Physical Processes

Processes that impact temporal and spatial variability of upper/lower boundary layer stratification at O(1-10 km, hours-days) scales.

meso/submesoscale processes → surface/bottom mixed layer structure → acoustic propagation/sonar performance

- Kuroshio variability and intrusion onto shelf/slope system

- Mesoscale/submesoscale eddies and filaments

- Cold dome NE of Taiwan Shelf break front

- Nonlinear internal waves

- Internal tide, near-inertial internal waves, Kuroshio impacts

- Canyon effects

- Shelf waves

- Local wind forcing

- Taiwan Strait current

Kuroshio impacts meso/submeso-scale variability, shelf/slope stratification and internal wave generation/evolution- proximity to the boundary current likely plays a defining role in acoustic propagation and sonar performance.

Physical Process Observing Assets and Proposed Tasking

Extended Observing (May – Sep 2009)

- Kuroshio drifter releases south of Ilan Ridge. Kuroshio pathways and intrusions. (2/week (?), started April 2008, extends through Sep 2009).

- 3 + 3(Mar09?) moorings with 75 kHz ADCP and T-C chain, ~600 m depth, in the canyons and over slope. Internal waves, canyon effects, Kuroshio intrusions, Cold Dome origins. Aug – Sep 2009.

- 2 NTU bottom-mounted 300 kHz ADCPs. Internal waves and circulation over shelf, inside Acoustic Observations Area.

- 4 Seagliders. Kuroshio structure and variability: (1) Upstream (N side of Ilan Ridge) and (2) Offshore of the Acoustic Observations Area. Jun – Sep 2009.

- Existing tide gauges across Taiwan Strait. Real time from Central Weather Bureau. http://www.cwb.gov.tw.
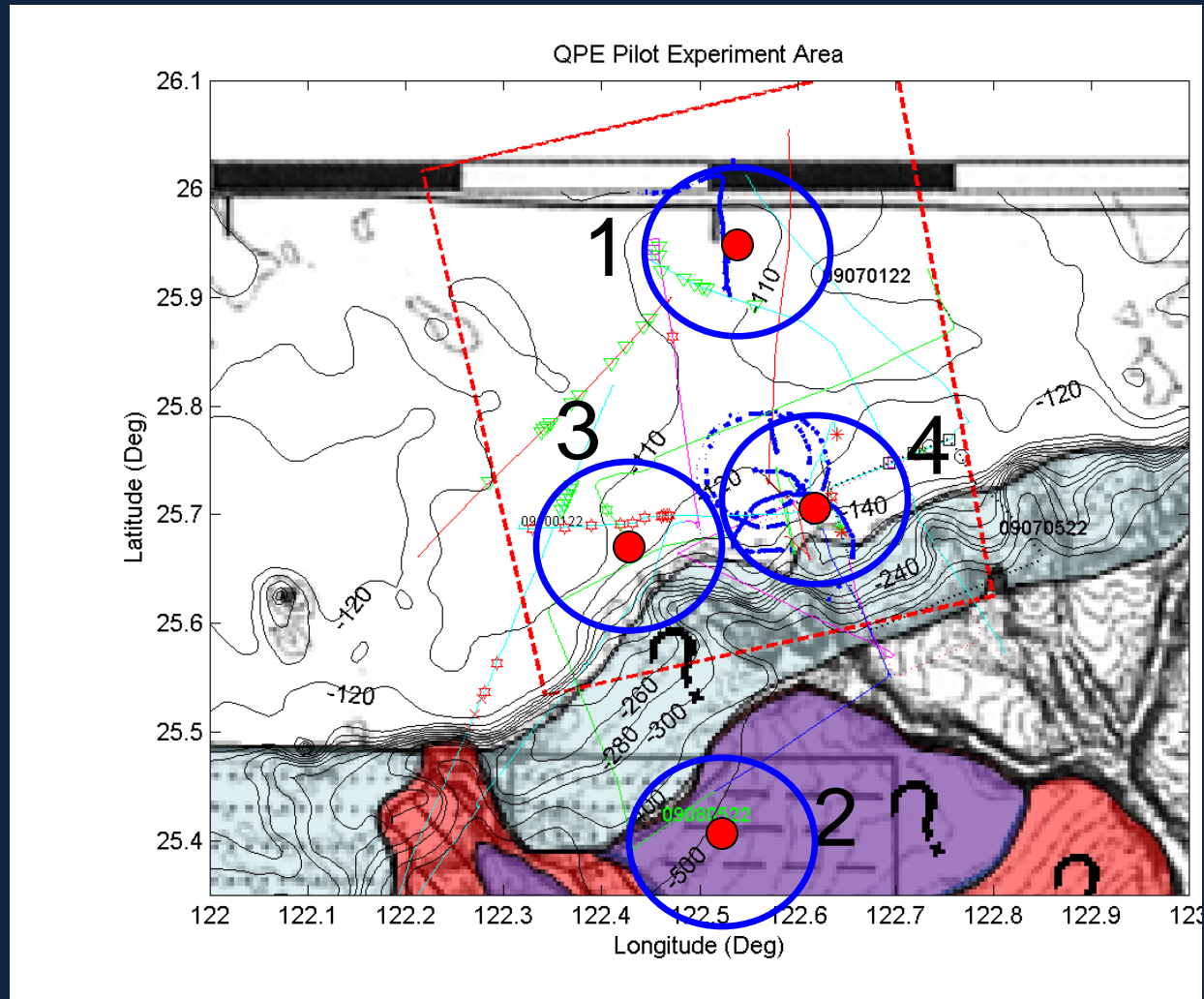
Intensive Observing (Aug – Sep 2009)

