PHYSICAL OCEANOGRAPHY

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Environmental Studies Program

Environmental Studies Program (ESP)

Develops and oversees applied scientific studies required for making responsible decisions for managing energy and marine mineral resources on the U.S. Outer Continental Shelf

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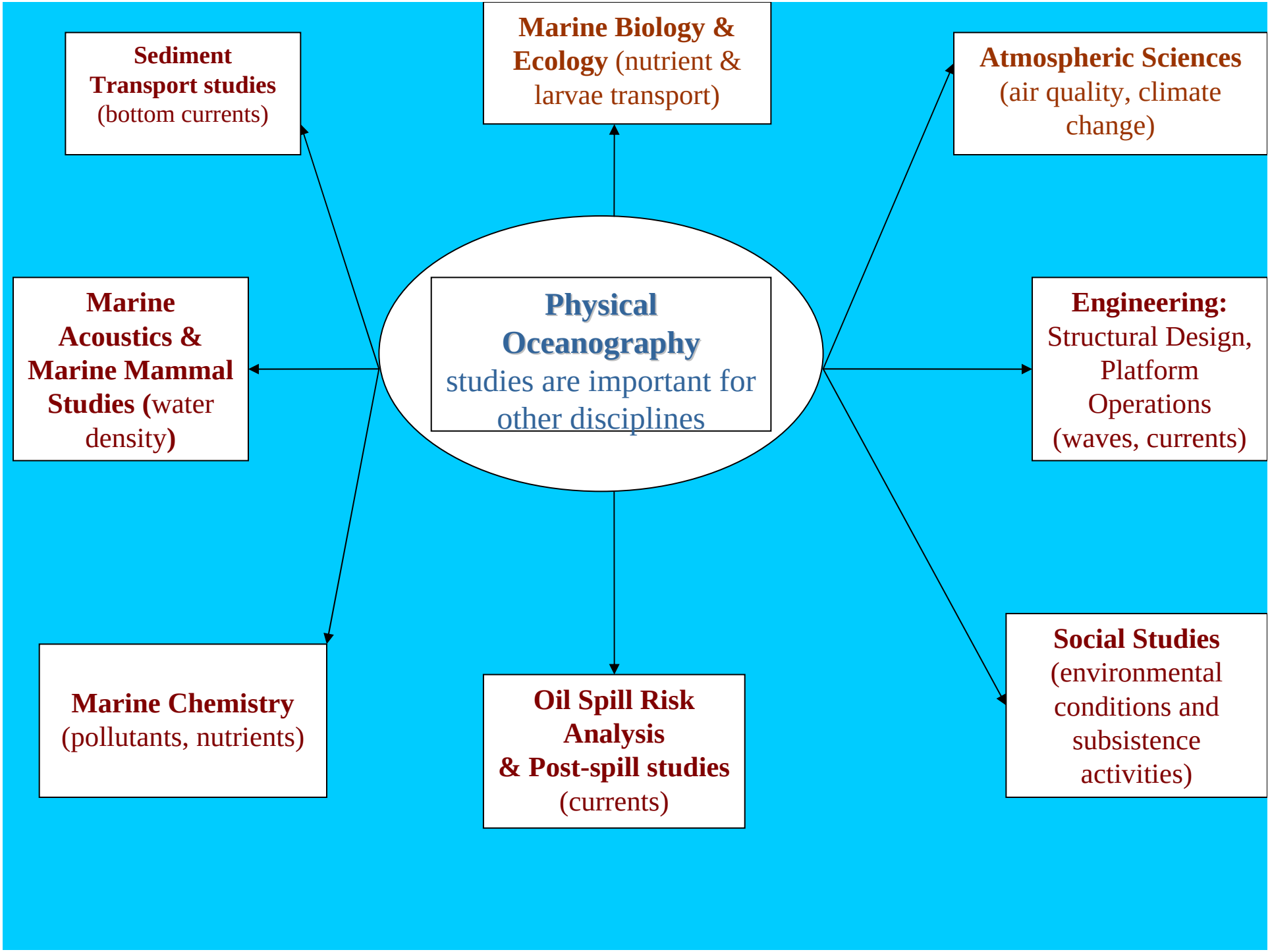

Marine Biology & Ecology (nutrient & larvae transport)
Sediment Transport studies (bottom currents)
Atmospheric Sciences (air quality, climate change)
Marine Acoustics & Marine Mammal Studies (water density)
Physical Oceanography studies are important for other disciplines
Engineering: Structural Design, Platform Operations (waves, currents)
Marine Chemistry (pollutants, nutrients)
Oil Spill Risk Analysis & Post-spill studies (currents)
Social Studies (environmental conditions and subsistence activities)

Examples of ongoing studies

Examples of ongoing/upcoming studies ➔

Chukchi Sea: 2 complementary studies

Gulf of Mexico: shelf-slope sediment exchange

Chukchi Sea Studies

- Physical Oceanography of the Chukchi Sea (ongoing)
- Hanna Shoal Ecosystem Study (just kicked off)

