Intensive Hydrographic Survey of Loop Current Edge Fine Scale Features

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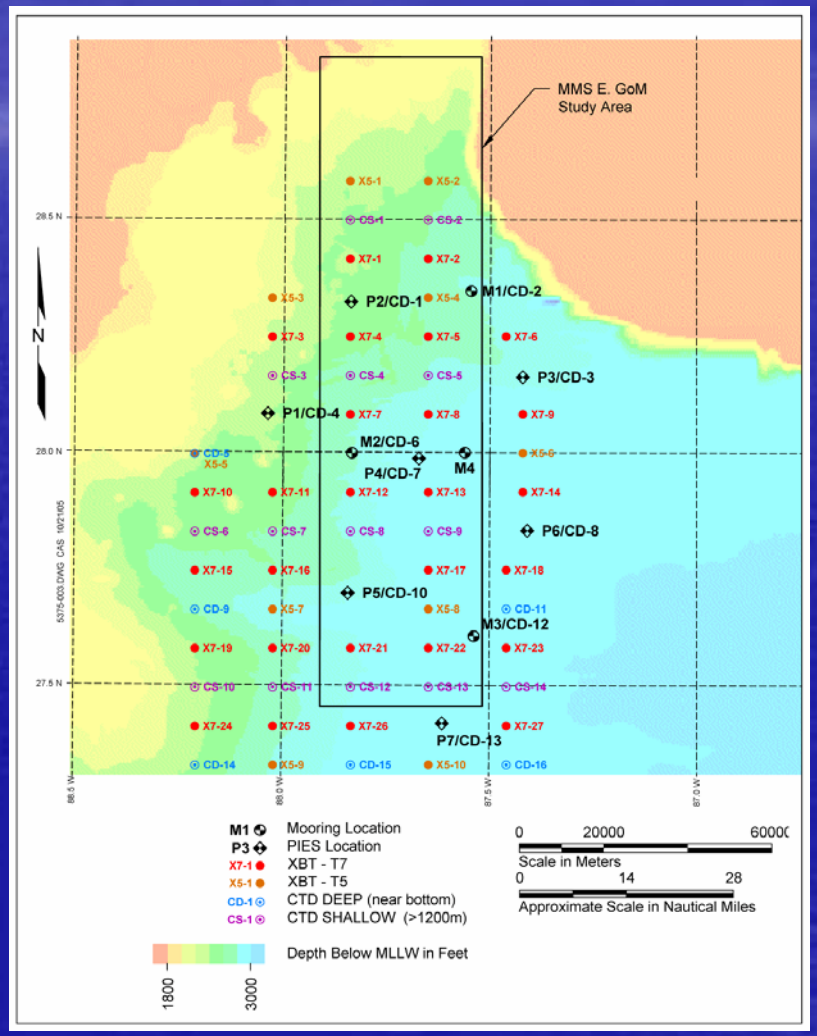
Background: Hydrographic Survey Design

- To collect measurements within the study area during each mooring cruise:
  - Deployment
  - Service
  - Retrieval
- Use a combination of CTD casts and XBT profiles considering:
  - Data density
  - Efficiency
  - Coverage of study area

Proposed Hydrographic Survey Design

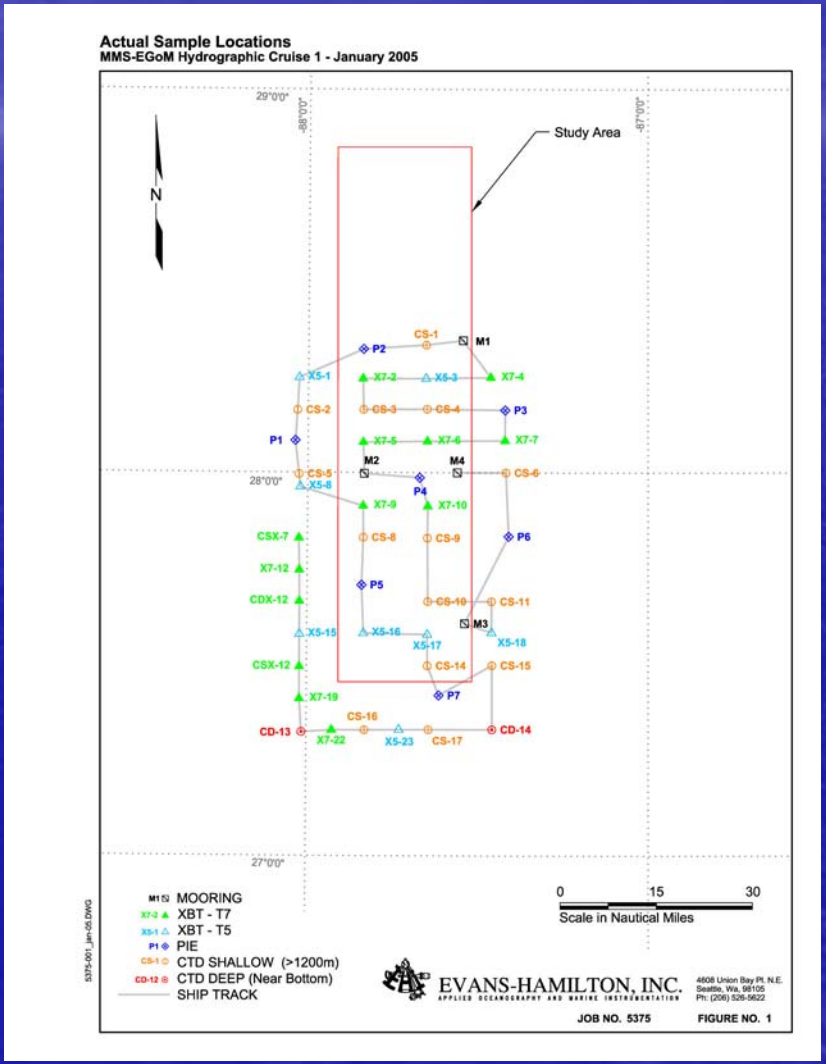
- Grid of CTD/XBT stations
  - Deep CTD ~2000m
  - Shallow CTD ~1000m
  - Deep XBT (T5 ~1830m)
  - Shallow XBT (T7~760m)
- Grid Spacing
  - 10 nmi E-W direction
  - 5 nmi N-S direction
- Grid pattern
  - Alternating lines of CTD and XBT
  - Each E-W transect line same type (e.g., all shallow CTD, all deep XBT, etc)
- Deep CTD cast at each mooring and PIES



Hydrographic Cruise 1: Deployment

17–23 January 2005

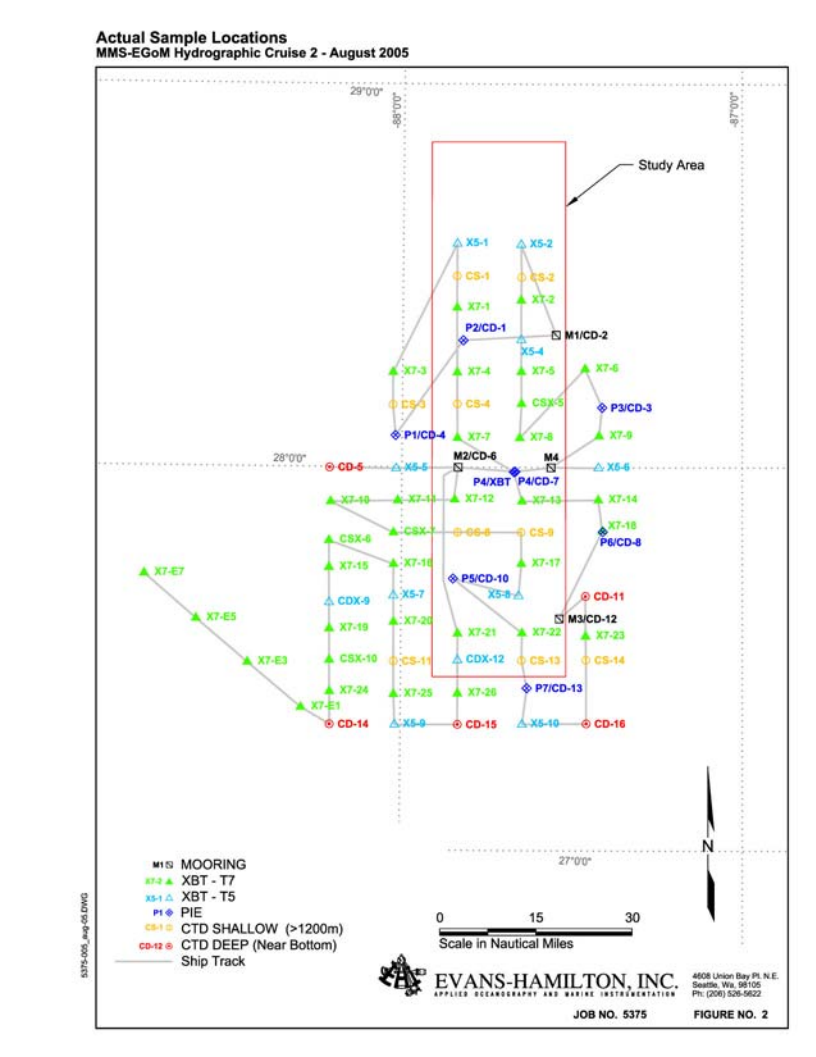
- Started at M4 with CTD cast following mooring deployment (18 January 2005)
- Hydro stations worked around mooring deployments (timed one/day during daylight hours)
- Deep CTD casts collected at each PIES location
- Far west N-S transect not measured due to lack of time



Hydrographic Cruise 2: Service

18–25 August 2005

- Start at CD-5
- Hydro cruise 2 worked around PIES downloads and service of moorings (retrieval one day and redeployment the following day)
- Eight-day cruise allowed time to collect far west N-S transect (appeared on edge of eddy)
- Additional XBT dropped every 10km steaming to shore until crossed eddy
- Closely watching weather!

