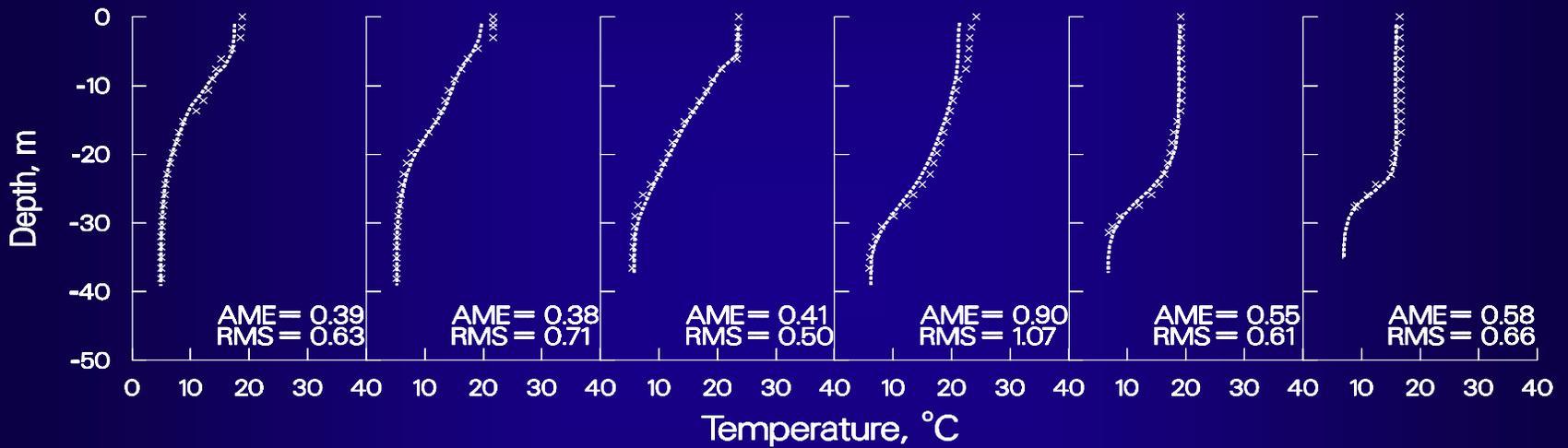
# Pineflat Reservoir

Water Quality and Contaminant Modeling Branch,  
WES





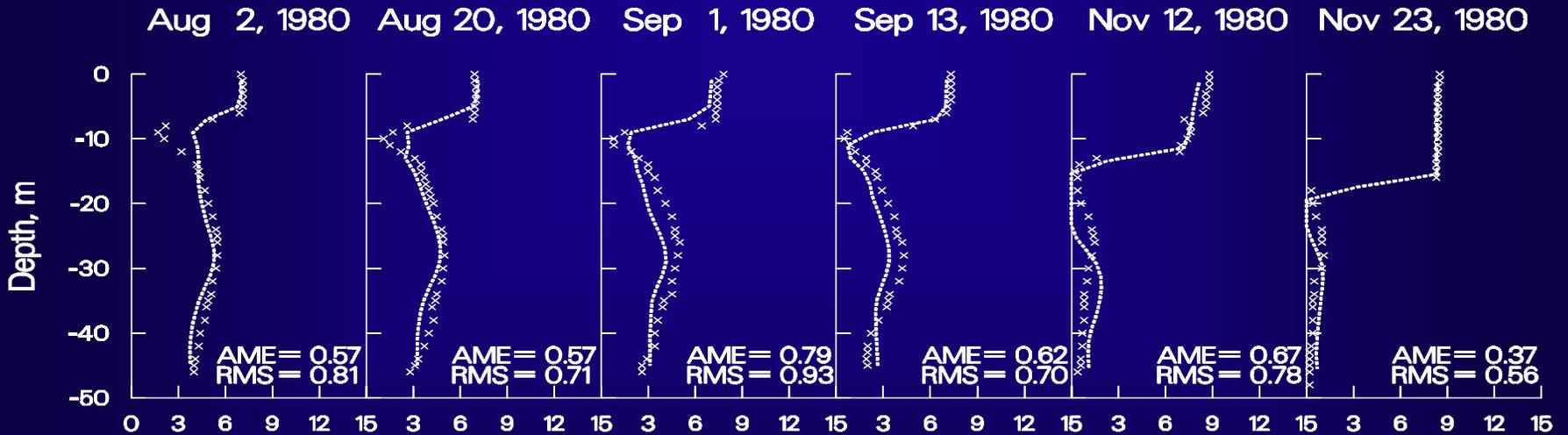