Information need:

- Model validation
- OSRA support
- NEPA analysis
- Oil spill contingency plans

Objectives:

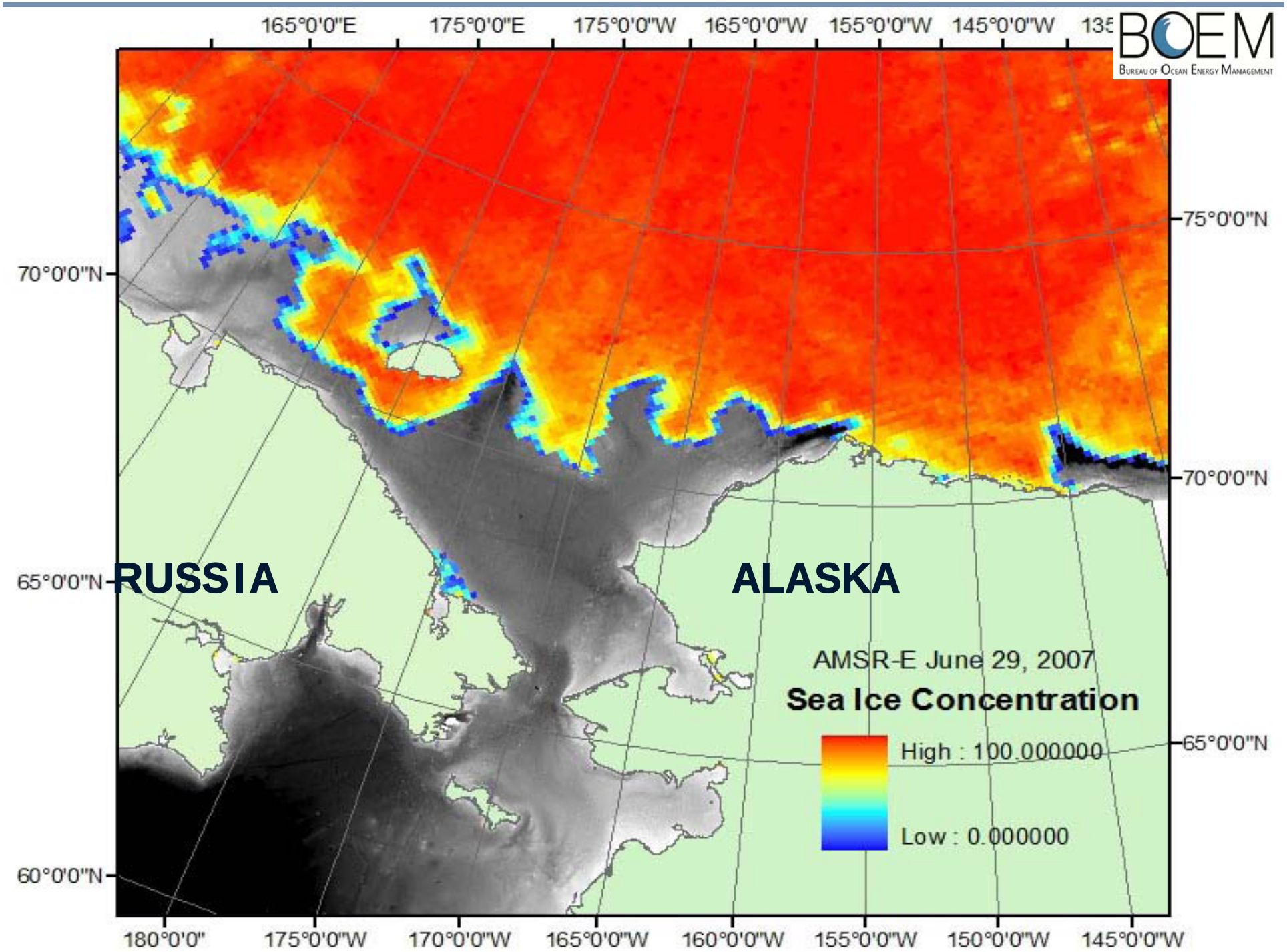
- Characterize surface ocean currents
- Compare HF radar-acquired observations against existing direct (ACDP) and indirect (CTD) observations.