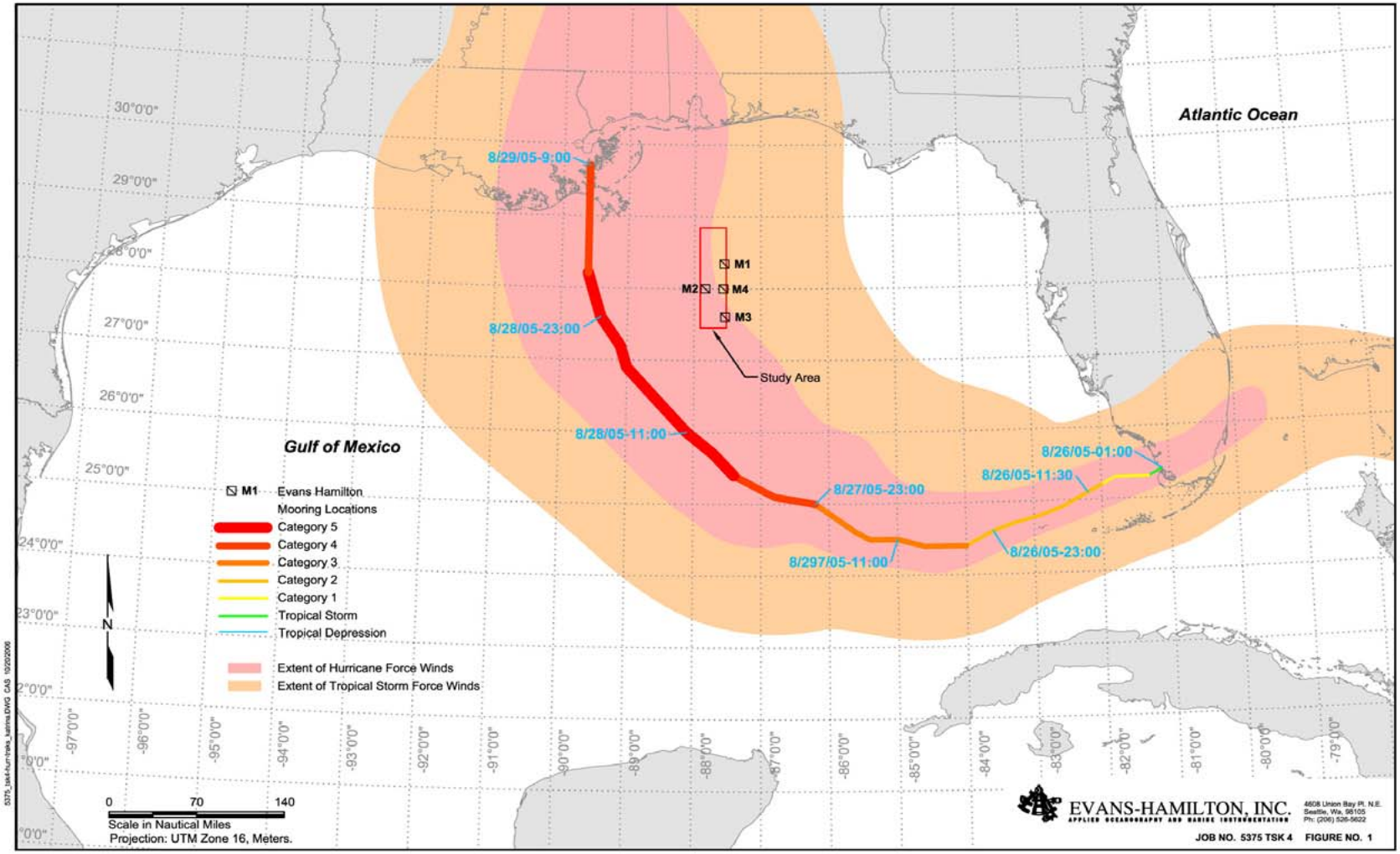


Hurricanes

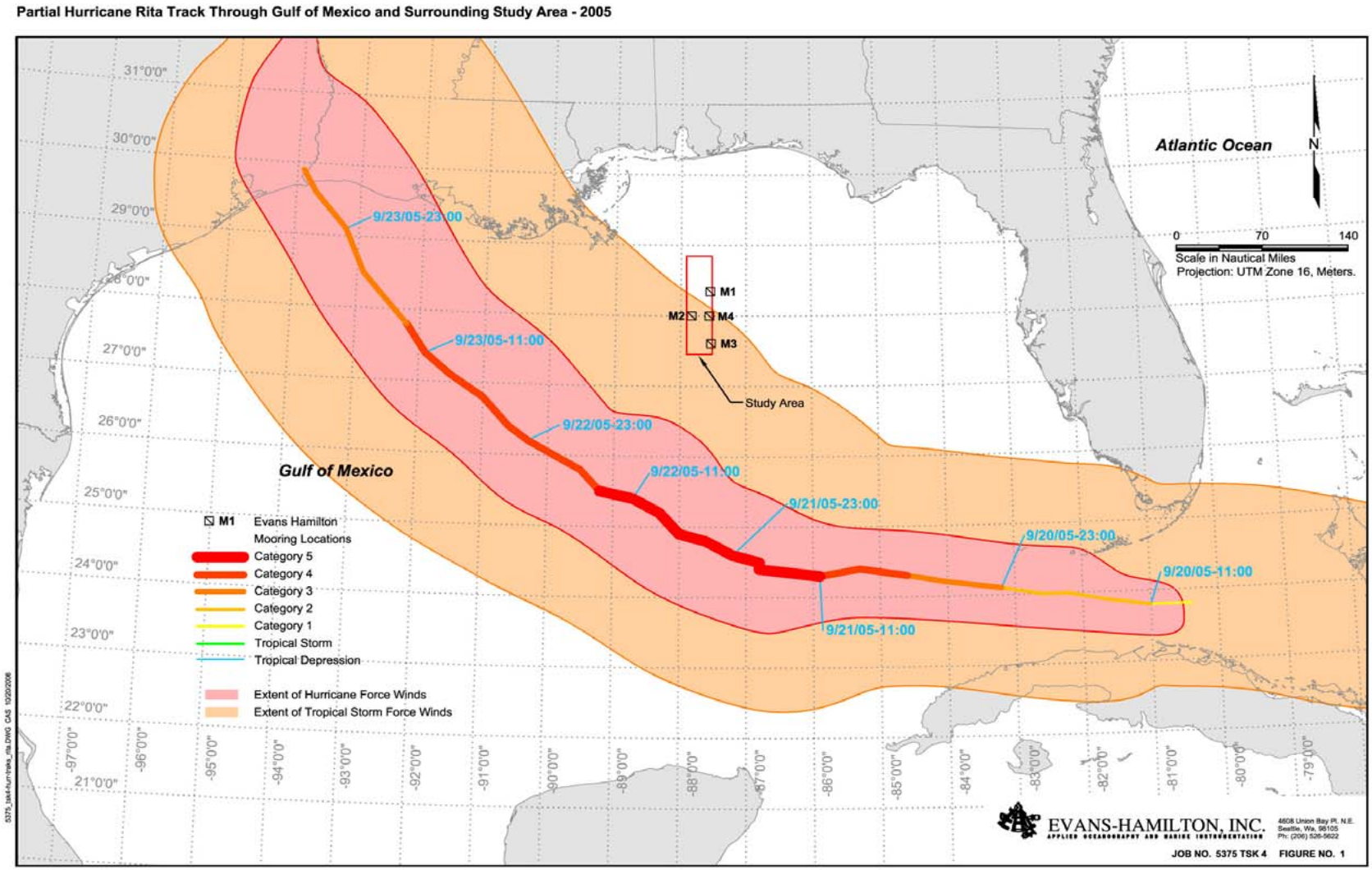
Potential Impact to Study Area Following Hydrographic Cruise 2

- 3 hurricanes
  - Katrina 26–29 August 2005 (Category 5)
  - Rita 20–23 September 2005 (Category 5)
  - Wilma 21–23 October 2005 (Category 3)
    (south of study area)

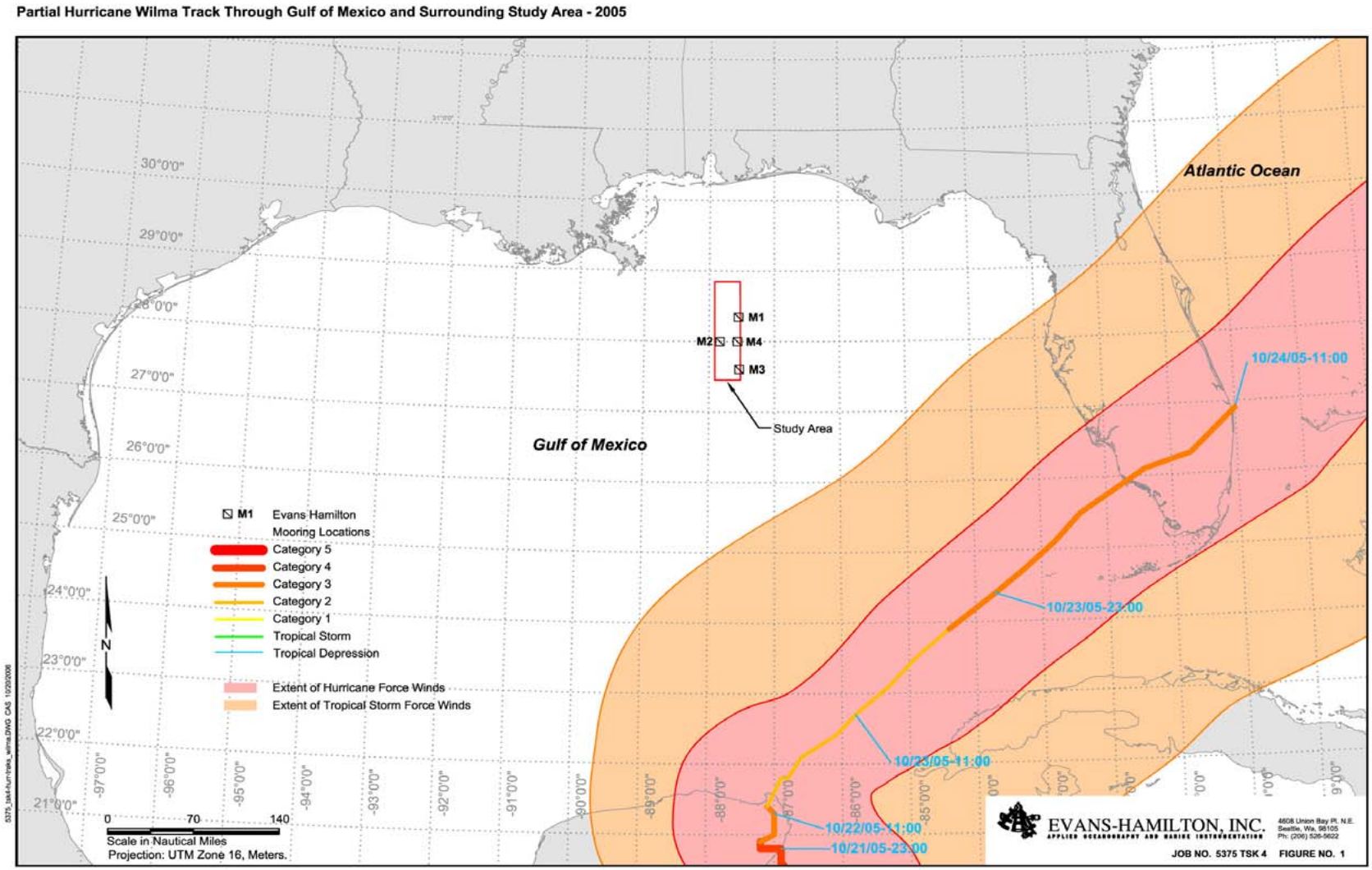
Hurricane Katrina



Hurricane Rita



Hurricane Wilma



Post Hurricane Study

- Additional funds earmarked for post- hurricane hydrographic study
  - Vessels <u>unavailable</u> following Hurricanes Katrina and Rita
    - Vessel requirements: capable of CTD casts
  - How best to use funds to benefit the program

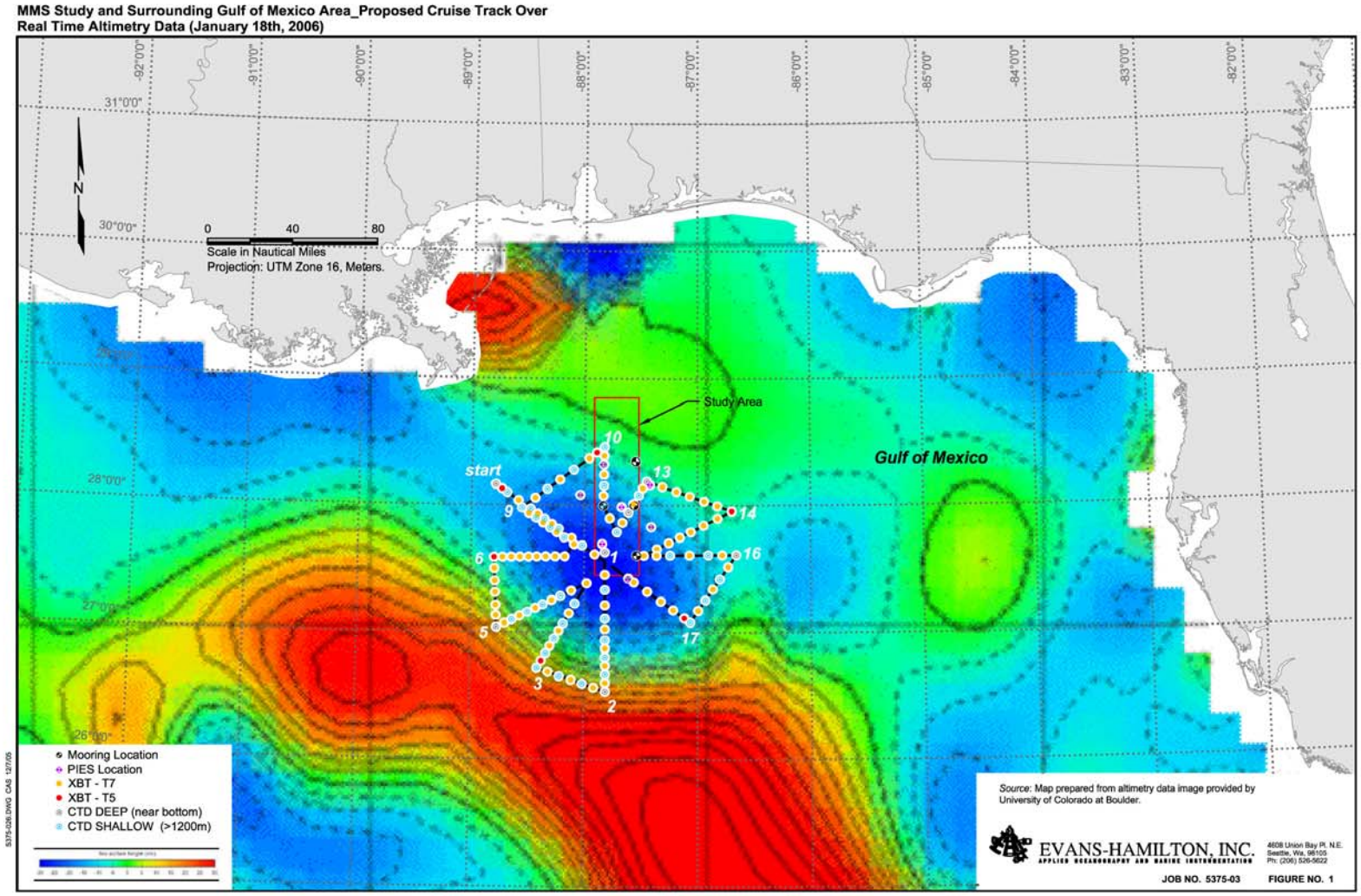
Hydrographic Cruise 3: Retrieval

20–28 January 2006

- Fine-scale (intensive) survey for final cruise
  - Edge of the Loop Current
  - Edge of the eddy
  - Frontal features
- Satellite imagery showed general features at start of cruise
  - Edge of the Loop Current
  - Double cold core eddies at south half of study area
  - Water squeezed by bathymetry at north side of study area possibly producing jets
  - No time for delay in order to catch these features