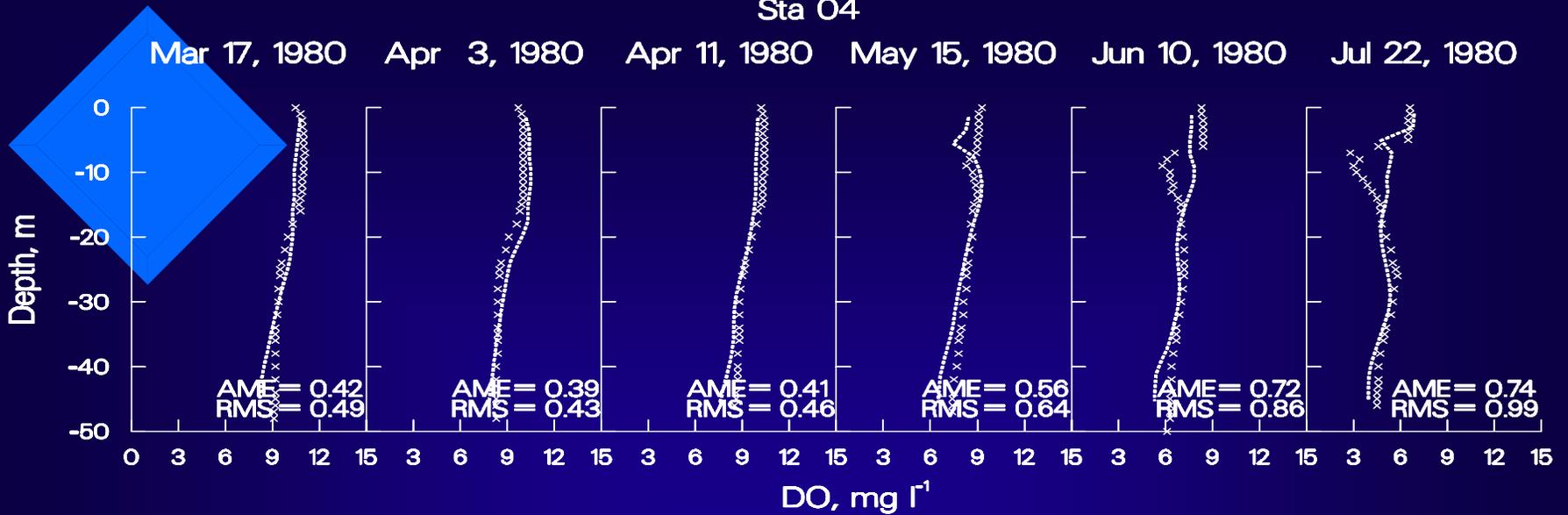
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## Youghiogheny Reservoir