Example 1

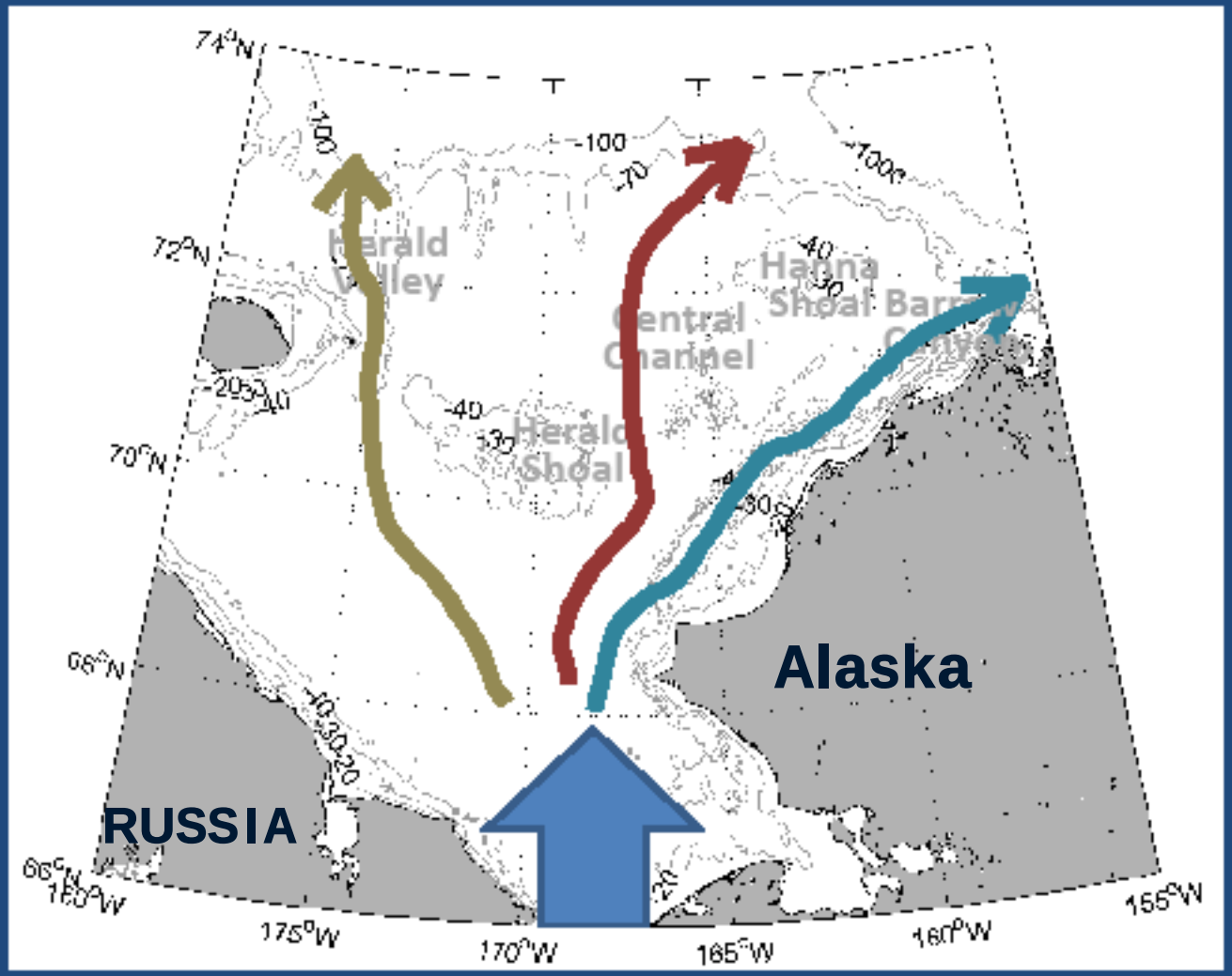
Physical Oceanography of the Northeast Chukchi Sea

Rachel Potter, Seth Danielson, Hank Statscewich, Tom Weingartner, and Peter Winsor
School of Fisheries and Ocean Sciences; University of Alaska Fairbanks