Hydrographic Cruise 3: Planning

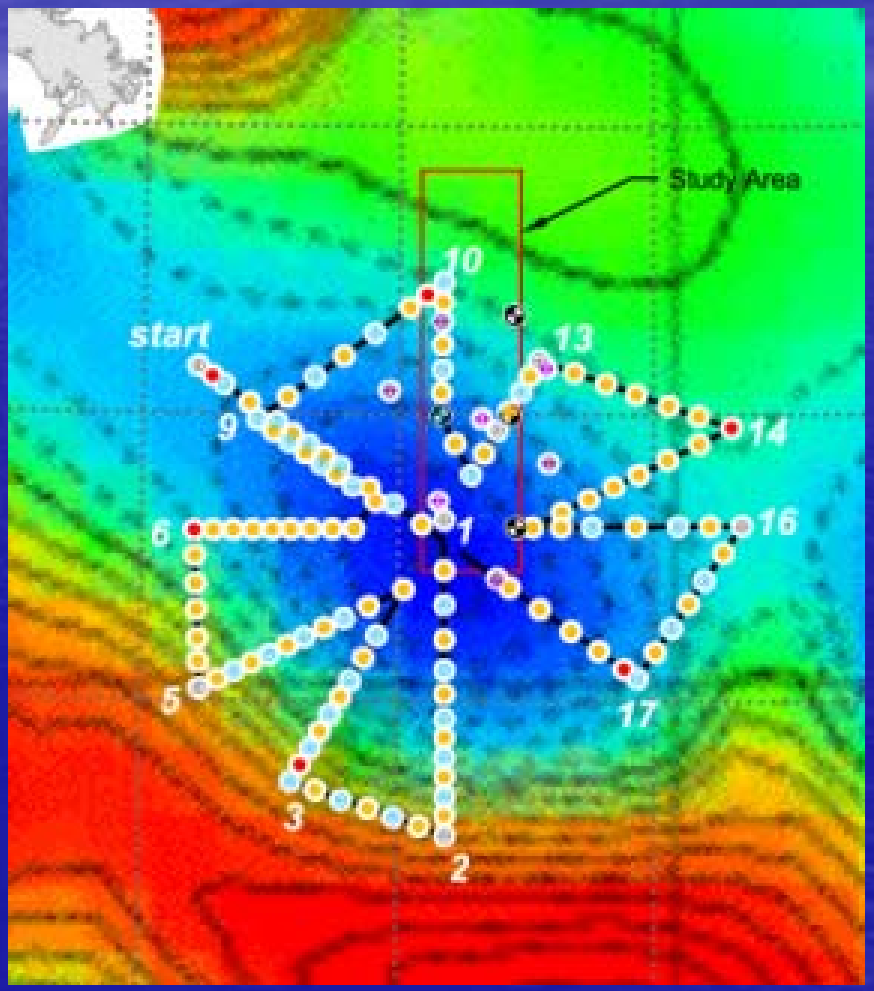
20–28 January 2006



Hydrographic Cruise 3: Planning

20–28 January 2006

- Pinwheel shape
  - Run to center to find cold core (start to 1)
  - Run to south across Loop Current (1 to 2)
  - Continue clockwise progression to sample new water
  - Deep CTD/XBT at each mooring and PIES and at the outer corners of the pinwheel to maximize the area available for deep contours
  - Retrieve moorings and PIES as progress



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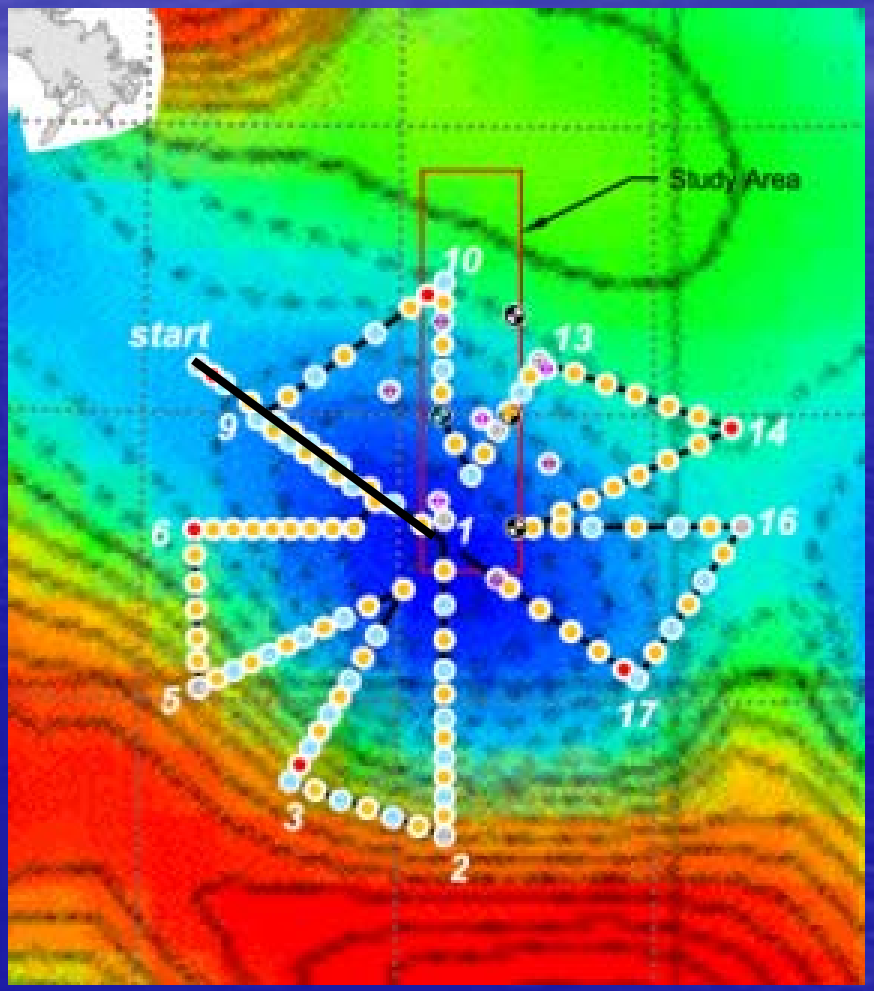

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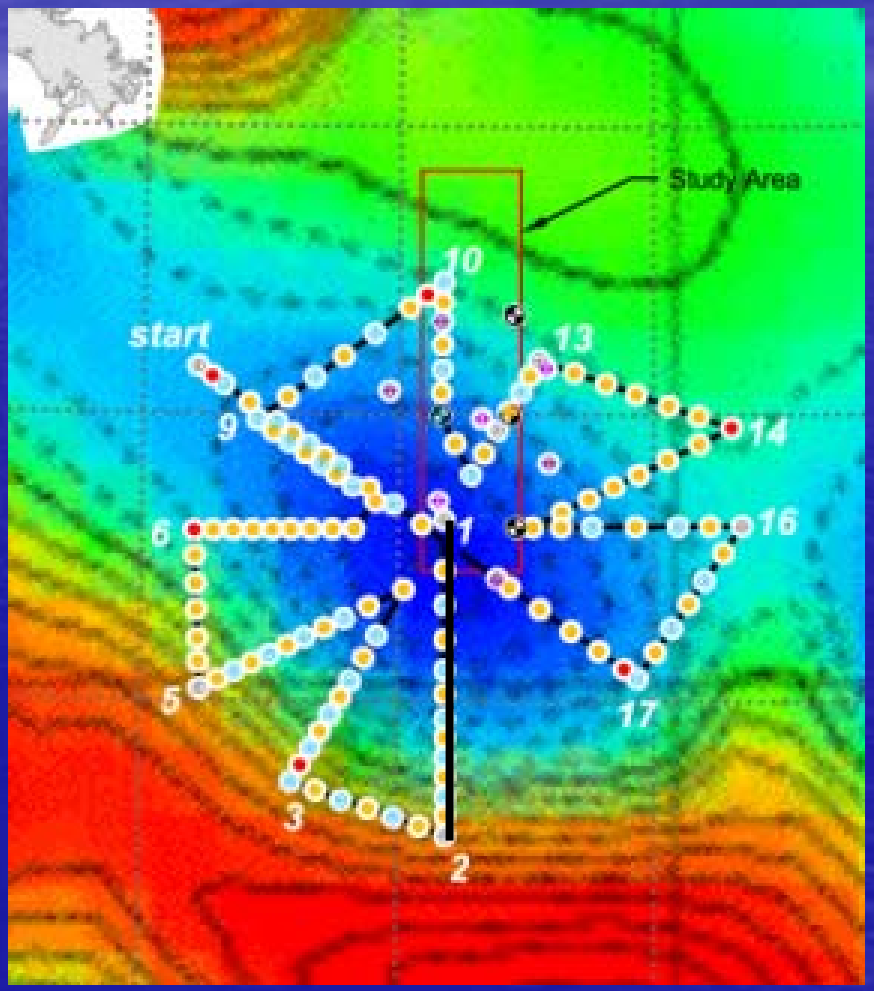

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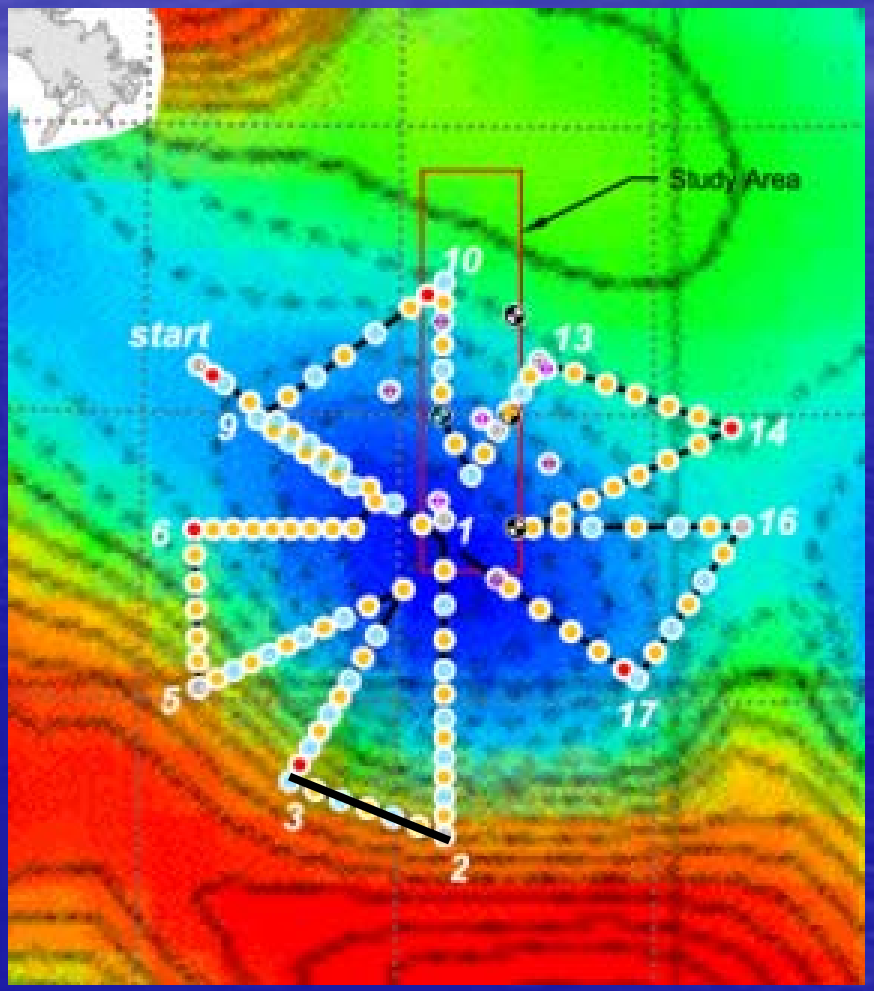

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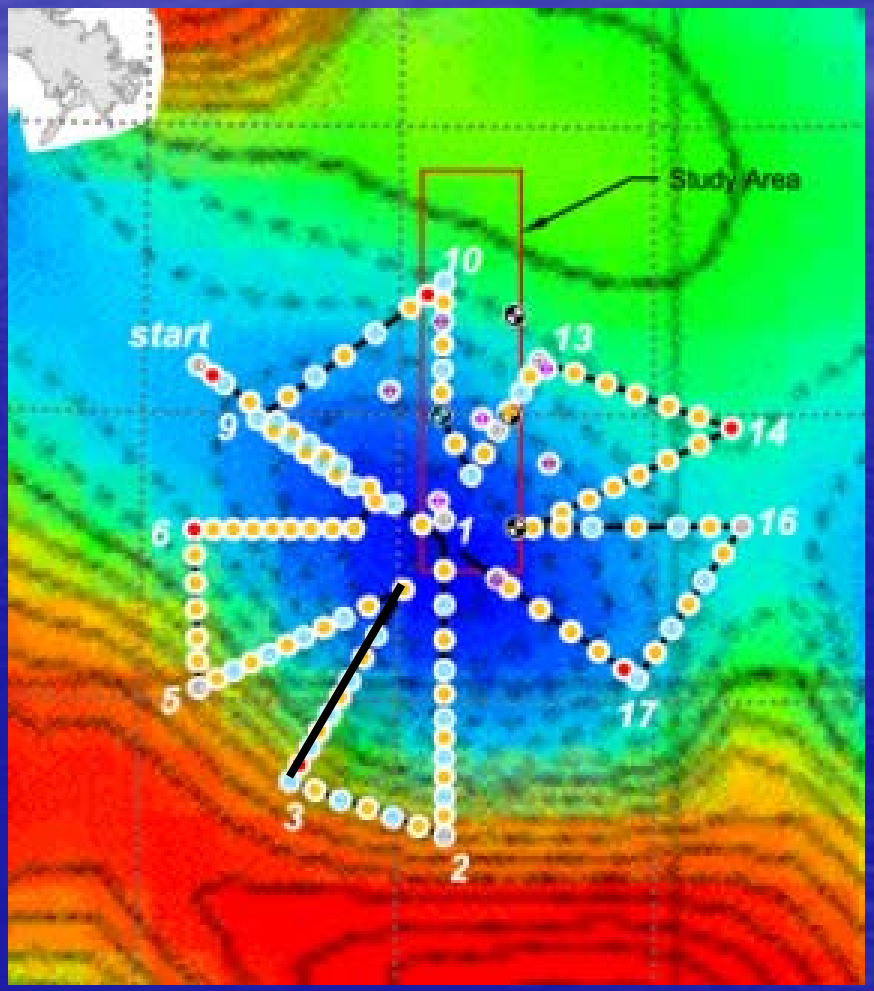

