Working Session on Monitoring and Data Assimilation

- Getting started
- Context
- Discussion and products

by David Freyberg, Ph.D

Monitoring and Data Assimilation

- Why?

  Significant developments:

  - Sensor technology
  - Cyberinfrastructure
  - Analytical tools

  Allowing:

  - More parameters
  - High spatial and temporal density of observation
  - Rational integration of observations and predictive models to enhance value

Sensors

- Technological innovation

  For example

  - Micromachining, nanotechnology
  - Acoustics, optics, remote sensing

  Consequences

  - Smaller size, lower cost, higher frequency response, selectivity

- Challenges

  Deployment

  - Remote sensing, mobile, fixed
  - Field readiness, longevity, fouling

  Calibration, self-calibration, QA/QC

  Automation

Cyberinfrastructure

- Hardware and software infrastructure

  Telecommunications

  - Loggers
  - Modems
  - Networks

  Parallel processing

  Data storage and retrieval

  Knowledge systems/knowledge management

  Intelligent agents

  Visualization tools

  Collaboration tools

Analytical Tools

- Theory, algorithms, methods
  - Control theory
  - Estimation theory
  - Deterministic and stochastic optimization
  - Numerical analysis
  - Models
    - Simulation and forecasting
    - Up- and down-scaling

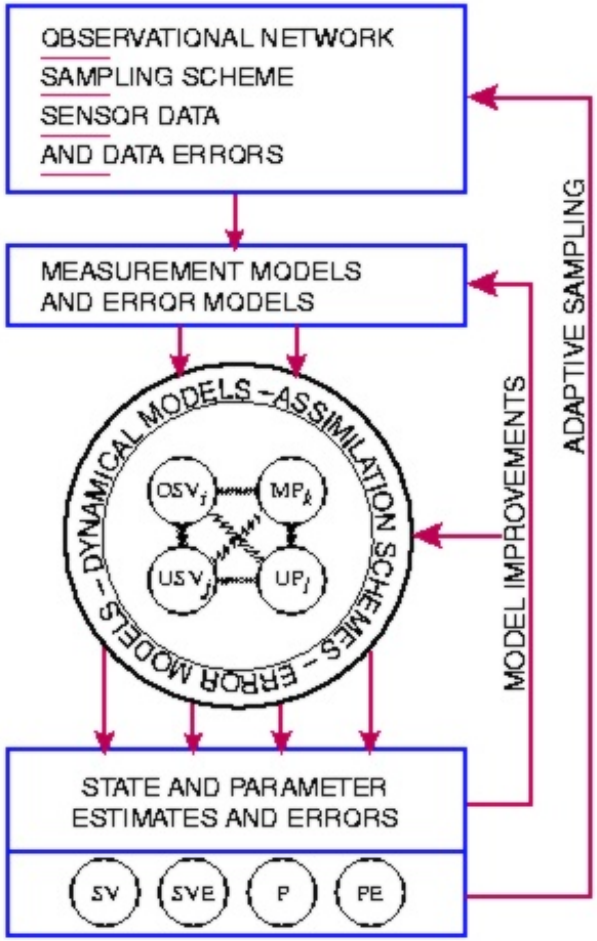
Data Assimilation

- Defined

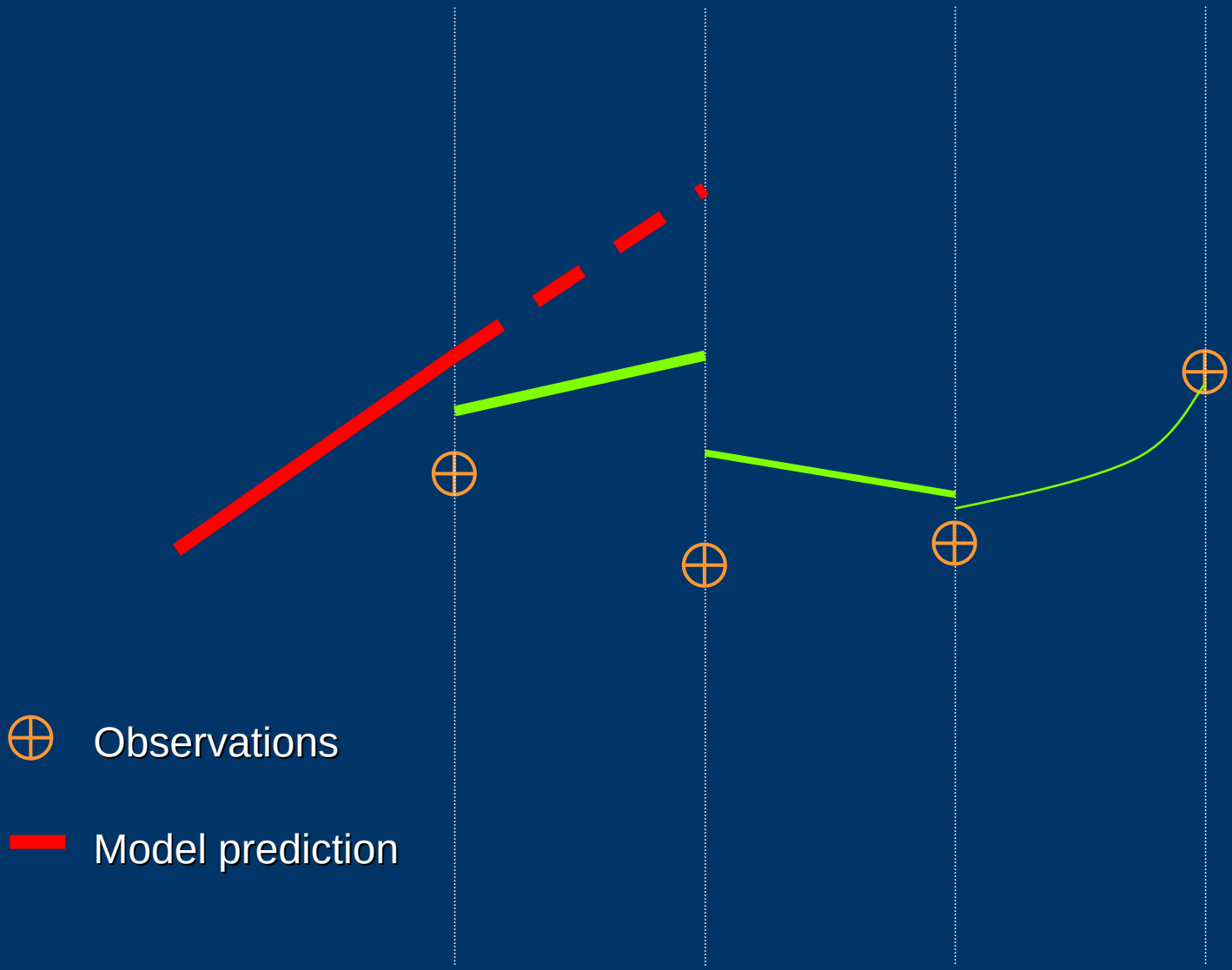
  Optimally combining information from imperfect models and imperfect measurements