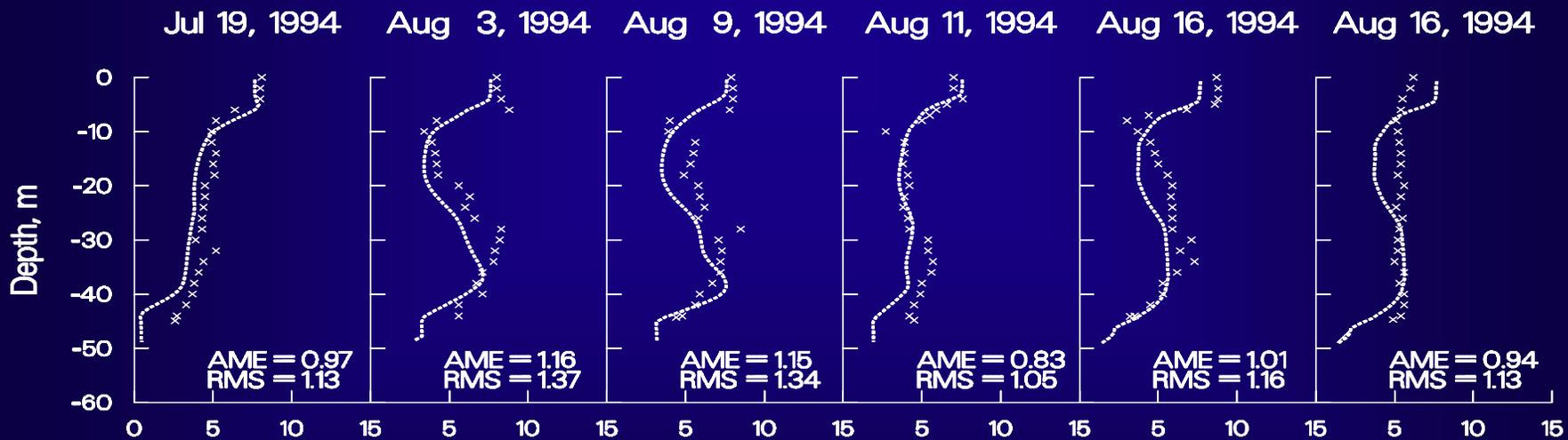
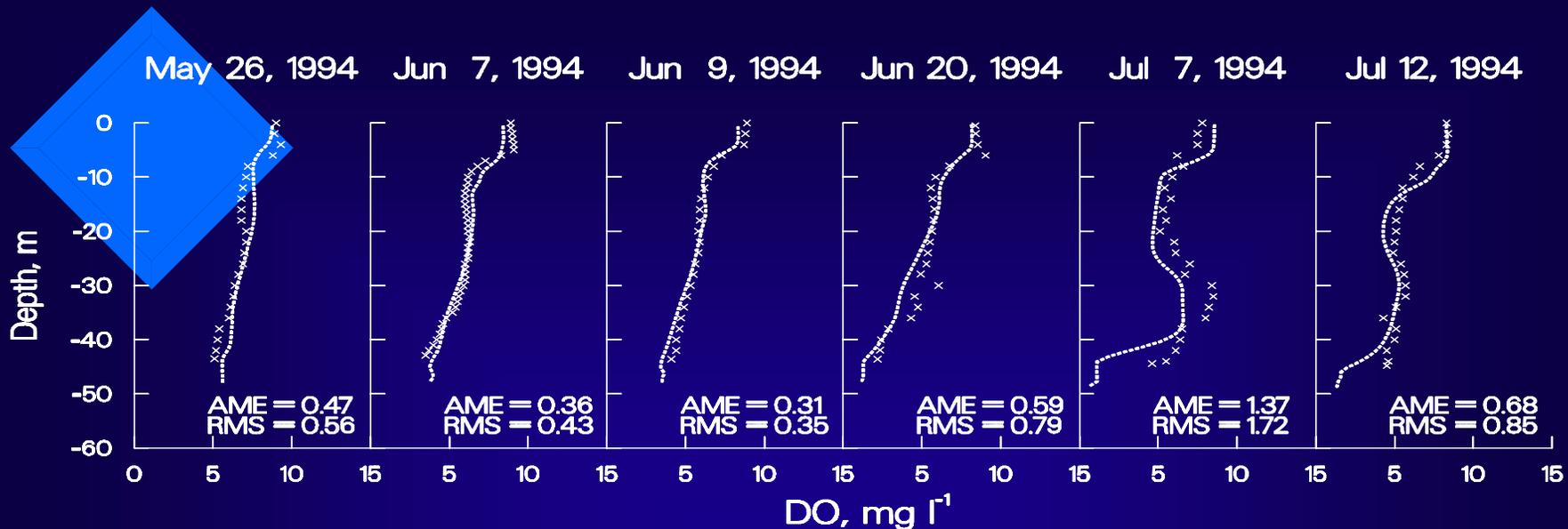


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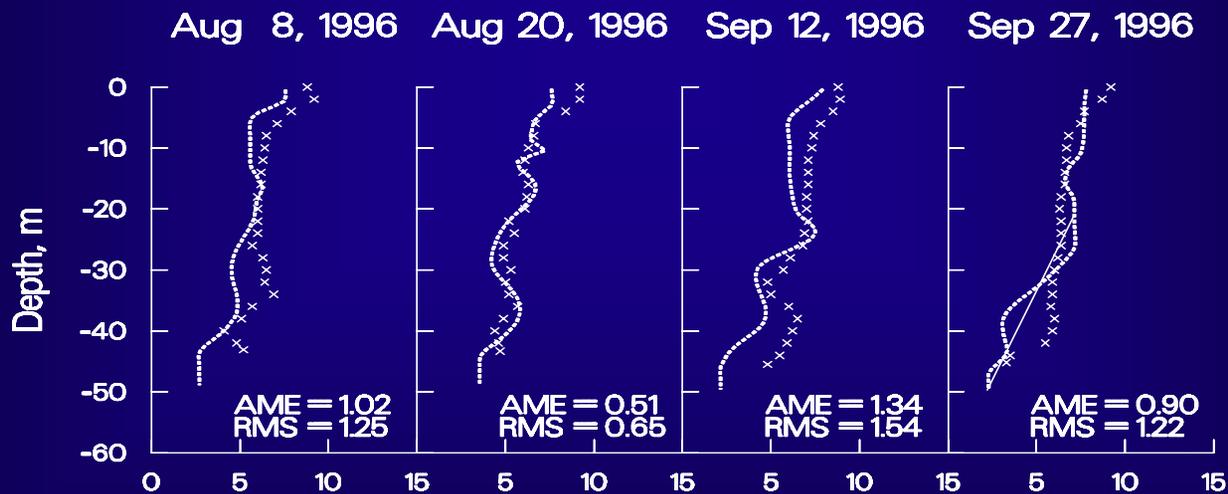
