Integration of routine and high-frequency data to improve 3-D water quality model predictions

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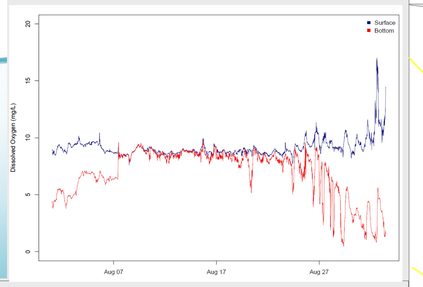
Water Quality (WQ) issues of algal blooms and hypoxia are being managed using nutrient control and artificial oxygenation, supported by modelling scenarios.

Gaps : WQ monitoring data are sparse and good for long-term trend analysis, but finer scale information on biogeochemical processes and event dynamics is needed.

? How can we integrate high-frequency sensor data with our numerical model to better quantify the estuary metabolism and its controls? ?

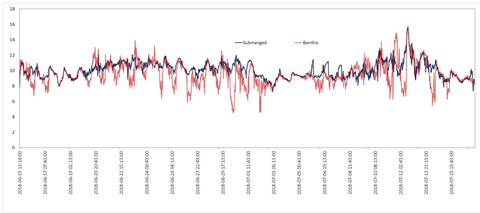
3 Data Driven Model Inputs

High frequency O_2 sensor data



Estuary metabolism

Raw data analysis



Inverse approach gives metabolism, using data-driven based models.

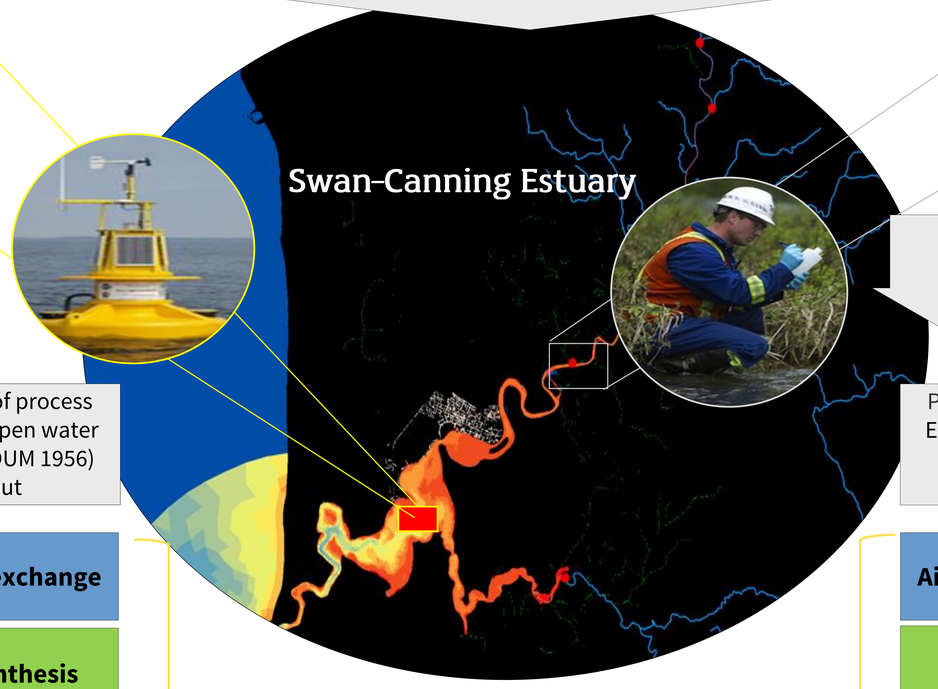
Extraction of process rates from open water method (ODUM 1956) output

Air-water exchange

Photosynthesis

Respiration

Sediment flux



Model – sensor integration

Can we constrain the numerical model's process rate predictions using the data-derived oxygen flux calculations?

Estuary metabolism

Process assessment: Extraction of process rates from AED2

Air-water exchange

Photosynthesis

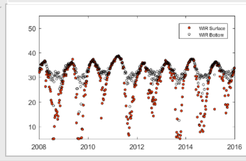
Respiration

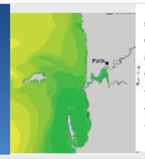
Sediment flux

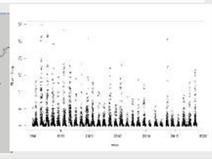
Advection & mixing

2 Mechanistic Model Inputs

Routine WQ monitoring	Weather data	Tidal data	Inflow data



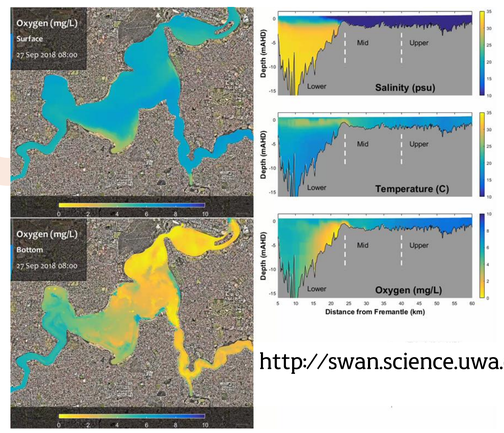




Swan-Canning Estuary Response Model-SCERM

TUFLOW AED

Condition assessment : Comparison with monitoring data



http://swan.science.uwa.edu.au

Swan-Canning Estuary Virtual Observatory SCEVO

Monthly Hindcast

- Monthly weather, tide, and catchment monitoring data
- Aquatic Real Time Management System (ARMS)
- Data Management and Model Simulation
- Visualisation
- Process-inspired Validation update

Daily Forecast

- Coastal and met forcing
- Inflow rates & nutrient levels from Machine Learning predictions
- Aquatic Real Time Management System (ARMS)
- Data Management and Model Simulation
- Visualisation

Automation

My research aims to answer these questions:

- How does dissolved oxygen change across an estuary across space and time?
- What implications does the oxygen metabolism have for net ecosystem metabolism and for estuary condition?
- How do we use high frequency sensor data with the numerical model to better quantify estuary metabolism and its controls?
- How does advection affect estuary metabolism ? (the model incorporates advection therefore will be used as a numerical laboratory)

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