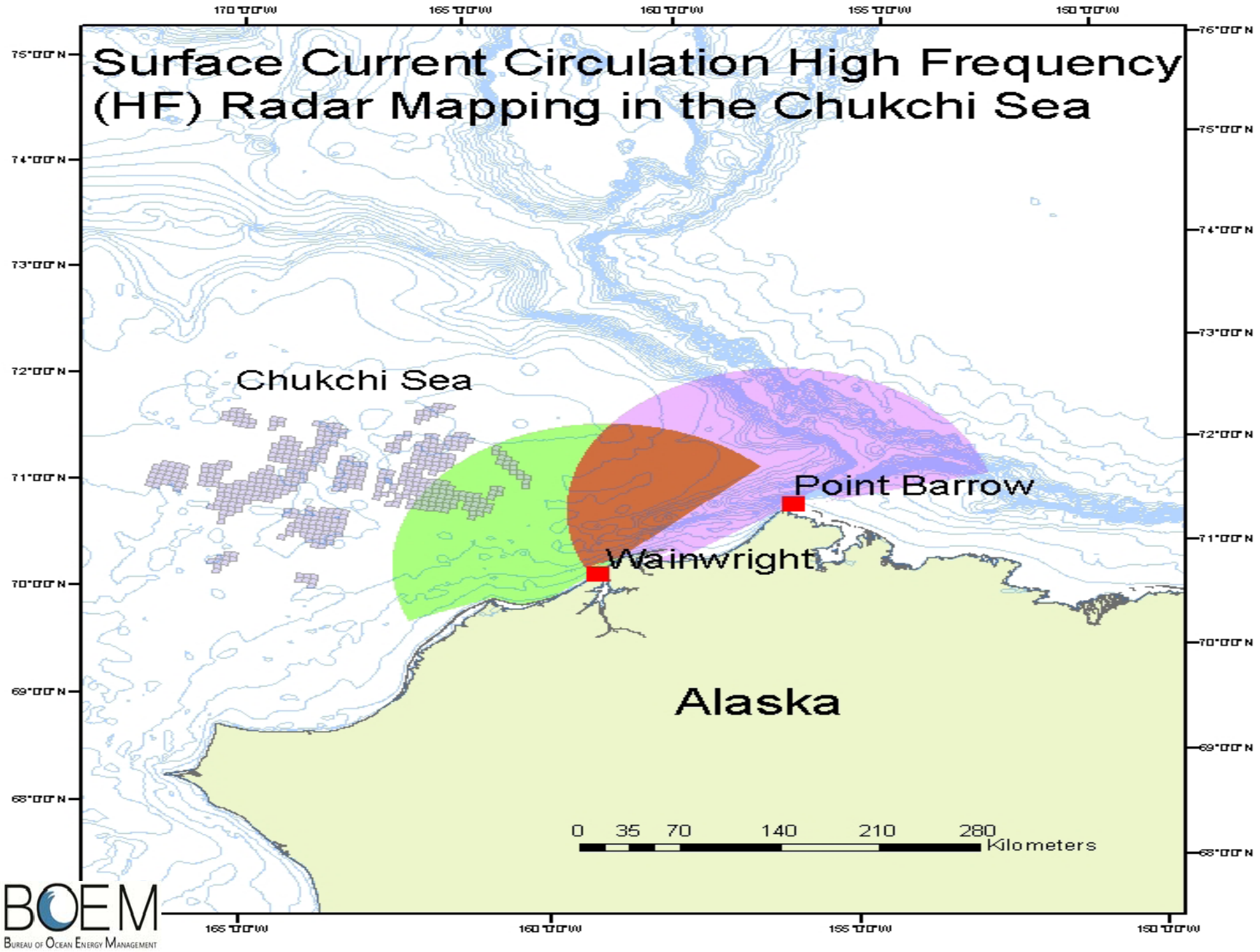
Funding provided by: ConocoPhillips


165°0'0"E
175°0'0"E
175°0'0"W
165°0'0"W
155°0'0"W
145°0'0"W
75°0'0"N
70°0'0"N
65°0'0"N
60°0'0"N
180°0'0"
175°0'0"W
170°0'0"W
165°0'0"W
160°0'0"W
155°0'0"W
150°0'0"W
145°0'0"W
RUSSIA
ALASKA
AMSR-E June 29, 2007
Sea Ice Concentration
High : 100.000000
Low : 0.000000