- OR1 (20d), OR2 (15d), OR3 (10d), R/V Melville.

- SeaSoar surveys of mesoscale variability in and around the Acoustic Observations Area.

- 5 restrained drifters with ADCP and T-chain. To be used for short deployments, could be relocated by ships during IOP.

- 4 EM-APEX floats. 2 in canyons, 2 over shelf and slope. Will likely need recovery and redeployment.

- 48 SVP drifters. Groups of 12 released in '+' patterns. One deployment per week.

- 28(?) SVP w/ARGOS (saved from weekly deployments)- use for initialization.

- 2 bottom-mounted 300 kHz ADCPs over shelf, at corners of Acoustic Observations Area (part of Acoustics effort). Also 4 T-C/T moorings.

- Glider missions could be tailored toward specific IOP goals.

Acoustic Measurement Locations
(*Strawman*)

Notes:

- Ordered in perceived complexity
- Prefer 1-4-2
- All sites strongly bottom interacting
- Present position of site 2 requires new SHRU case (a few $k)
- Sites 3 and 4 may be roughly equal in complexity
- Measurements should be done spring/neap tides to look at impact of ocean dynamics
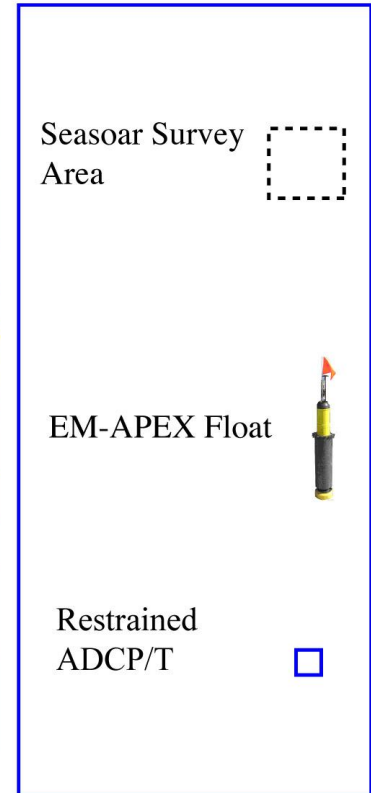- Measurements should be done day/night (esp Sites 3,4) to examine impact of fish/bubbles
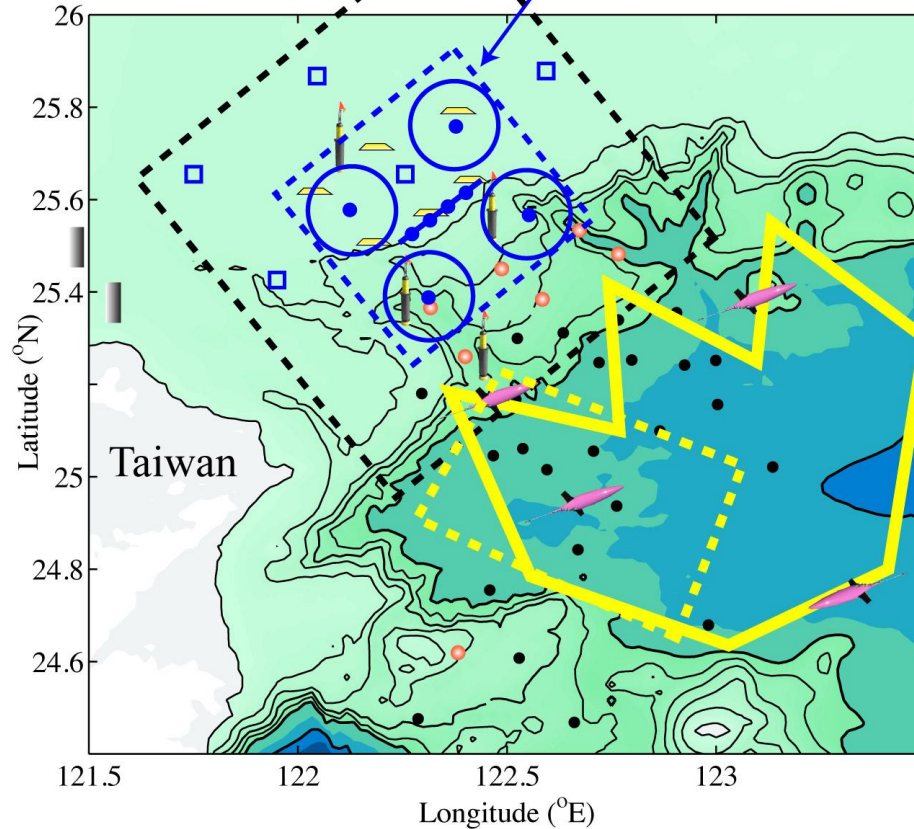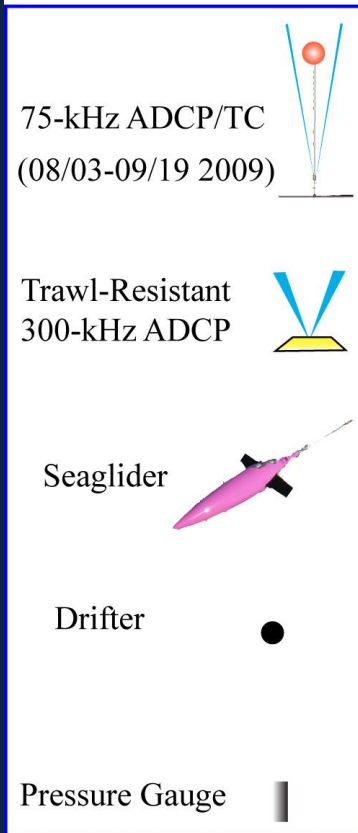

QPE Pilot Experiment Area

Integrated Acoustic and PO Observational Plan

EXTENDED OBSERVING PERIOD (06/2009-9/2009)

Acoustic Observation Area (~50 km x 50 km)

INTENSIVE OBSERVING PERIOD (08/2009-09/2009)