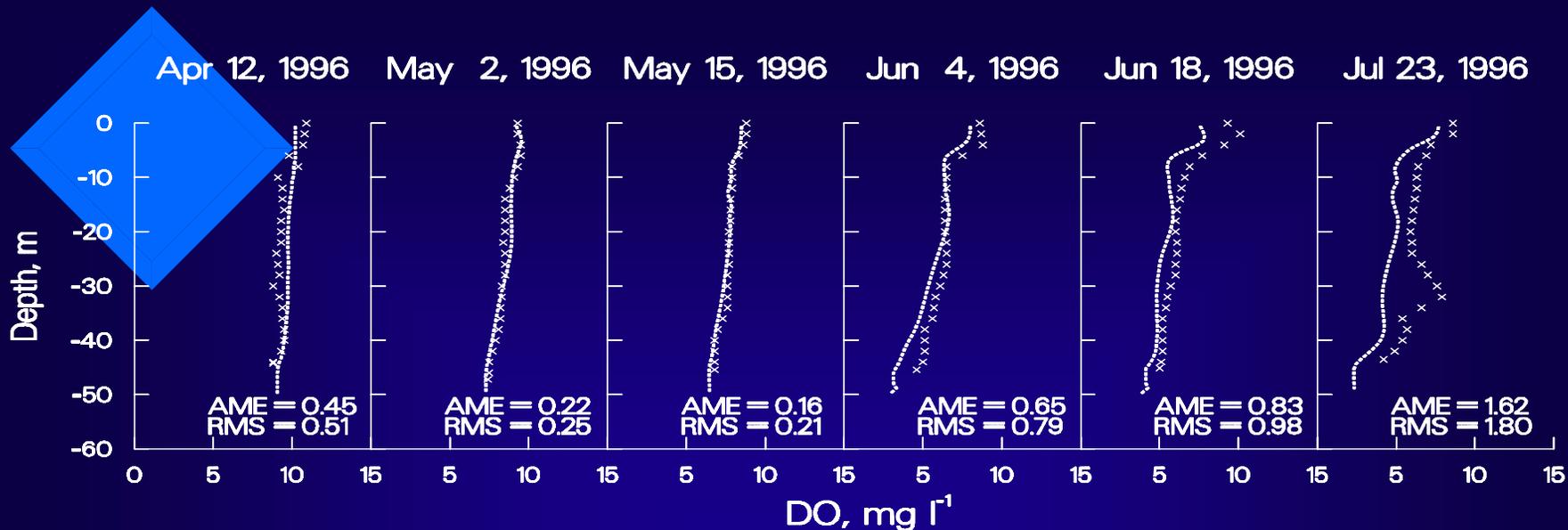
## DeGray Reservoir





## Richard B. Russell Reservoir





## Richard B. Russell Reservoir