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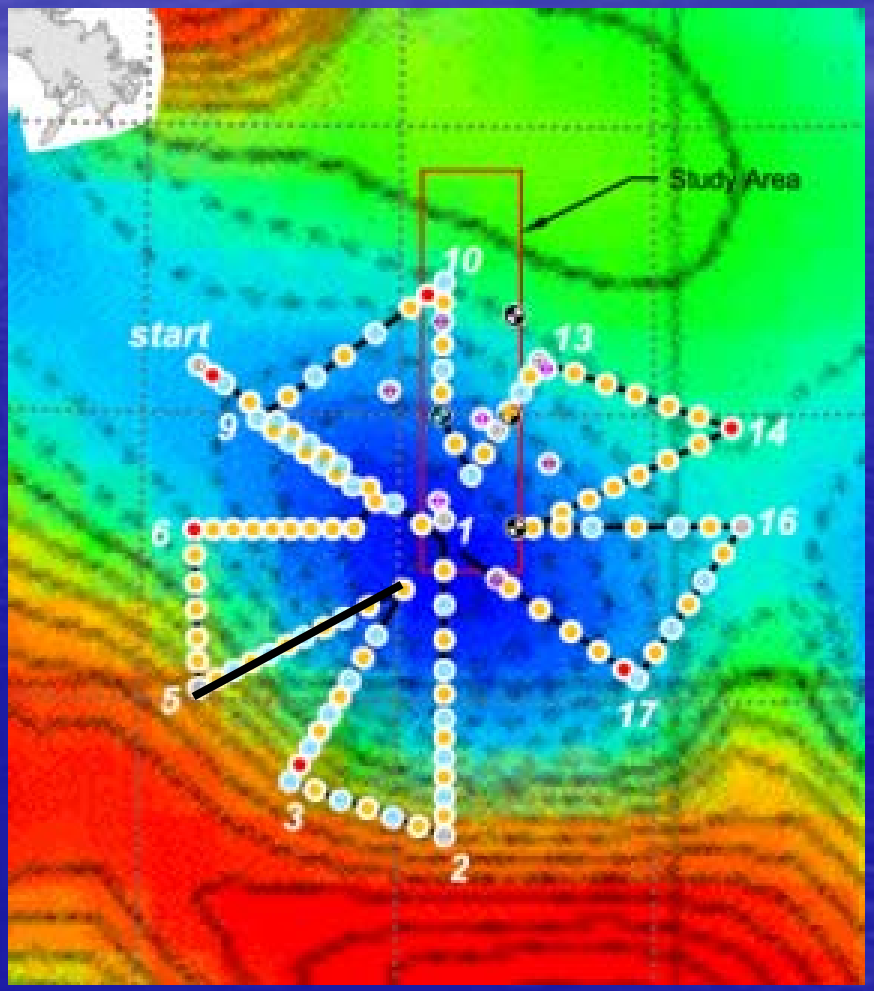

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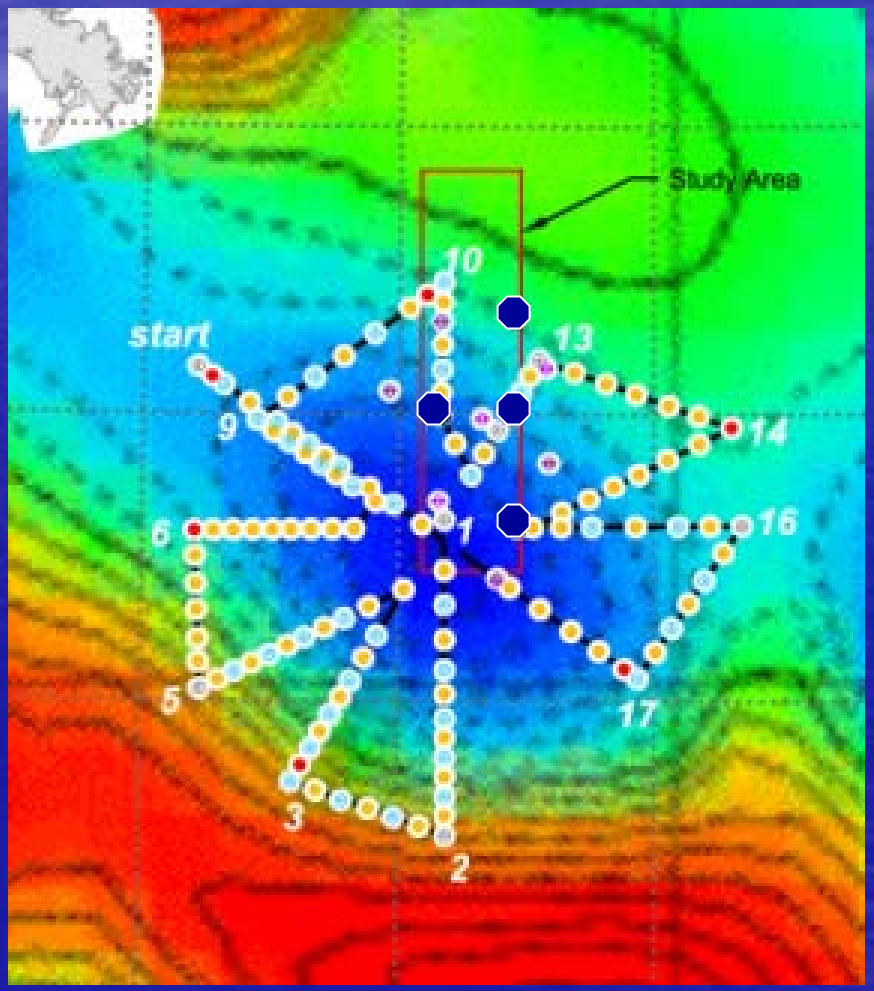

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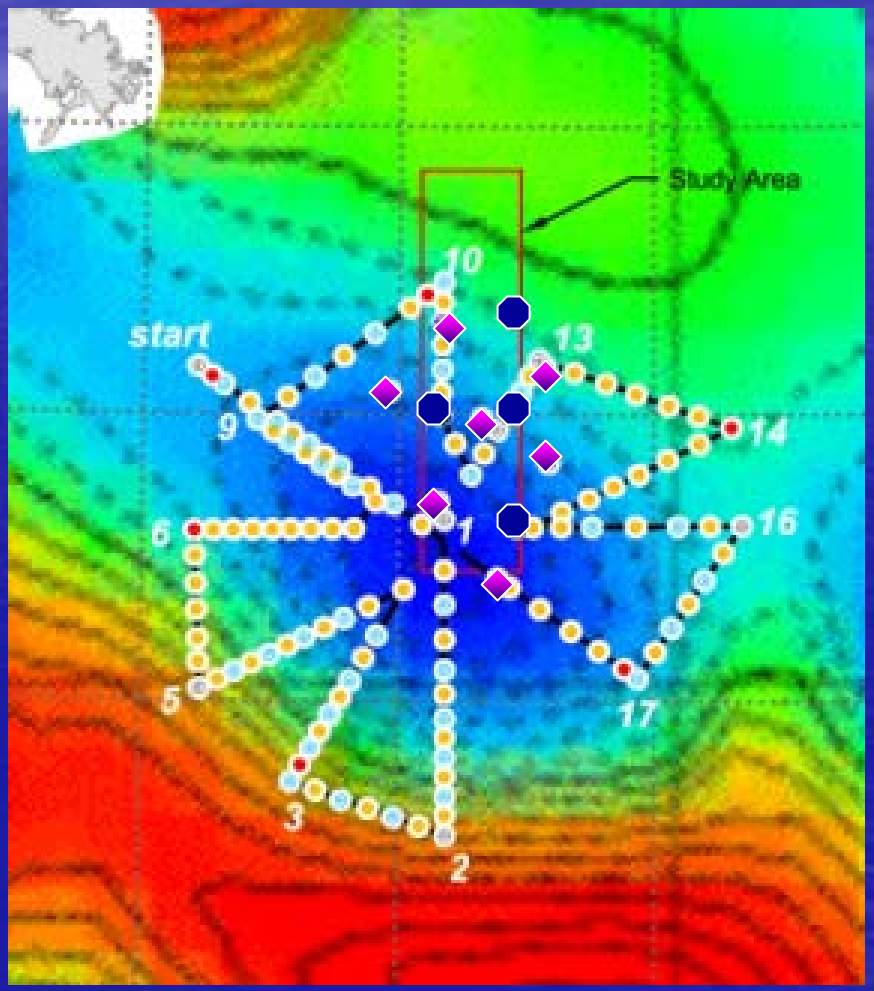

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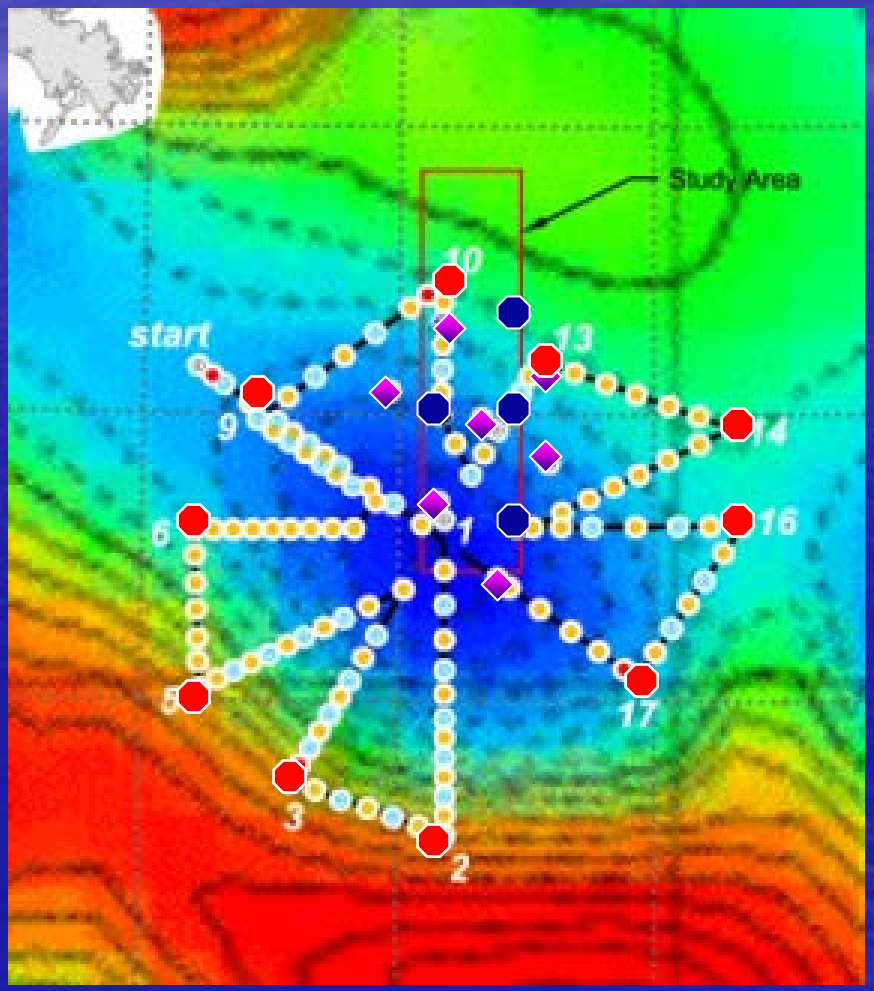
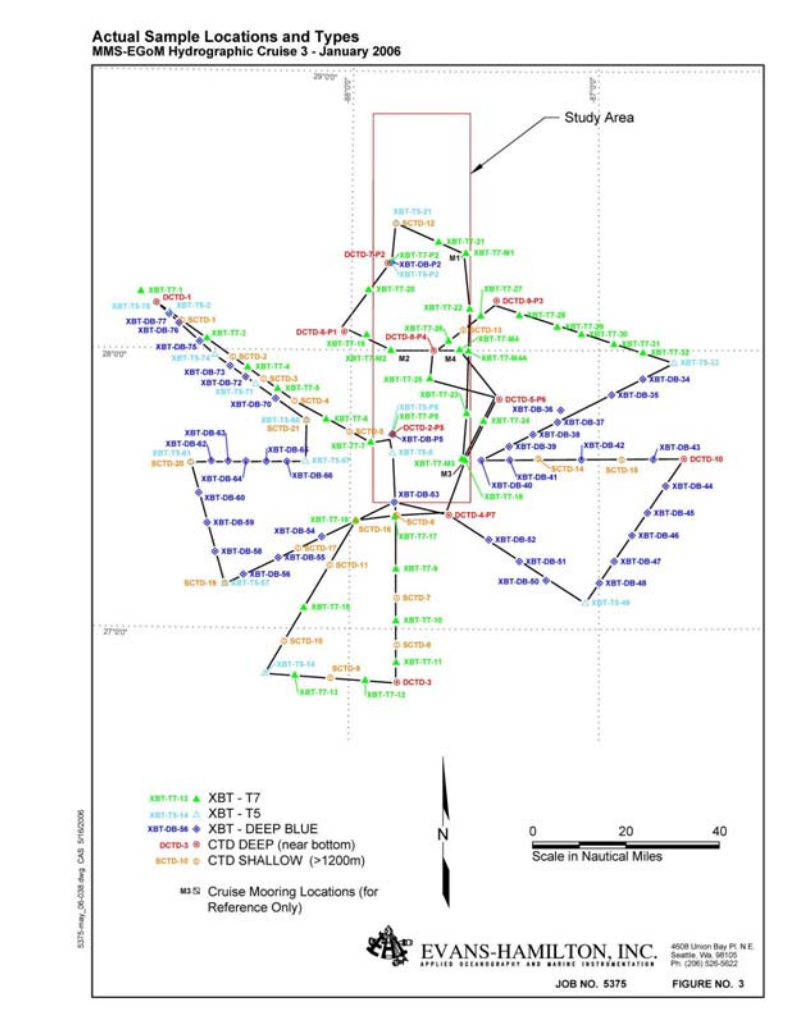


