Applying AUVs to routine offshore Water Quality Monitoring in Southern California

By

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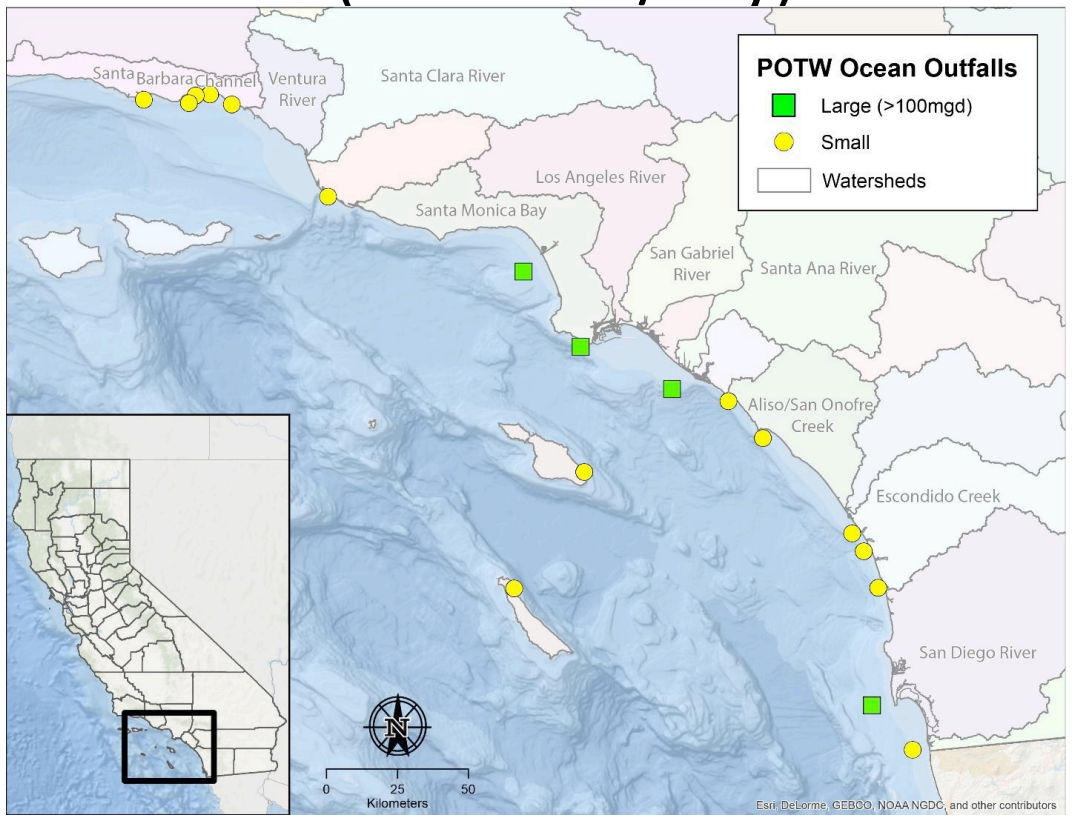
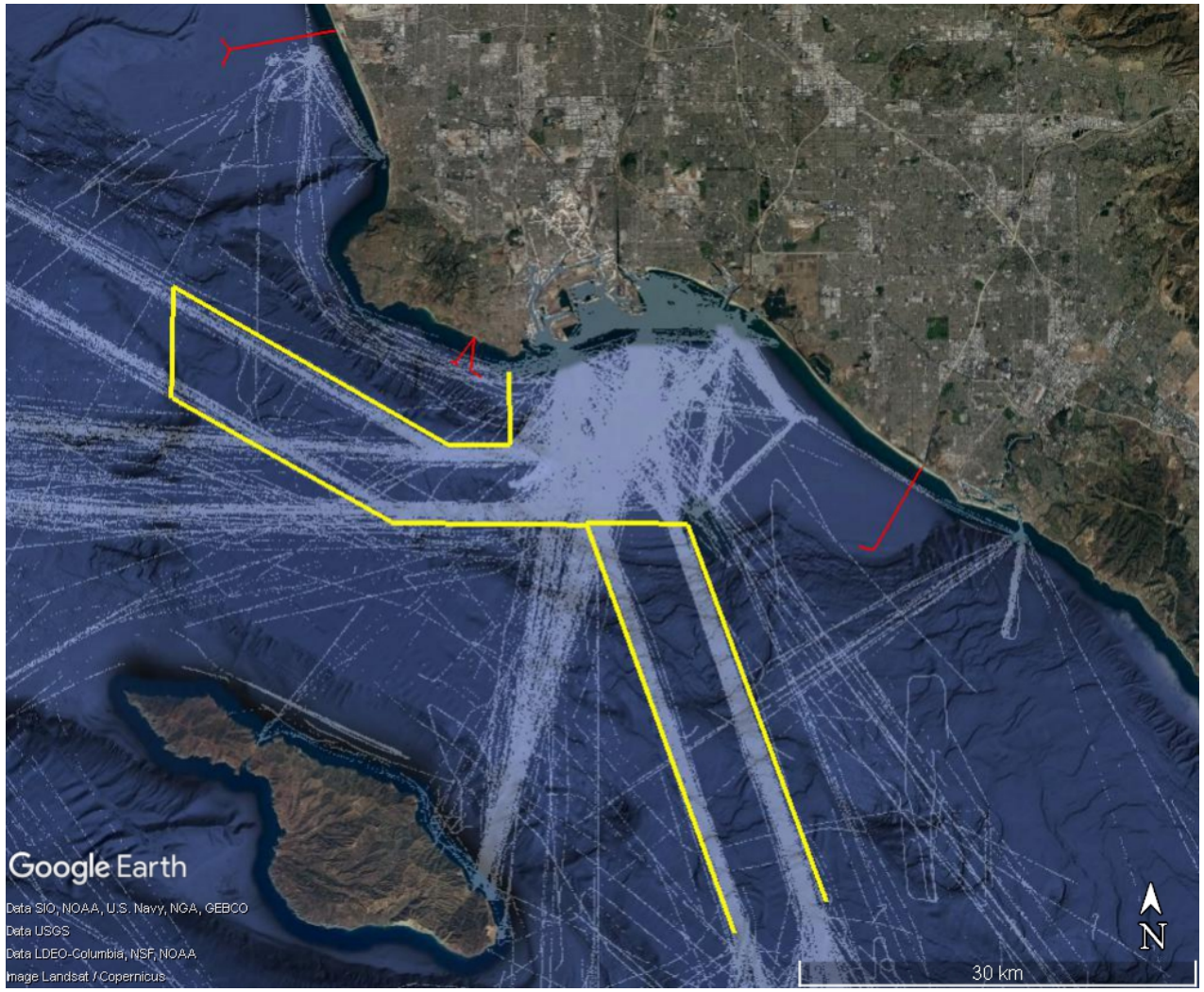
Southern California

