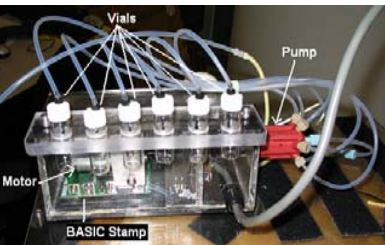
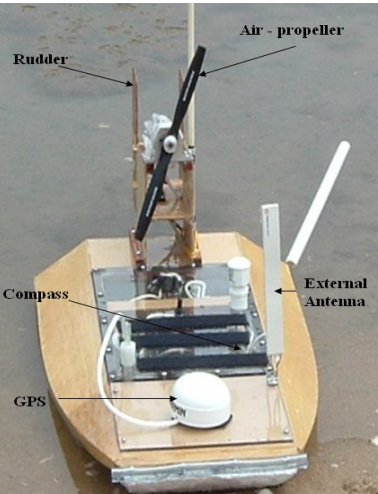
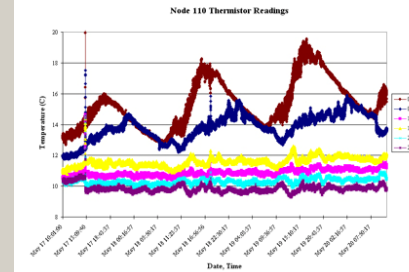
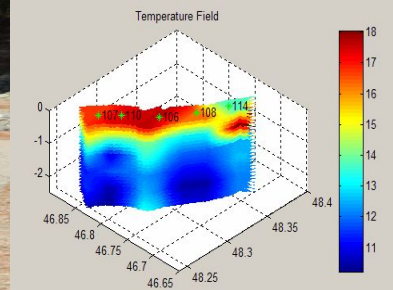
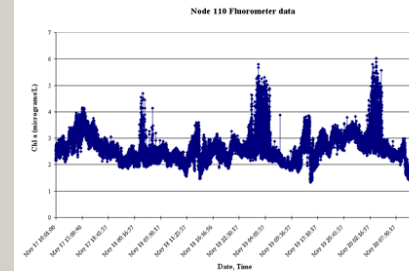
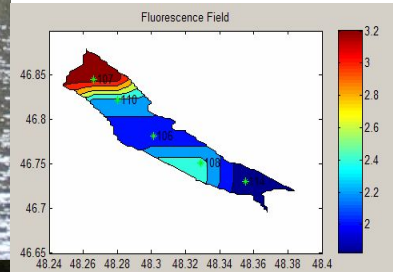


A Generic Multi-scale Modeling Framework for Reactive Observing Systems

Focus on observing systems which are (a) *embedded* into environment, (b) include *stationary and mobile* sensors, and (c) *react* to collected observations by reconfiguring the system and adapting which observations to collect next.



Networked Aquatic Microbial Observing Systems (NAMOS)

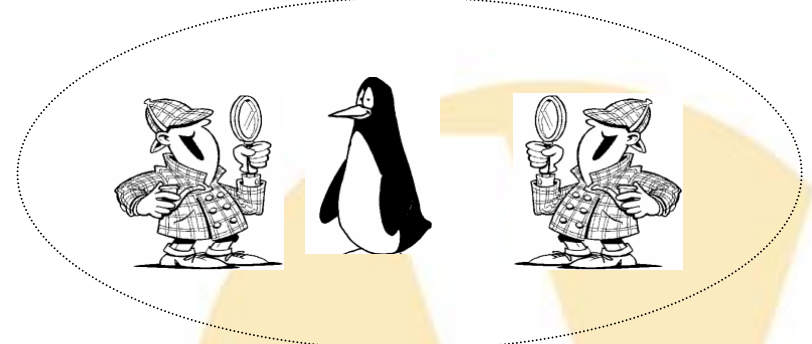
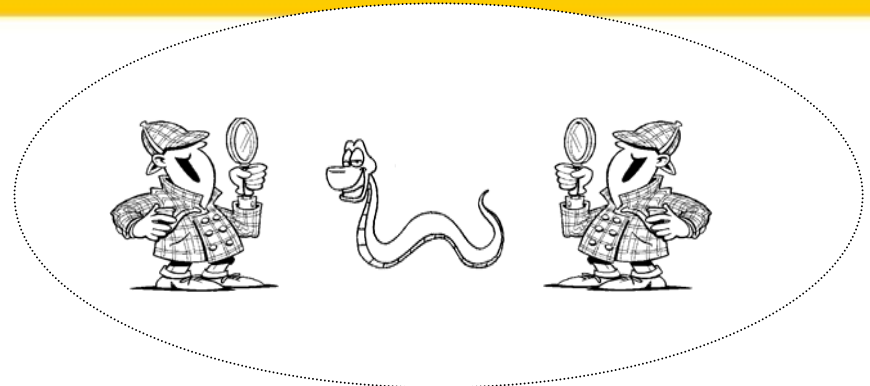