75-kHz ADCP/TC (08/03-09/19 2009)

Trawl-Resistant 300-kHz ADCP

Seaglider

Drifter

Pressure Gauge

Seasoar Survey Area

EM-APEX Float

Restrained ADCP/T

Taiwan

Acoustic Observation Assets

○ OMAS Source Track (D=20km) w/ sonobuoys in each circle

● WHOI Single Hydrophone Receiver Unit (SHRU) w/ thermistor string

WHOI Bottom Mounted Horizontal Array; NTU Vertical Line Array Locations of Fixed/Towed Acoustic Sources (TBD)

Model Initialization Surveys and Ilan Ridge Section
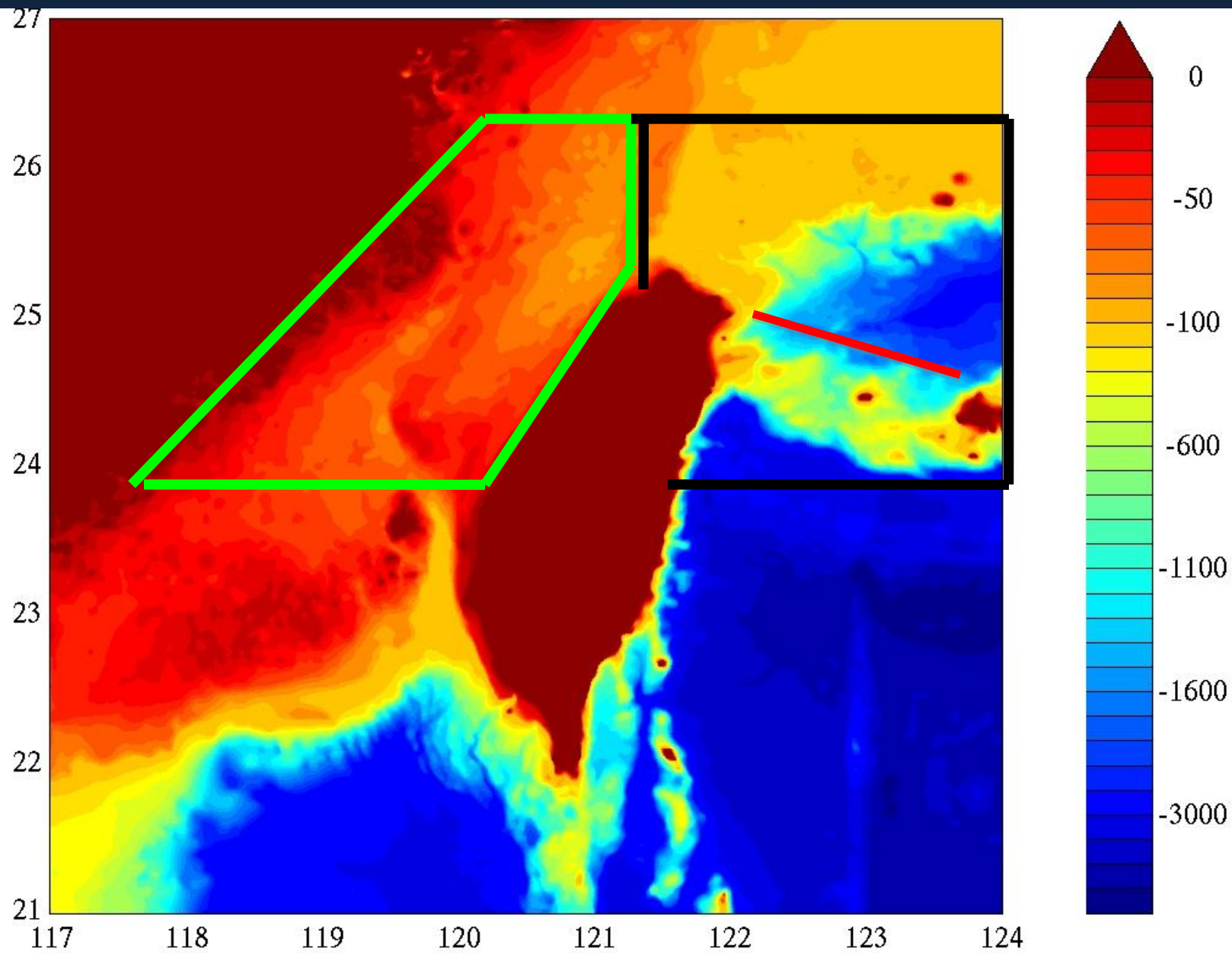
Timeline