- > 21 million people
- 4 major POTW discharge + others: > 800 MGD ($3.0X10^9$ L/day)
- Current regulations
  - no harm to organisms near plume
- Grid-based WQ monitoring
  - CTD casts
  - Niskin bottles for water samples
- Applying AUVs
  - Couple of case studies



Complications: Commercial Ship Traffic



Case Study 1

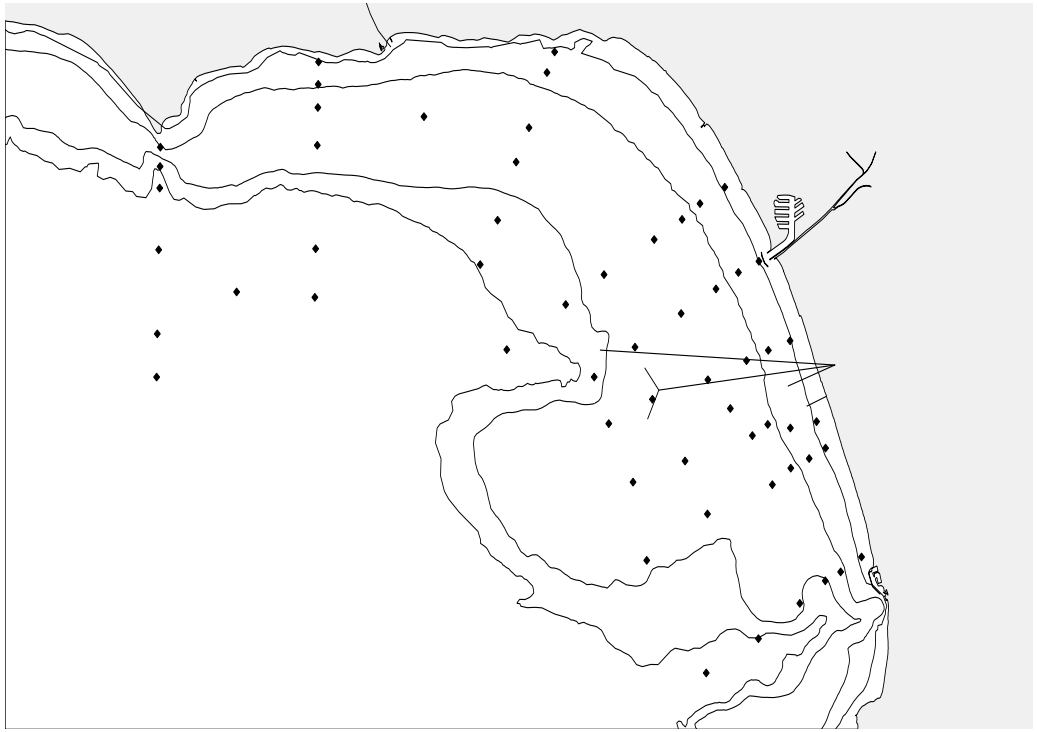
- Research effort: Health effects related to sewage pipe maintenance
  - 3 wk diversion: $5.3X10^8$ L/day from a 7 Km ocean outfall to a 1.6 Km pipe
  - Slocum Gliders, CTD/boat sampling, wave rider, wire walkers, moored ESP, etc
  - Involved multiple organizations and universities