Hydrographic Cruise 3: Actual

20–28 January 2006

- Modified the cruise track
  - Loop current feature slid north so initial legs were shortened
  - Good weather windows were used to retrieve moorings and PIES
- Modified station plan
  - Some stations sampled with multiple probes (CTD and XBT)
  - Some stations sampled multiple times



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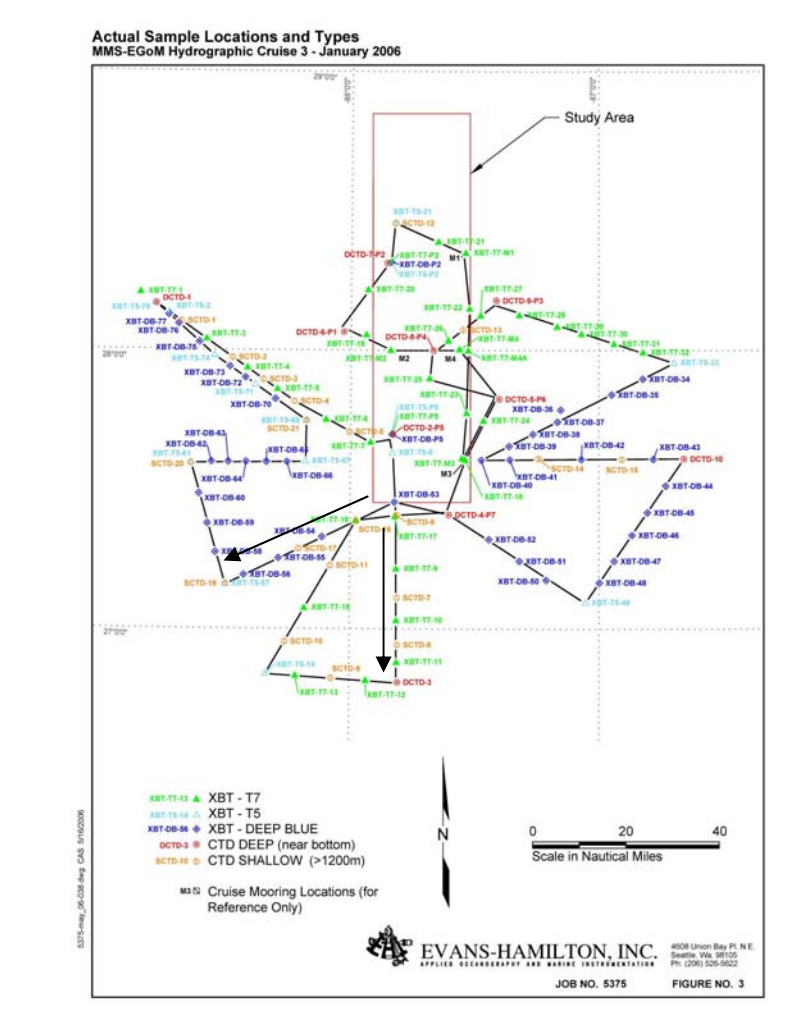

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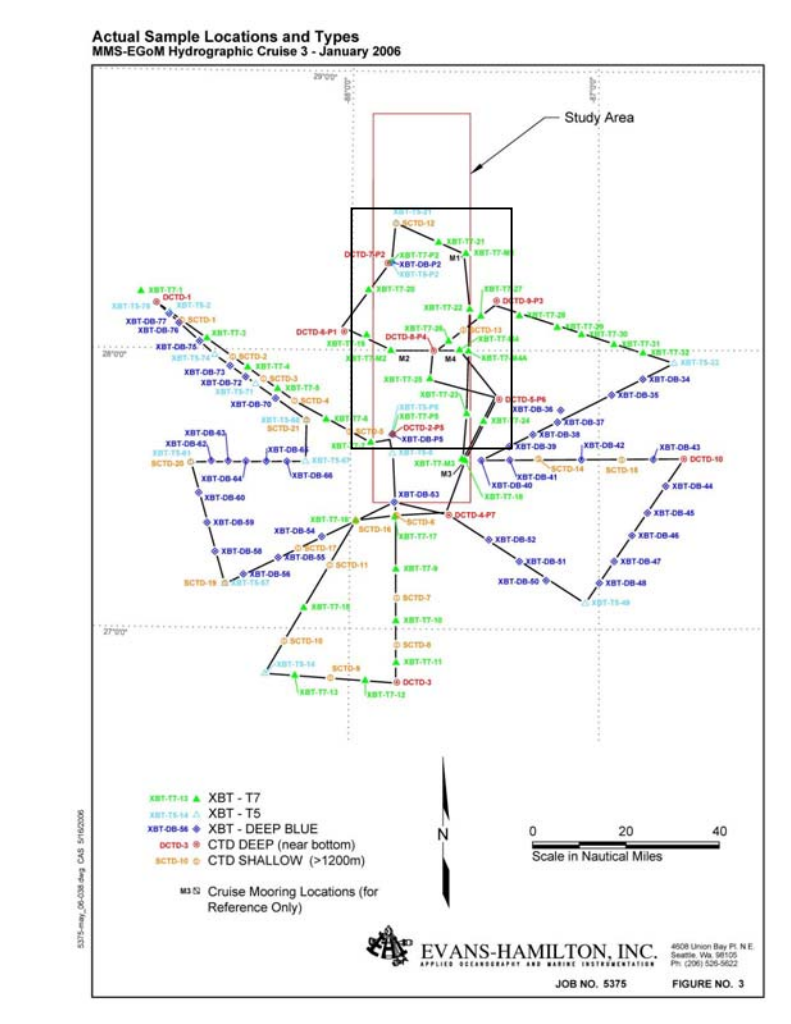

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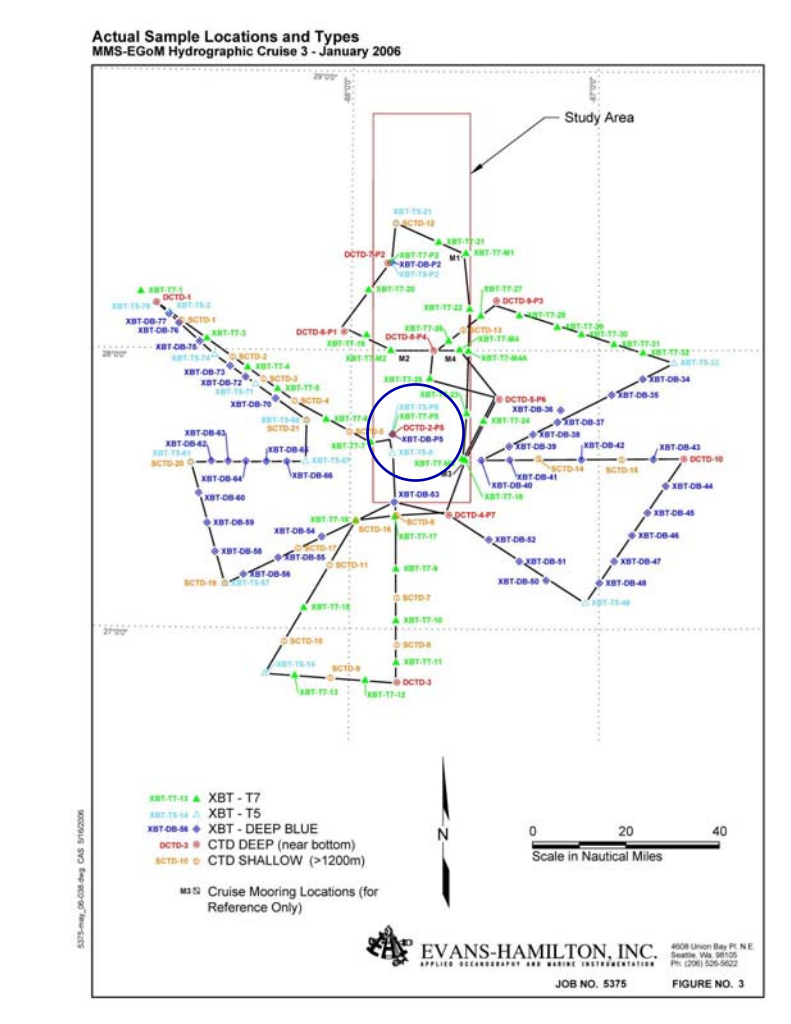