20-26 May	Seagliders deployed, R/V Melville
3-9 Aug	Mooring Deployments (6 75 kHz), R/V Melville
13-17 Aug	Initialization Survey, Western half, OR2 or OR3(?)
13 Aug	Melville sails to start IOP
13-17 Aug	Initialization Survey, Eastern half and Ilan Ridge section, Melville
17-21 Aug	Kuroshio surveys, Melville
22 Aug-1 Sep	Leg 1 acoustics effort, OR1
23 Aug – 7 Sep	EM-APEX operations, Melville
~25-29 Aug	Second set of initialization surveys, OR2 & OR3, times and location to be. negotiated
2-11 Sep	Leg 2 acoustics effort, OR1
8-12 Sep	Glider recoveries, Melville
13-16 Sep	Mooring/drifter recoveries, Melville
16 Sep	Melville returns to port.

- Melville operations divided into 6 legs- glider deployment, mooring deployment, surveys and restrained drifters, EM-APEX, glider recovery, mooring recovery.
- Restrained drifter relocations will require ~1d.
- Fishing boat protects restrained drifters during 13-22 Aug Melville surveys.
- Negotiate w/ SIO for short port calls- pilot boat exchanges.
- All gear set up prior to first Melville sailing, demob at end of program.

Planning Phase Communications
- Once per month through spring, twice per month during summer.

Operational Communications
-Ship-to-ship: VHF, Freewave or other line of sight data comms.
-Cell phone connectivity when near islands. Could use 3G for data transfer. Skype conference. Works near Mien-Hua Canyon, 2G only.
-Comms schedule- regular reports, etc.

Clearances
-Taiwan clearances all in progress.
-Japanese clearances for gliders requested Dec 08.
-*** Need to submit Japanese clearance request for EM-APEX ops ***
-DoS visit for chief sci & program managers.
-Drifters covered under blanket WMO agreement.

Timeline

20-26 May	Seagliders deployed, R/V Melville gliders, nutrients, students from MIT modeling & NTU acoustics
3-9 Aug	Mooring Deployments (6 75 kHz), R/V Melville
13-17 Aug	Initialization Survey, Western half, OR2 or OR3(?) Jan Sen or Y-J Chief Sci + 5 berths (Glen?)
13-17 Aug 17-21 Aug	Initialization Survey, Eastern half and Ilan Ridge section, Melville Kuroshio surveys, Melville Luca Chief Sci + 1 SIO, 1 or 2 NTOU (nutrients), 1 or 2 NTU students
22 Aug-1 Sep	Leg 1 acoustics effort, OR1
23 Aug – 7 Sep	EM-APEX operations, Melville Tom/Ren-Chieh chief sci, 2 APL-UW, 2 APL-UW students/postdocs, 1 SIO engineer
~25-29 Aug	Second set of initialization surveys, OR2 & OR3, times and location to be negotiated. Jan-Sen and Y-J to assign personnel.
2-11 Sep	Leg 2 acoustics effort, OR1
8-12 Sep	Glider recoveries, Melville
13-16 Sep	Mooring/drifter recoveries, Melville
16 Sep	Melville returns to port.

- All ships to be equipped with Iridium w/ external antenna.

- All ships to be trained for recovery of autonomous assets (floats, restrained drifters, drifters, gliders).

- Central site for providing position information for ships.