What did we learn from Case 1

- No observed ocean effects from the short-term change
- Glider data
  - localized upwelling related to HABs toxin (Pseudo-nitzschia)
- Operationally, needed multiply gliders to complete study
- 24 hour monitoring was required
- Dropped scheduled communications

Case Study 2

2) Replicating a monitoring grid for a regulated sewage discharge
   - City of Los Angeles discharges $13.2X10^8$ L/day from a 8 Km ocean outfall
   - Monitoring grid area about 400 Km^2, depths range 9 – 750m

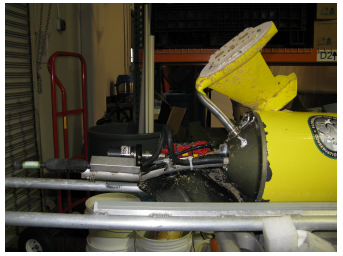


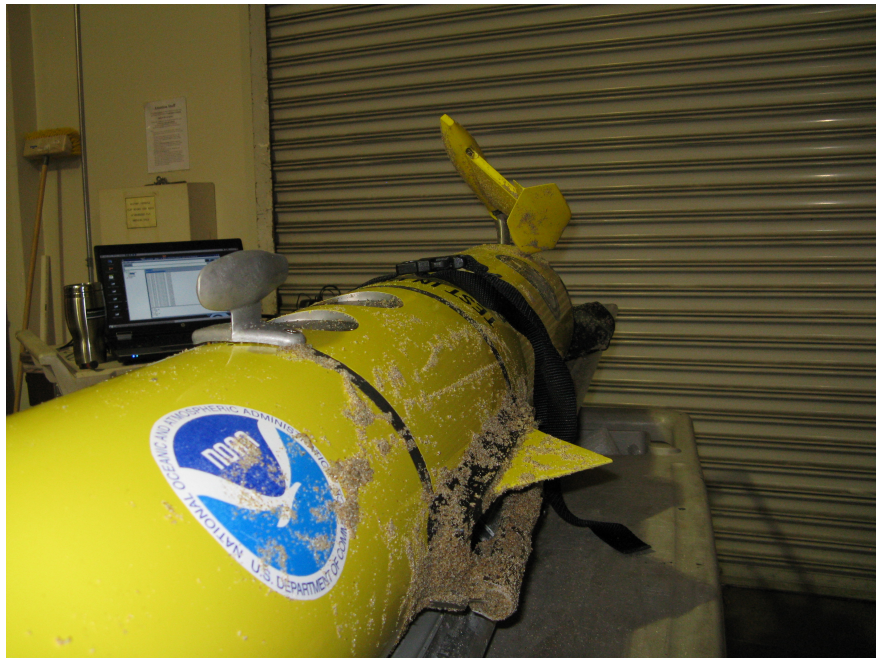
What did we learn from Case 2

- The monitoring boat took 3 days to complete the grid
- Glider took 15 days to traverse 54 of 58 waypoints
- Operationally, shallow depths were problematic
  - Glider programmed to avoid ship drafts
  - Tidal forces and wind currents
- Kelp will entangle a Glider

Are Liability Issues Warranted

- Observations over numerous deployments
  - Recreational boats have hit gliders and a Wave Rider
  - Commercial fisherman have pickup gliders for concern or reward
  - Good Samaritans
  - Optical sensor damage
  - Nearly lost a glider
  - Ballast pump failure nearshore
  - Reliability a concern





AUVs Operations Add to Monitoring Cost

- NPDES permits require Water Quality (WQ) monitoring at depth
  - Gliders can’t take discrete water samples
  - Available optical sensors do not meet all the WQ requirements
- Maintenance costs include ballasting, sensor calibration, factory repair, telemetry
- 24 hour monitoring: many problems occur nights, weekends, holidays
  - Experienced people were needed to handling emergencies
  - Potential overtime for personnel
- Agency personnel have limited budgets and data processing expertise
  - need user friendly, simplified, turnkey software

Applying Gliders to Regulatory Agencies

- Use it as a specialty tool
  - Plume tracking with CDOM measurements
  - Future uses: HABs and ocean acidification monitoring
- Glider data was superior to agency CTD monitoring data
  - The challenge is to filter out the details for simplify graphics
- Agencies see multi-day deployments as useful
  - The challenge is distinguishing old and new plume