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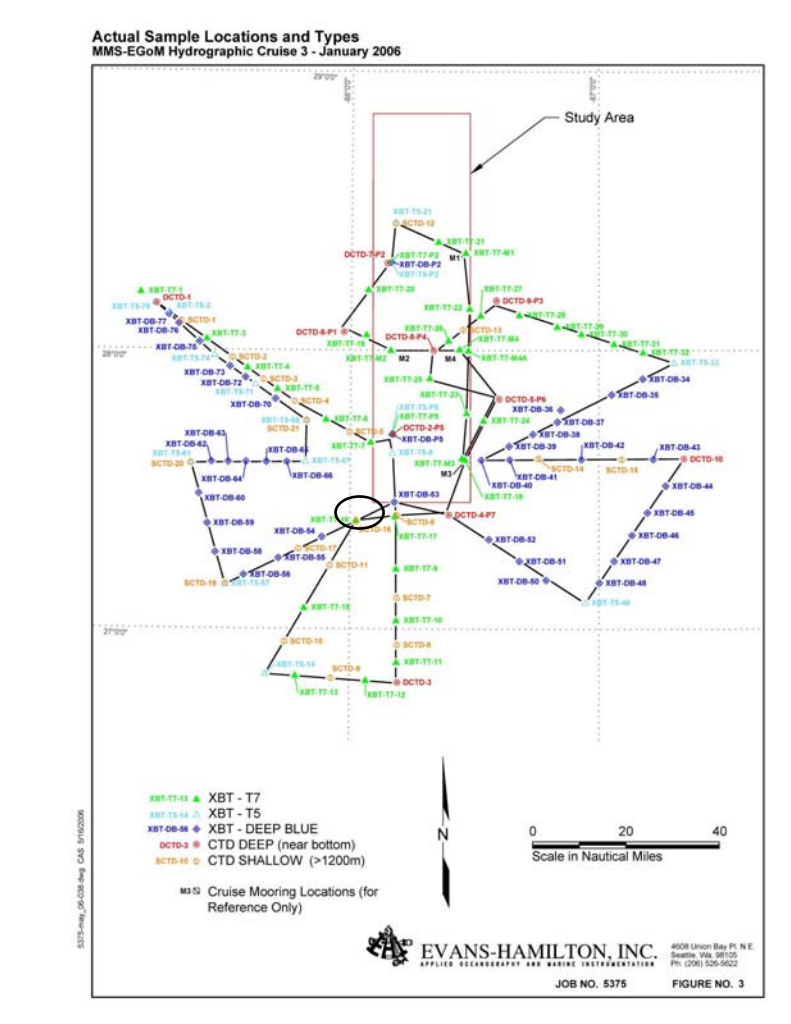
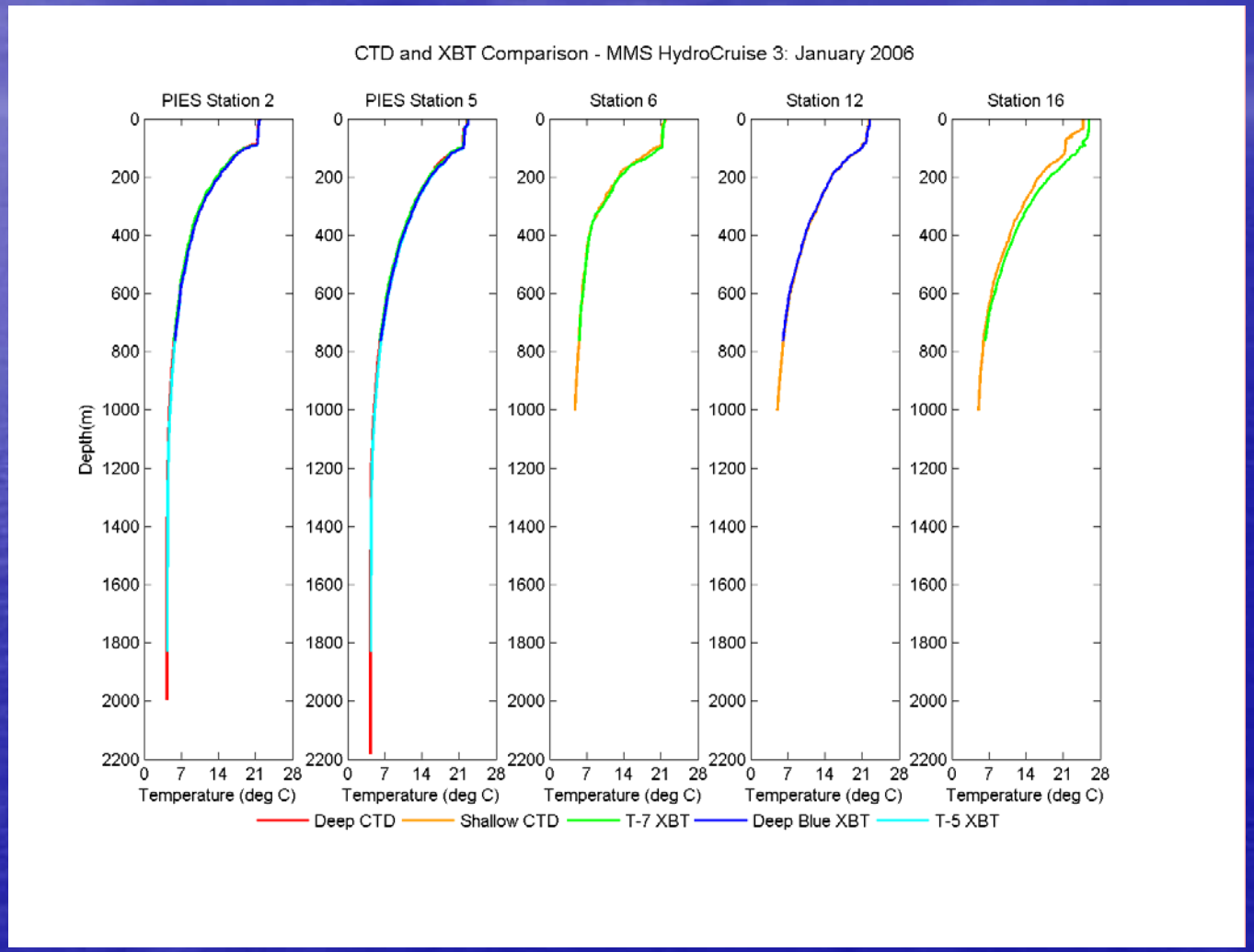
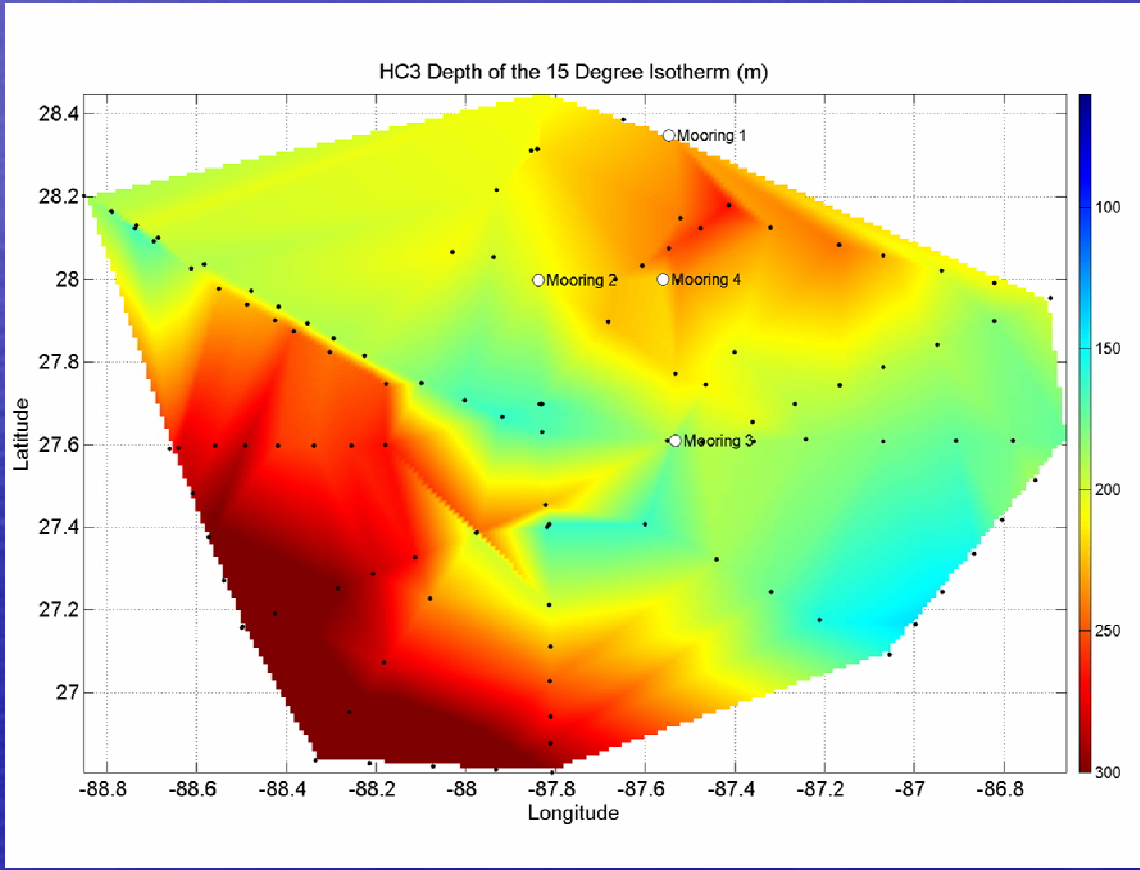


Preliminary Results



Preliminary Results

All XBT and CTD Profiles Hydrographic Cruise 3
Depth Contour of 15 Degree Isotherm (m)



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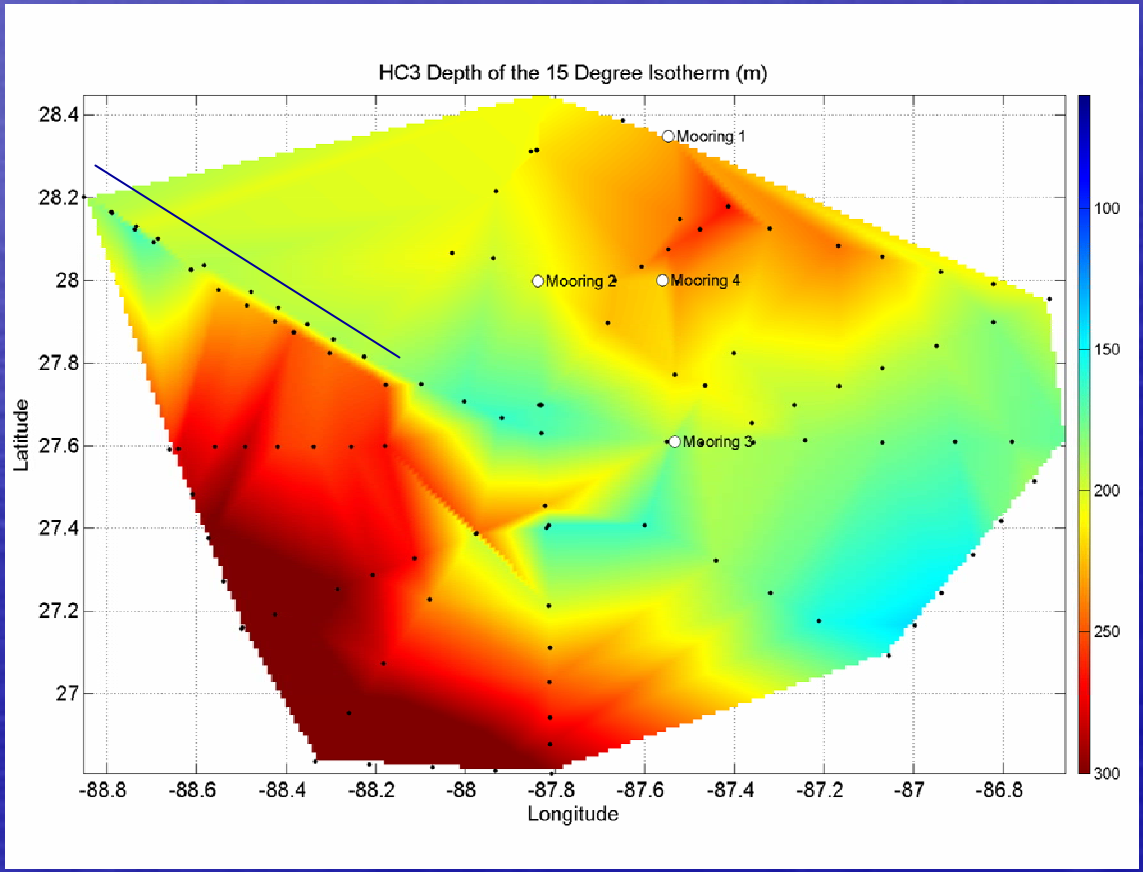
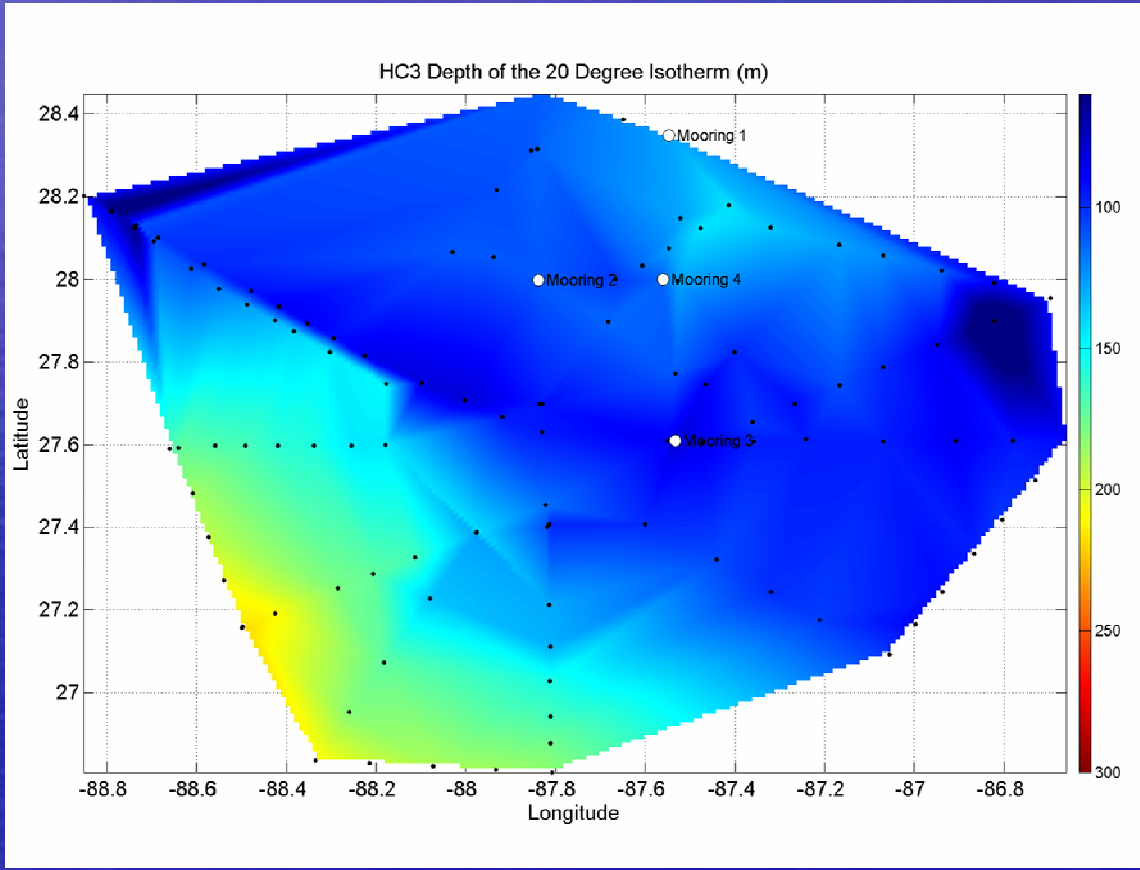


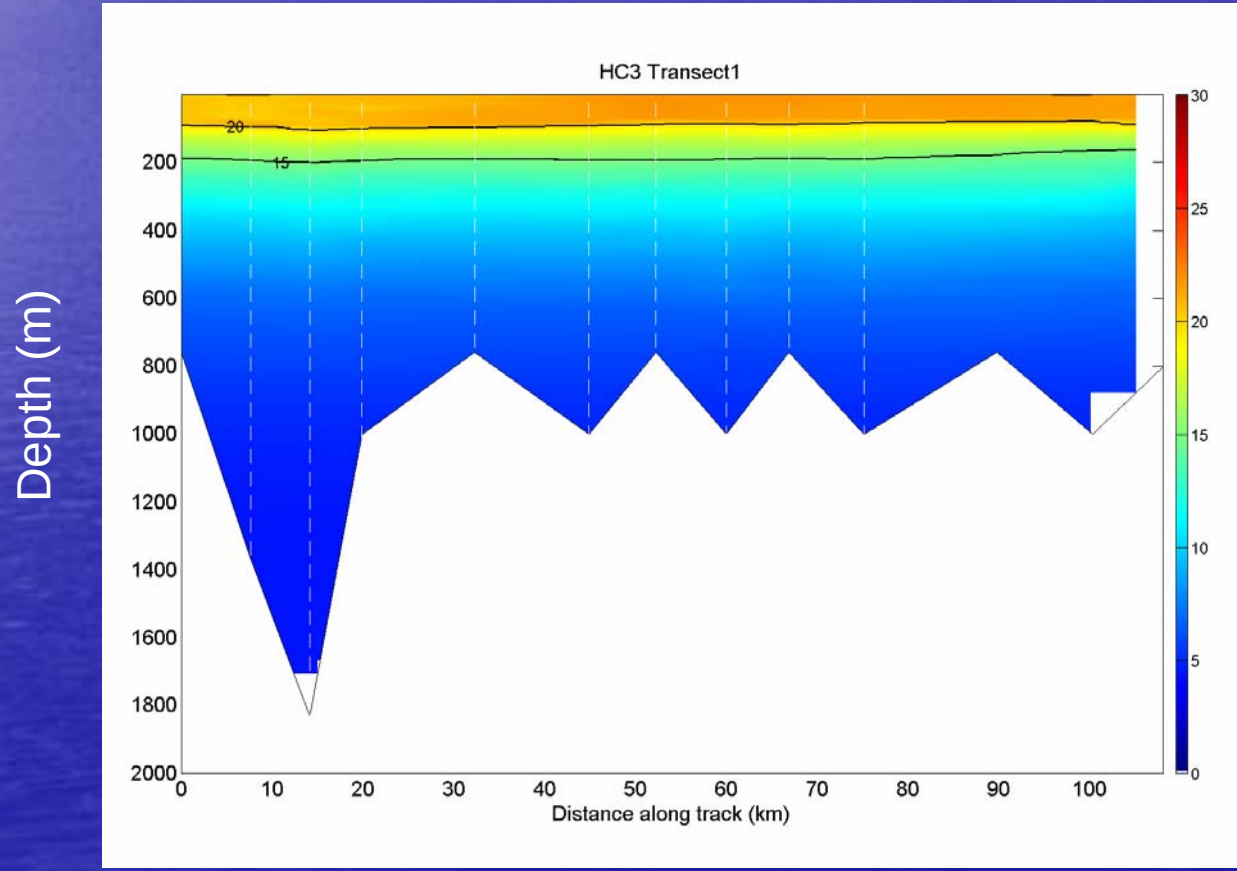
Preliminary Results

All XBT and CTD Profiles Hydrographic Cruise 3
Depth Contour of 20 Degree Isotherm (m)