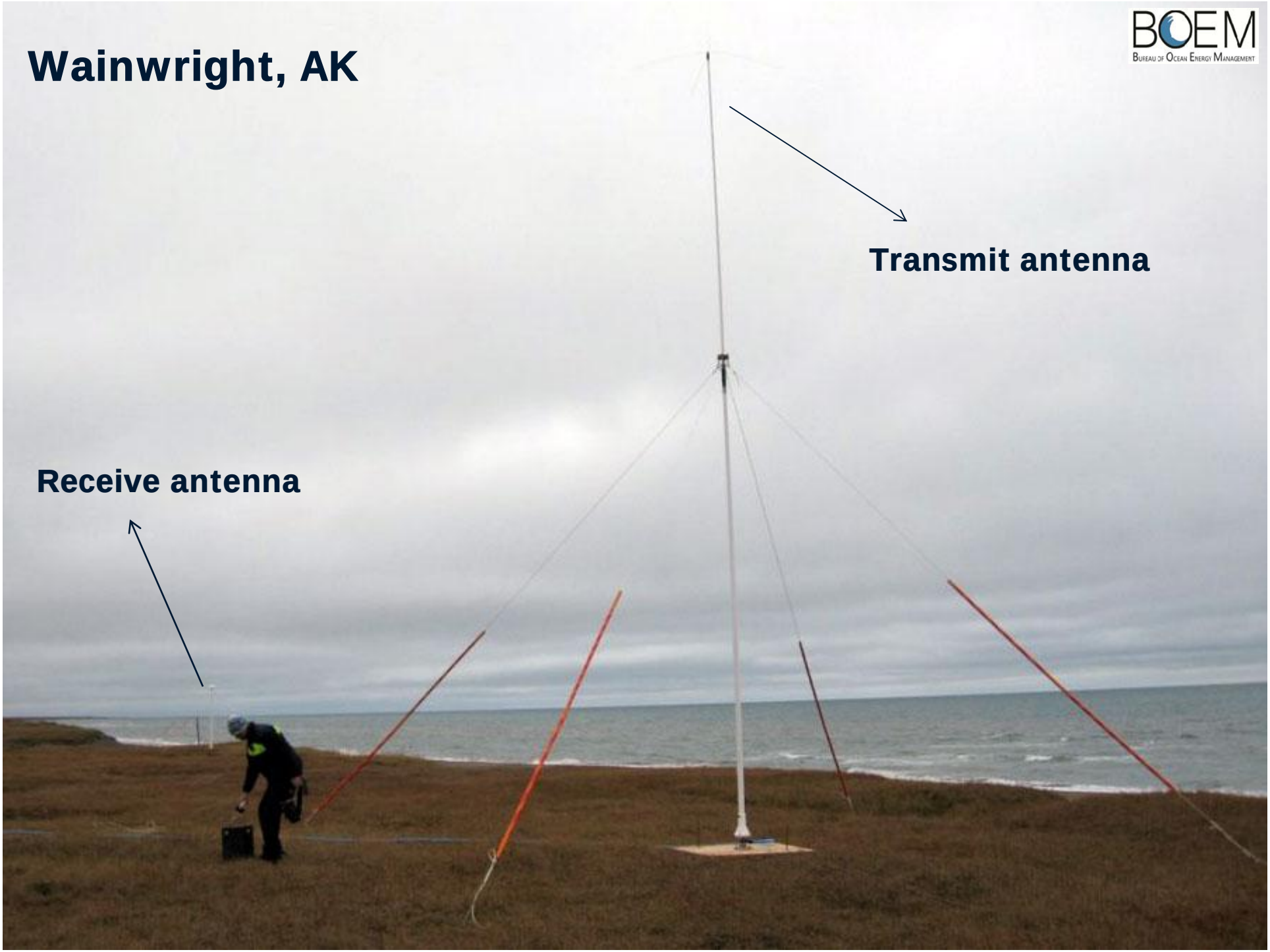
Bathymetry Steers Currents

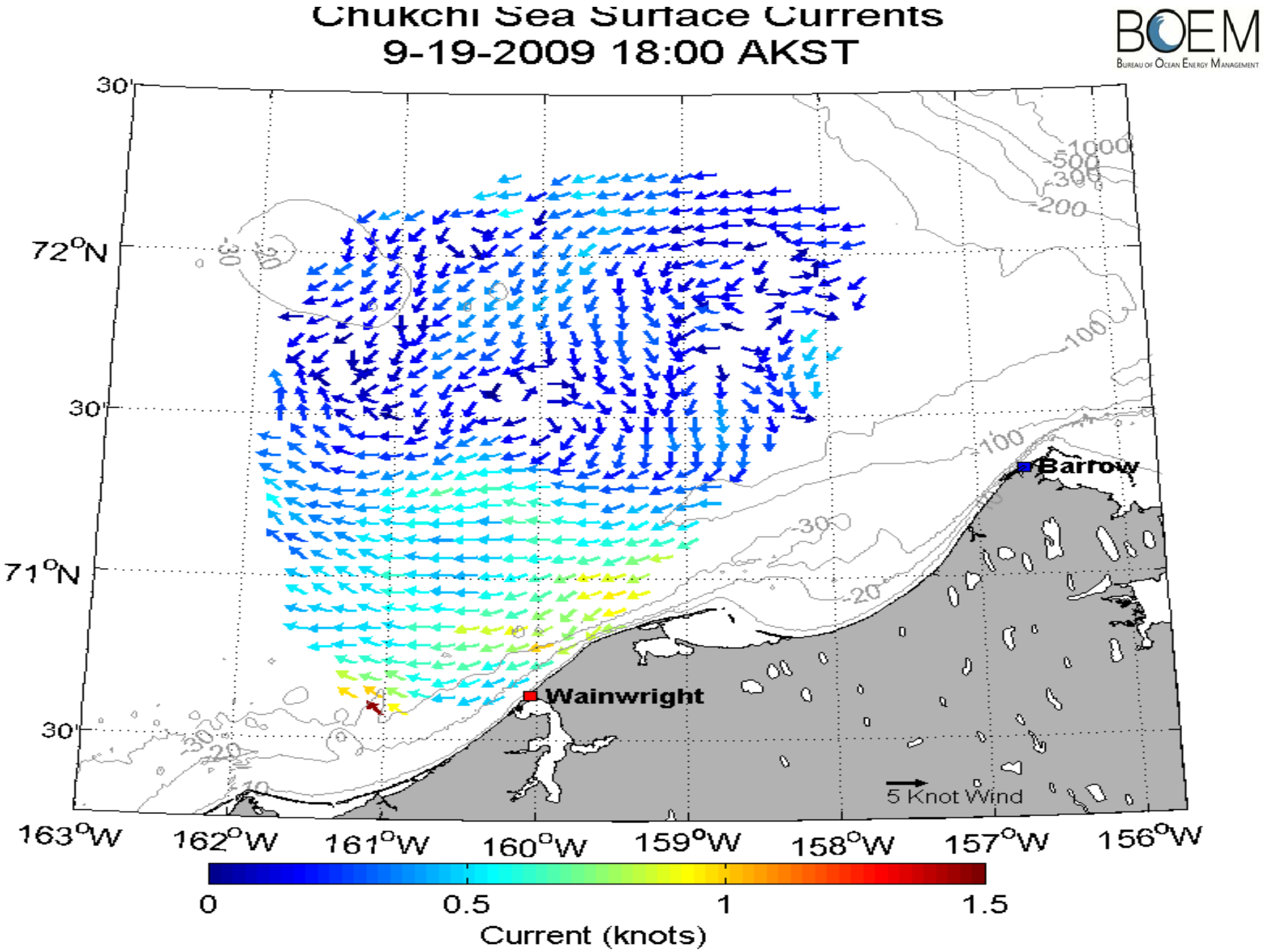


- Shallow Shoals
- Deeper Canyons and Channels
- Mean northward flow due to pressure gradient from Pacific to Arctic
- Flow field follows the deeper areas


Surface Current Circulation High Frequency (HF) Radar Mapping in the Chukchi Sea
Chukchi Sea
Point Barrow
Wainwright
Alaska
0 35 70 140 210 280
Kilometers
BOEM
Bureau of Ocean Energy Management

Wainwright, AK




Chukchi Sea Surface Currents
9-19-2009 18:00 AKST
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72°N
71°N
30'
163°W
162°W
161°W
160°W
159°W
158°W
157°W
156°W
Barrow
Wainwright
5 Knot Wind
-1000
-500
-300
-200
-100
-30
-20
-10
0
0.5
1
1.5
Current (knots)

Variables measured:
Temperature, Salinity, Ice, Circulation, Nutrients, Chlorophyll.

- Brown lines:
  - locations of hydrographic and zooplankton data collection;
- Red dots:
  - location of moorings