  Three components

  - Observations
  - Dynamical model(s)
  - Data assimilation (melding) scheme



http://people.deas.harvard.edu/~robinson/PAPERS/red_report_62.html


Observations
Model prediction

Data Assimilation

- Purposes and benefits

  Prediction/forecasting

  Control loss of predictability

  Adaptive sampling/monitoring/interpolation

  Up- and down-scaling

  Parameter estimation

  Process inference, i.e., better models

  Uncertainty characterization

  Adaptive management

  Better decisions

Data Assimilation

- History
  - Engineering feedback and control
  - Meteorology
  - Oceanography
  - Rapidly expanding to other -ologies

ISB Challenge

- Can we articulate a vision of and a rationale for an investment in monitoring and data assimilation for CALFED?

  What is the added value to CALFED?

- Can we recommend CBDA actions? Can we define the issues facing implementation of M & DA systems? What are the next steps?

- If so:

  2-3 slides for Tom to use in presentation to CBDA Board

  3-5 page document fleshing out slides

Strategy

- Very brief overview (*Freyberg, ISB*)
- Context

  To keep things concrete—South Delta Barriers Program (*Mount, ISB*)

  Inter-agency Real Time Data and Forecasting (*Rob DuVall, Municipal Water Quality Investigations Program, DWR*)

  Broader California perspective (*Rich Losee, Water Quality Lab, Metropolitan Water District of Southern California*)

  Even broader perspective (*Peter Goodwin, ISB*)
- ISB discussion