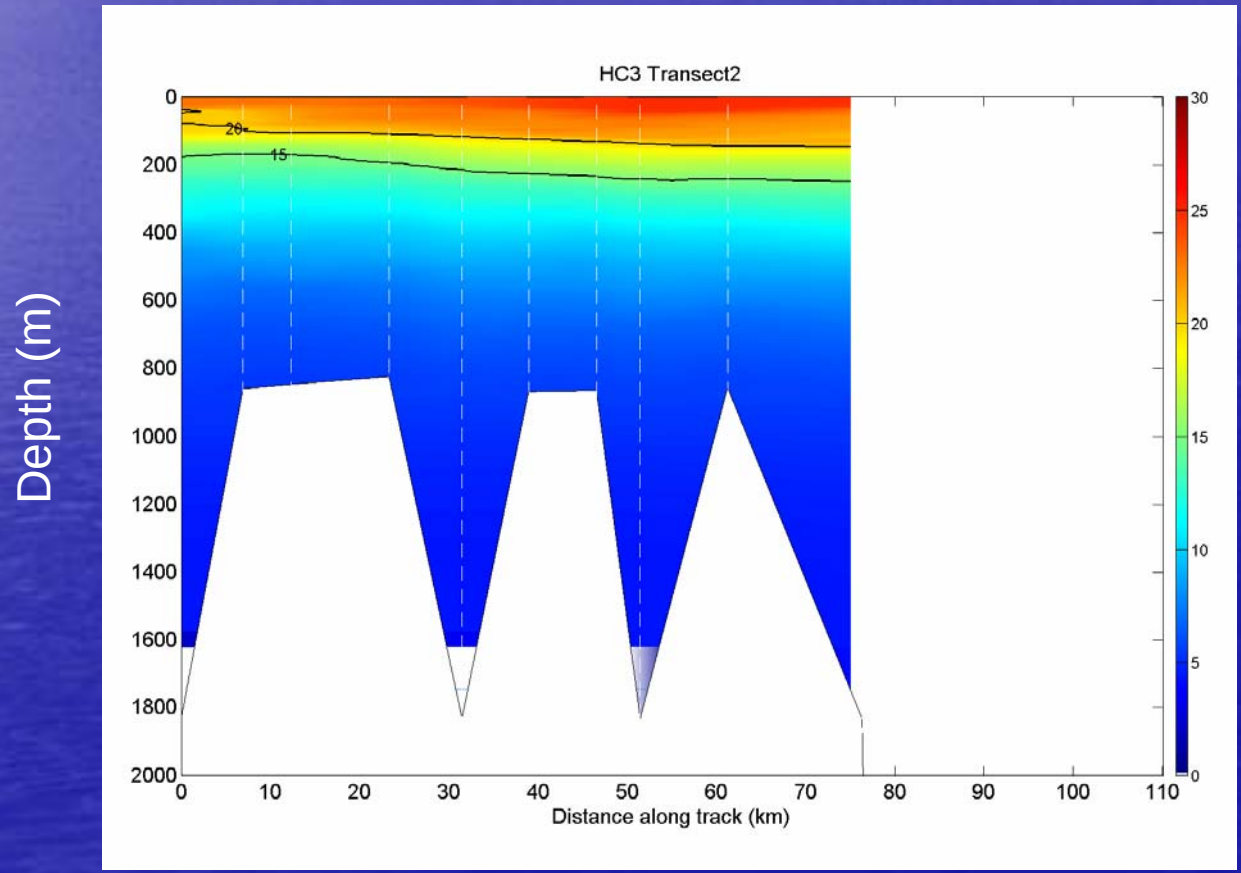
Preliminary Results

XBT and CTD Contour Hydrographic Cruise 3
Initial Transect into Study Area



Preliminary Results

XBT and CTD Contour Hydrographic Cruise 3
Final Transect out of Study Area



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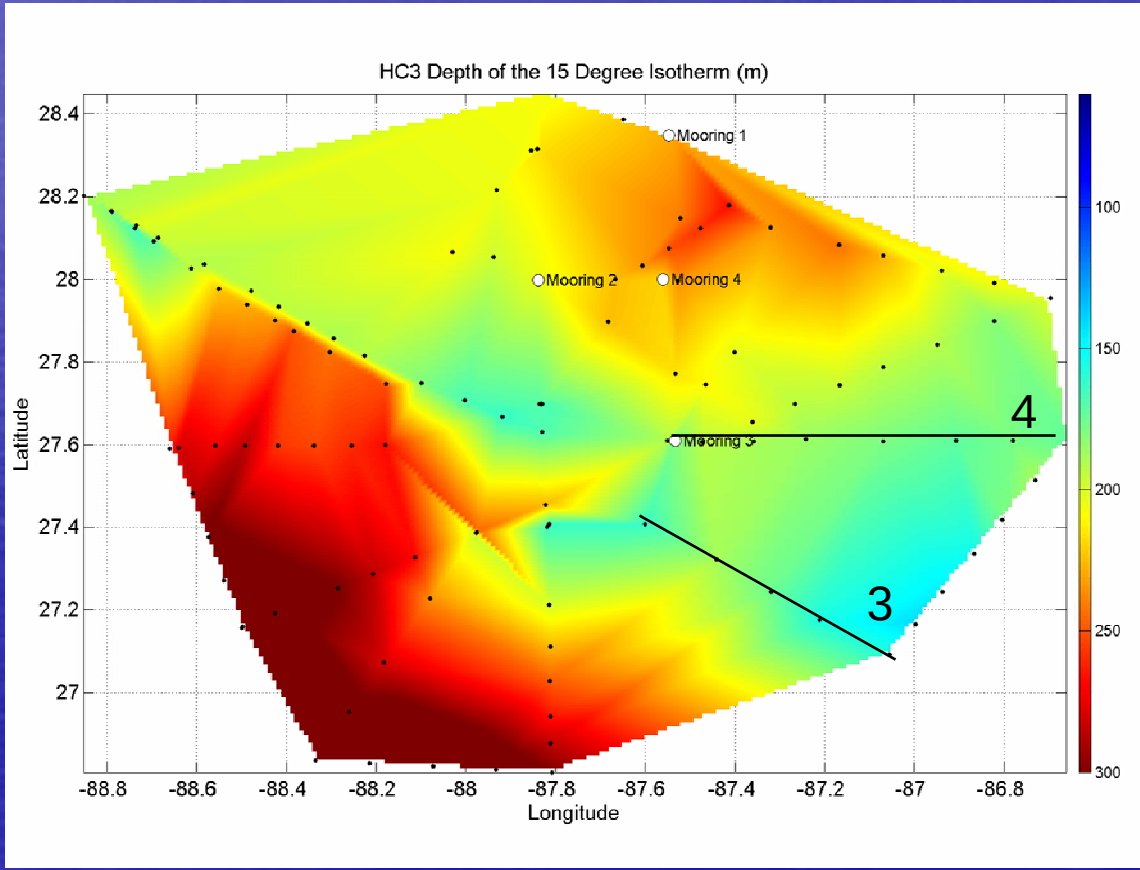
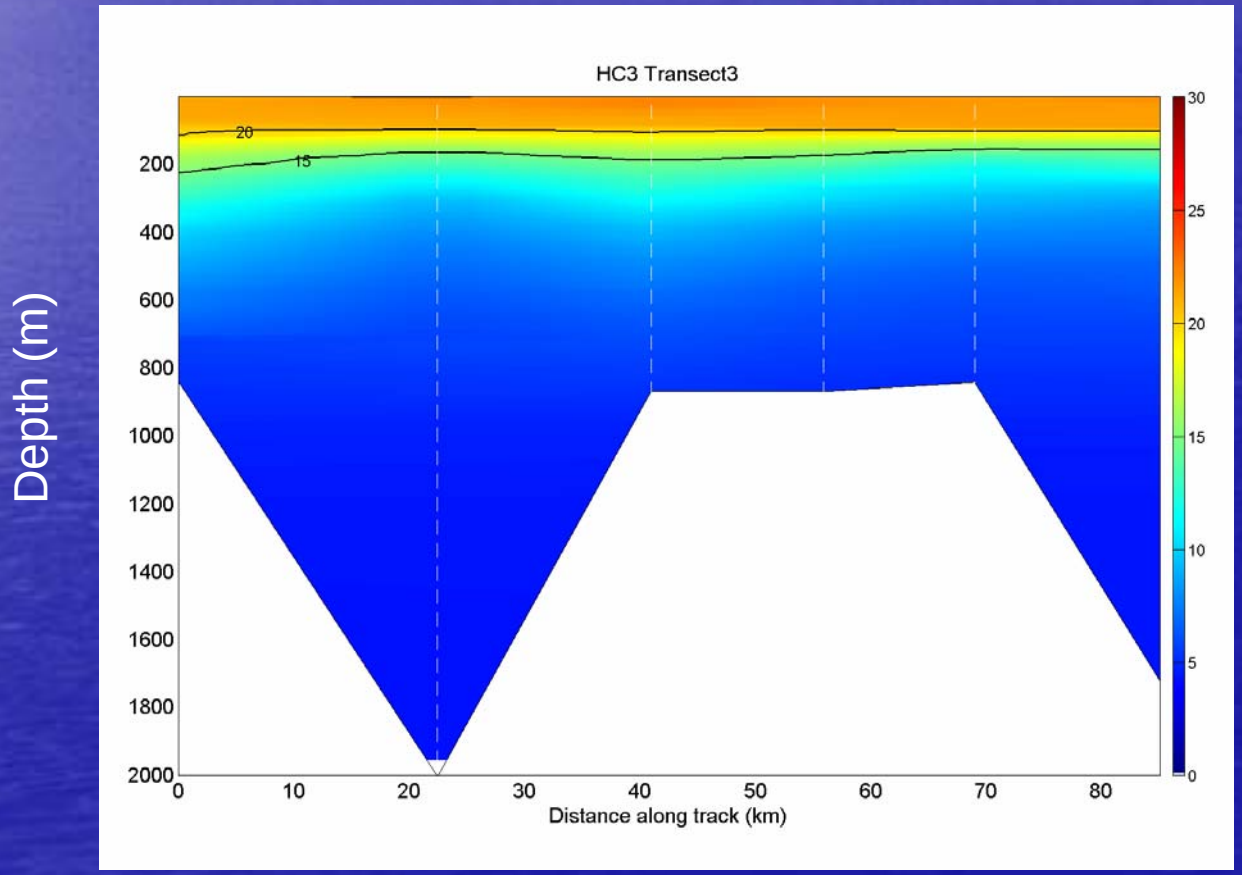
Depth Contour of 15 Degree Isotherm (m)