10 Static floating buoys and a robot boat (deployment in Lake Fulmor CA)

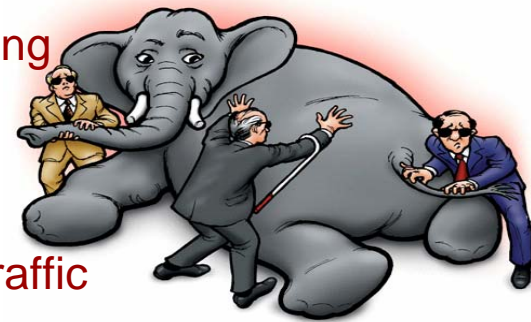
Datasets: spatial patterns of chlorophyll and temperature and some unexpected fluctuations

Similarity Tessellations

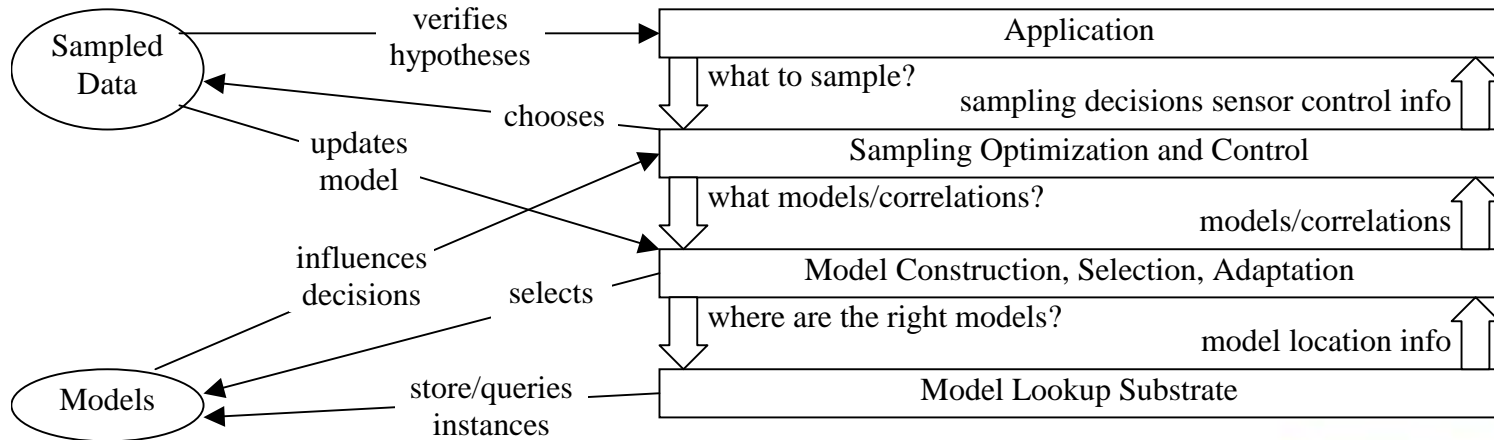
- **An example problem:**
 - Spatially “*tessellate*” the buoys into sets such that within each set, all buoys observe the “*same*” phenomenon
- **What is this useful for?**
 - Characterizing event(s) observed by the sensor network
 - Planning how to re-deploy sensing resources, or where to add redundancy
 - Detecting outliers (or faulty observations/sensors)



- **Challenge- gathering information**
 - In the absence of a priori models/ signatures, detecting “similarity” is non-trivial
 - Individual sensors (buoys) may not be able to detect/characterize a phenomena
 - Infer concise models empirically to reduce network traffic
 - Our initial approach:
 - define similarity based on statistical models of sensed data where nodes exchange statistical models
- **Challenge- Adaptation**
 - Adapt spatial sampling density to achieve desired fidelity using available sensors
 - Adapt sampling frequency at individual sensors to utilize available bandwidth efficiently
- **Challenge- Tessellation**
 - Efficient distributed algorithm to compute the tessellation
 - Efficient distributed clustering of data into similarity groups



AMBROSia: Autonomous Model-Based Reactive Observing Systems



➤ Main research thrusts:

- Model development and validation
- Algorithms and system development for measurements optimization and control
- Systems design and protocol development

➤ Team:

- D. Caron (marine biology)
- L. Golubchik (systems modeling & analysis)
- R. Govindan (network routing & sensor networks)
- D. Kempe (optimization algorithms)
- G. Sukhatme (distributed robotics & mobile sensors)

➤ Vision:

- AMBROSia will aid scientific research by facilitating observation, detection, and tracking of scientific phenomena that were previously only partially (or not at all) observable and/or understood.