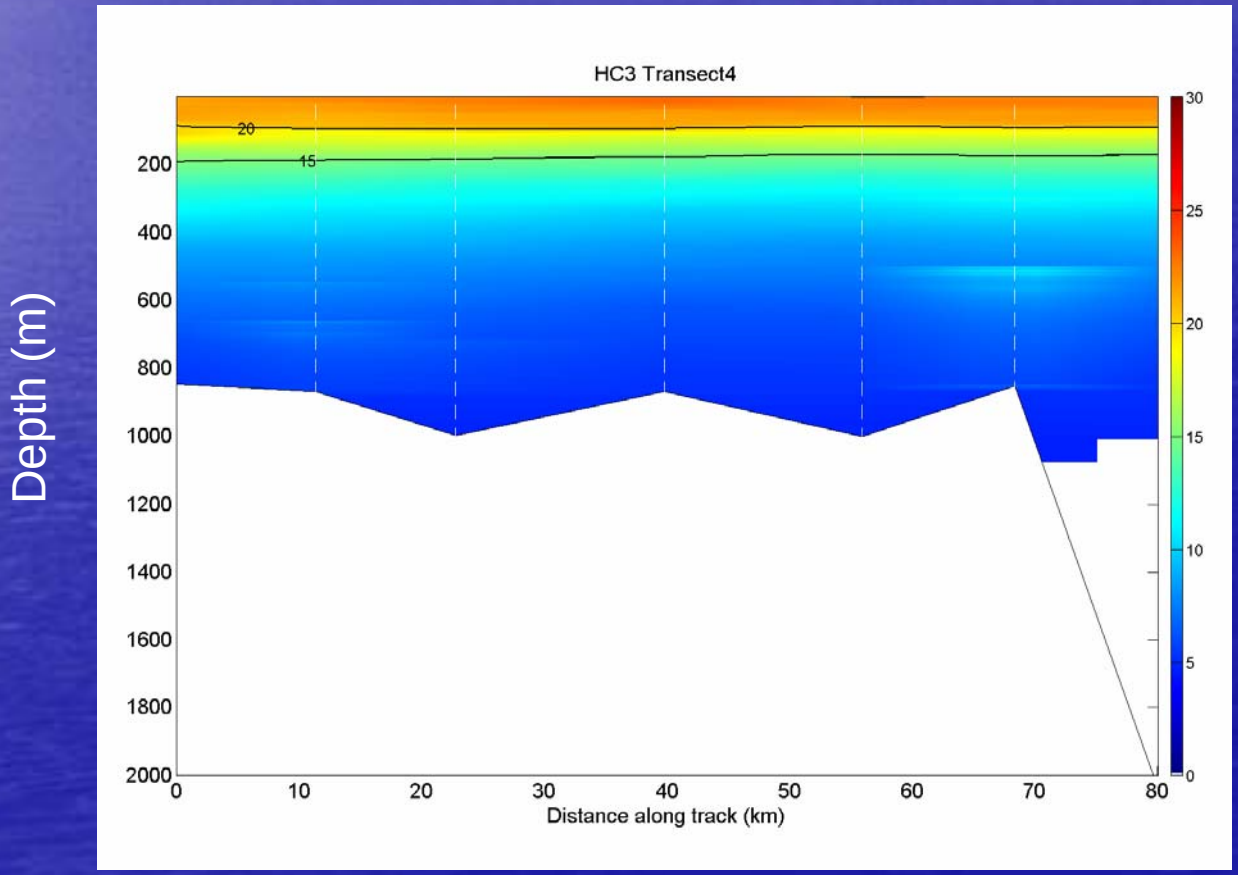
Preliminary Results

XBT and CTD Contour Hydrographic Cruise 3
Transect 3



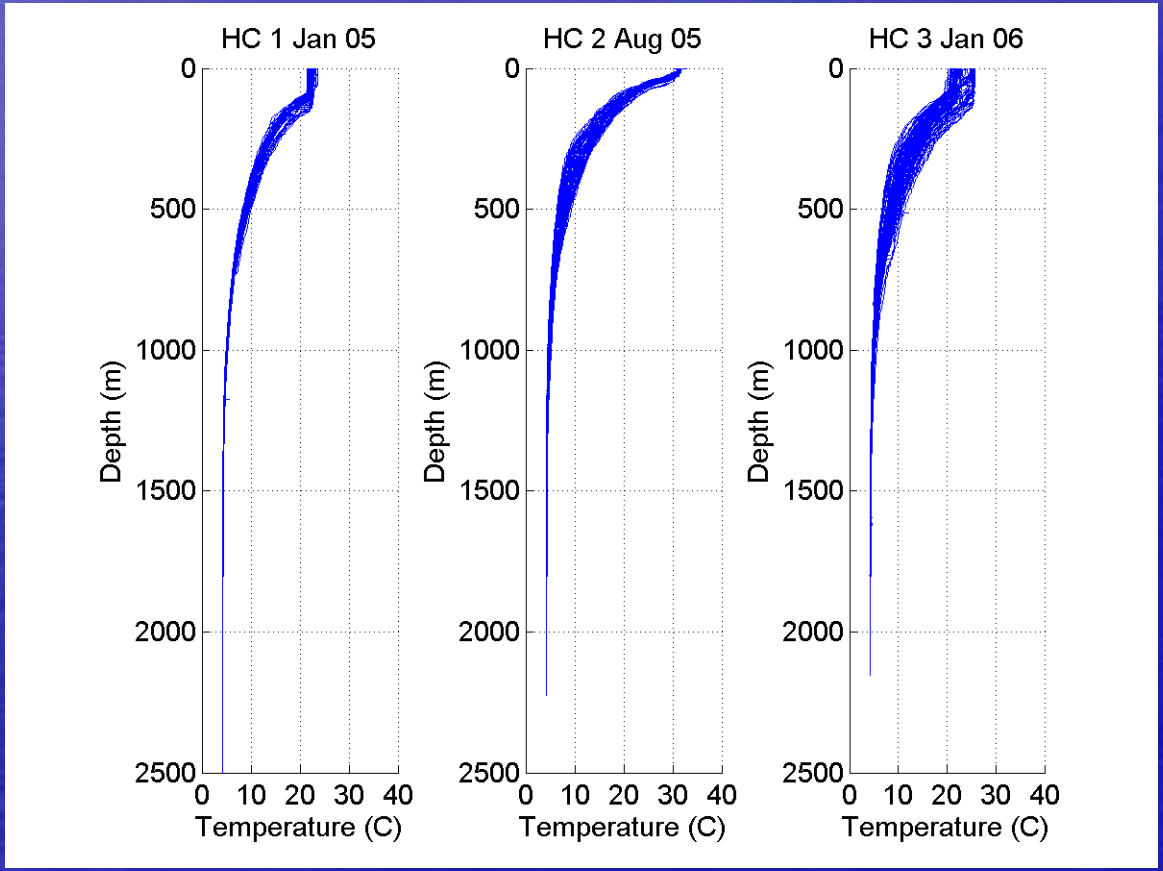
Preliminary Results

XBT and CTD Contour Hydrographic Cruise 3
Transect 4



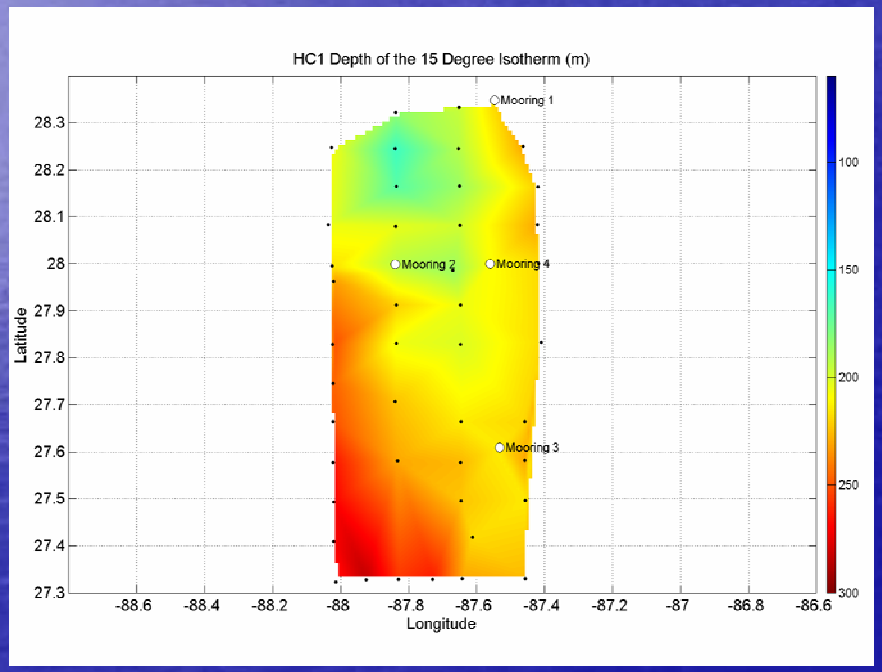
Preliminary Results

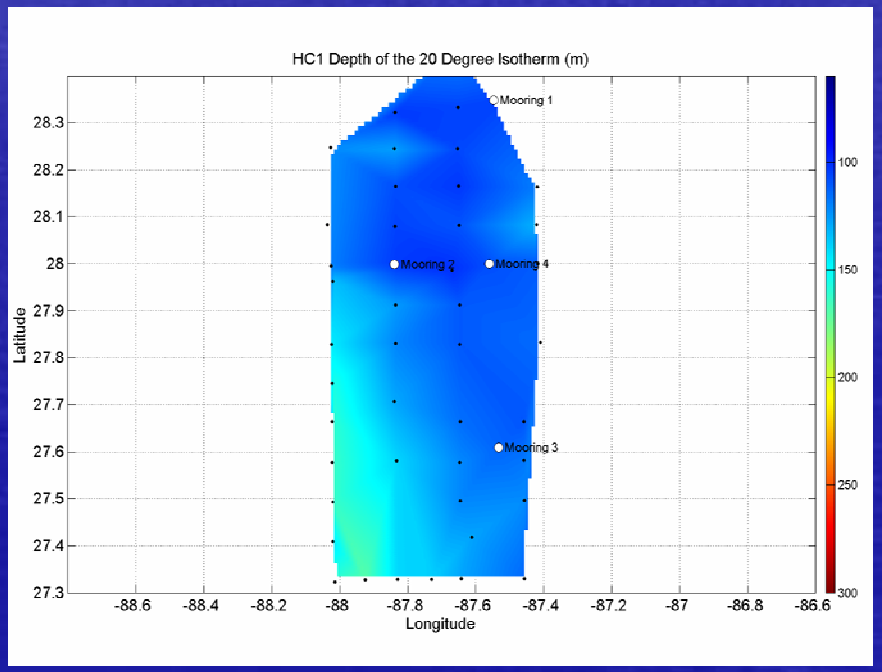
All XBT and CTD Profiles



Preliminary Results

All XBT and CTD Profiles
Hydrographic Cruise 1





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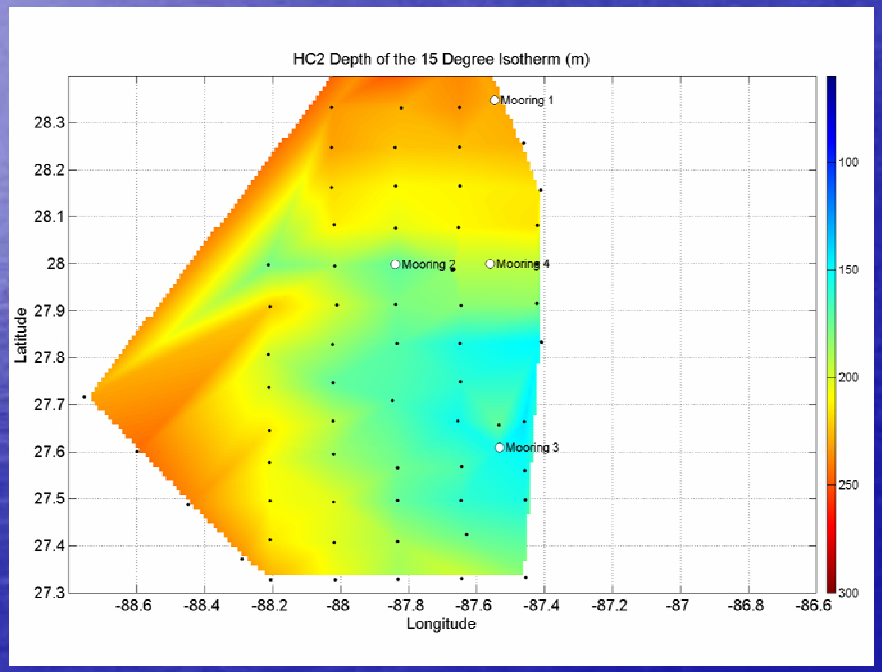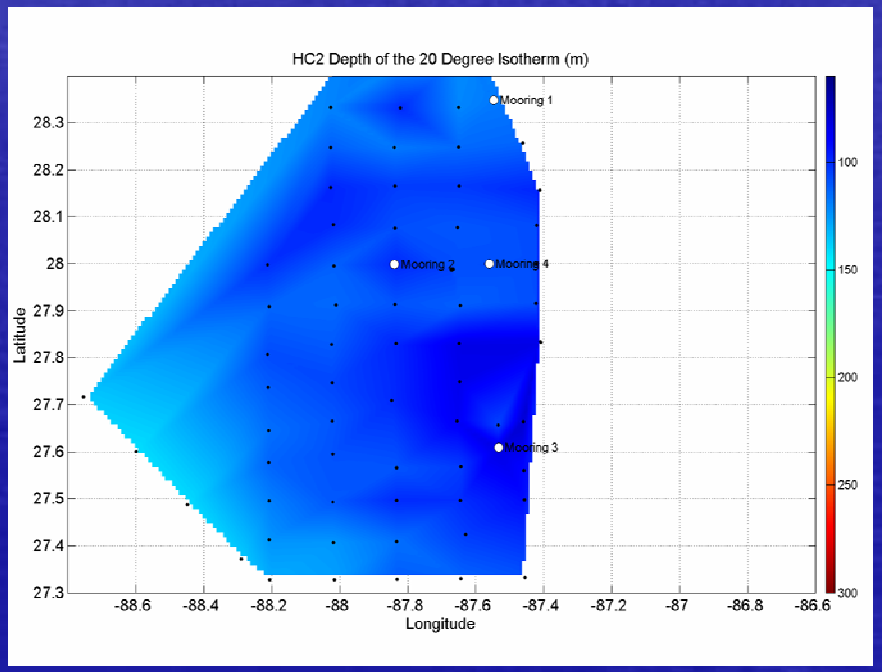
All XBT and CTD Profiles
Hydrographic Cruise 2