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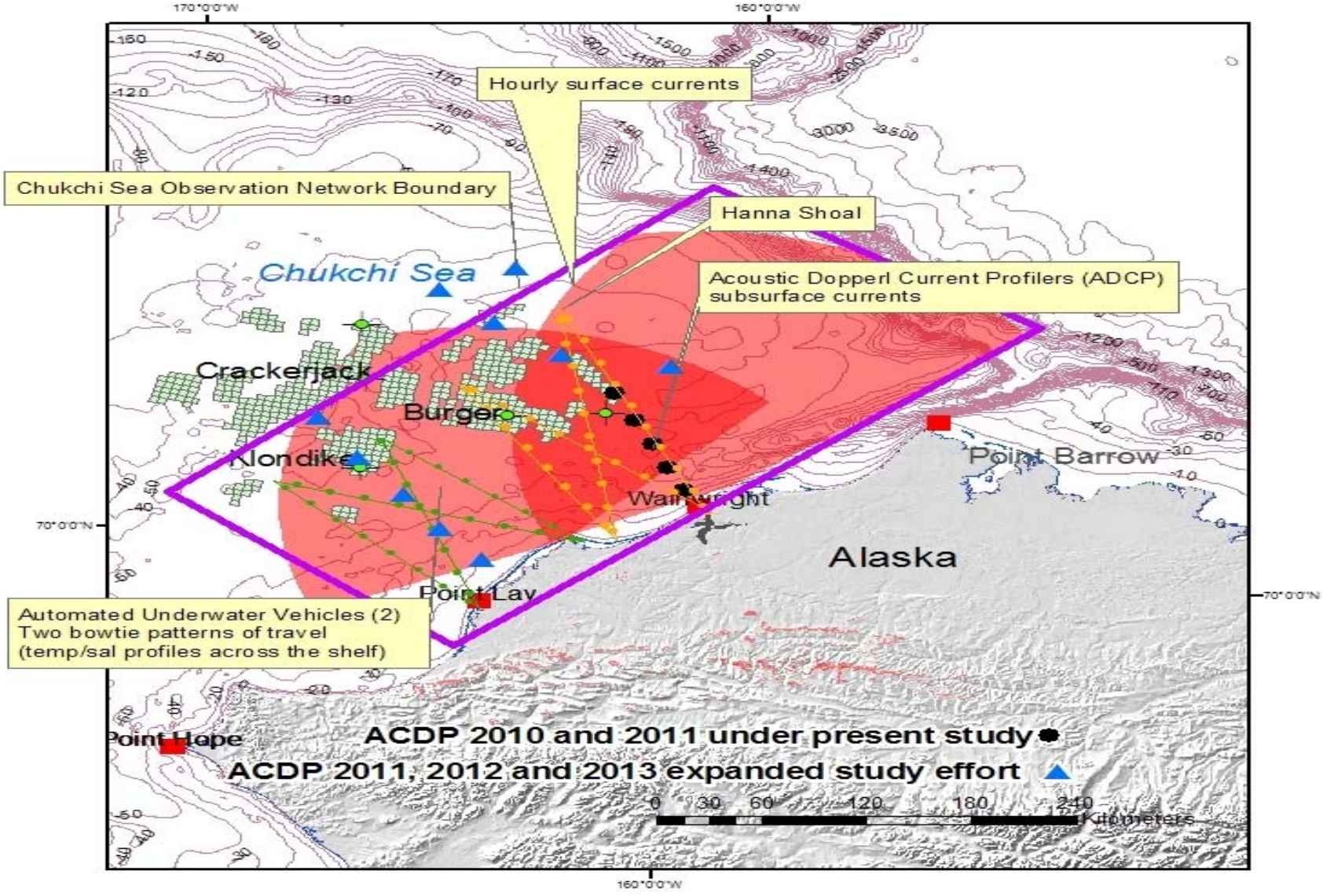
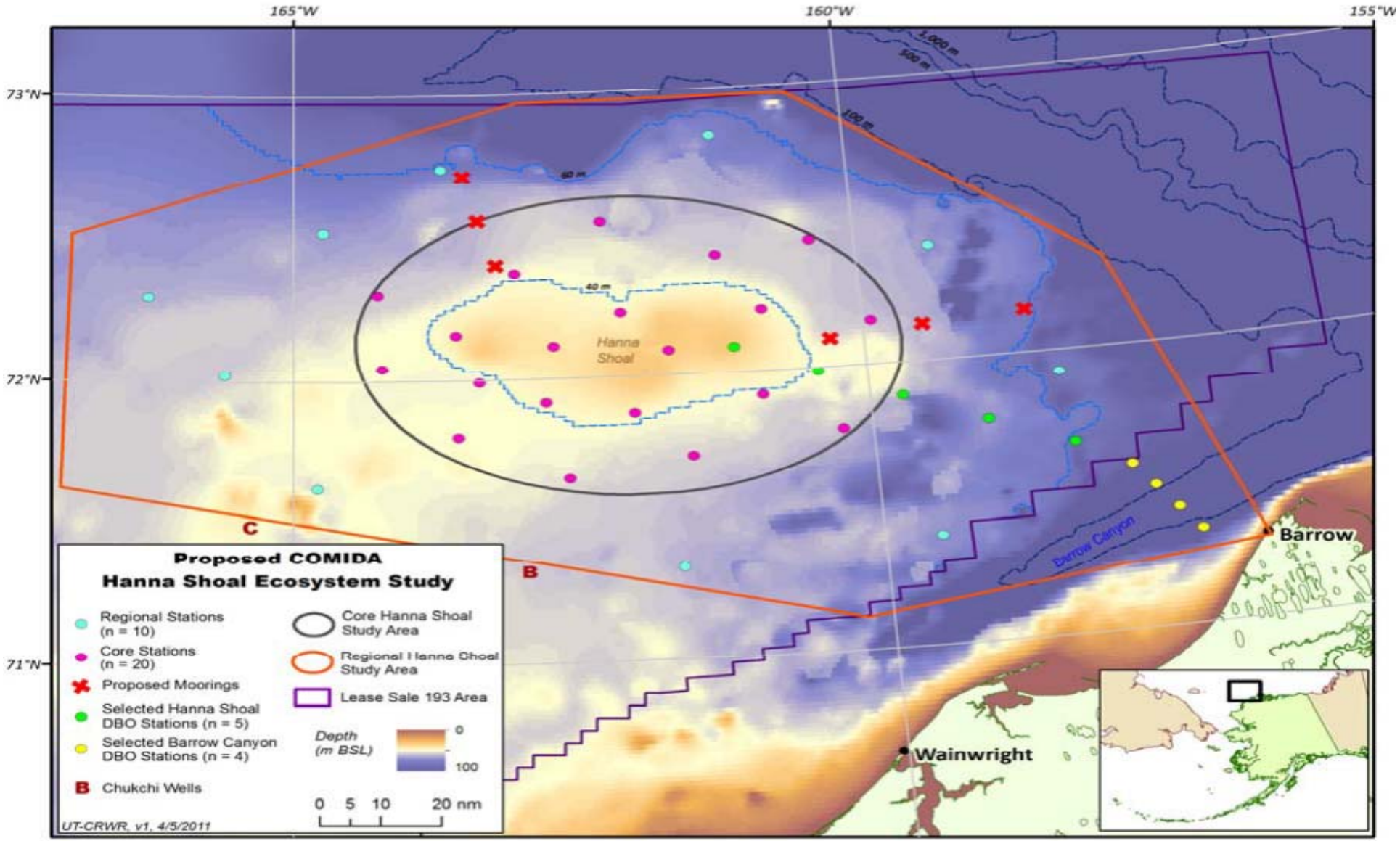
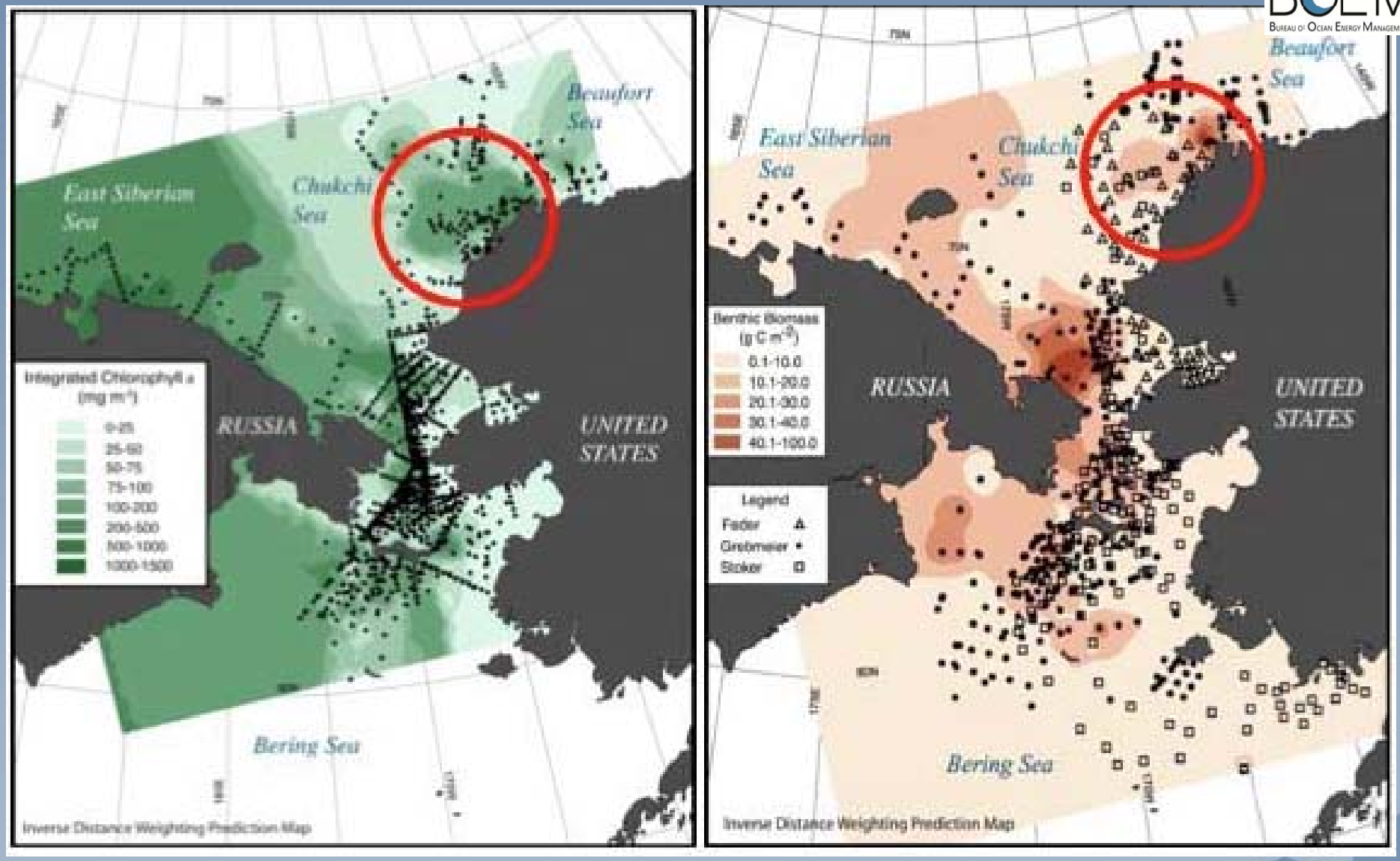
Physical Oceanography of the Chukchi Sea OCS
Surface and subsurface current measurements



2.- Hanna Shoal Ecosystem Study

Started: September of 2011 (5 year study)





Multi-decadal time series (distribution of integrated water column chlorophyll (left panel) and benthic biomass (right panel) over four decades in the Pacific sector (from Grebmeier et al., 2006a).

Disciplines to be studied at and around Hanna Shoal:

- Physical: circulation and ice conditions
- Biological: conceptual food web model
- Chemical: focus on denitrification
- Sediments: hydrocarbons baseline
- Interdisciplinary: impacts & feedbacks)

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3.- Shelf-slope sediment exchange in the northern Gulf of Mexico during extreme events

Information Needs

•Oil spill & fate studies

•NEPA analysis

•Water quality and benthic communities studies

Objectives

- Sediment response to extreme events
- Areas (e.g., canyons) which are more prone to turbidity current activity
- Minimum flow speed triggering turbidity currents and sediment transport

This BOEM-funded study builds on previously funded efforts by *NOAA, NSF, ONR* and *CSDMS*

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-> ONR funded several stages in the development of ROMS

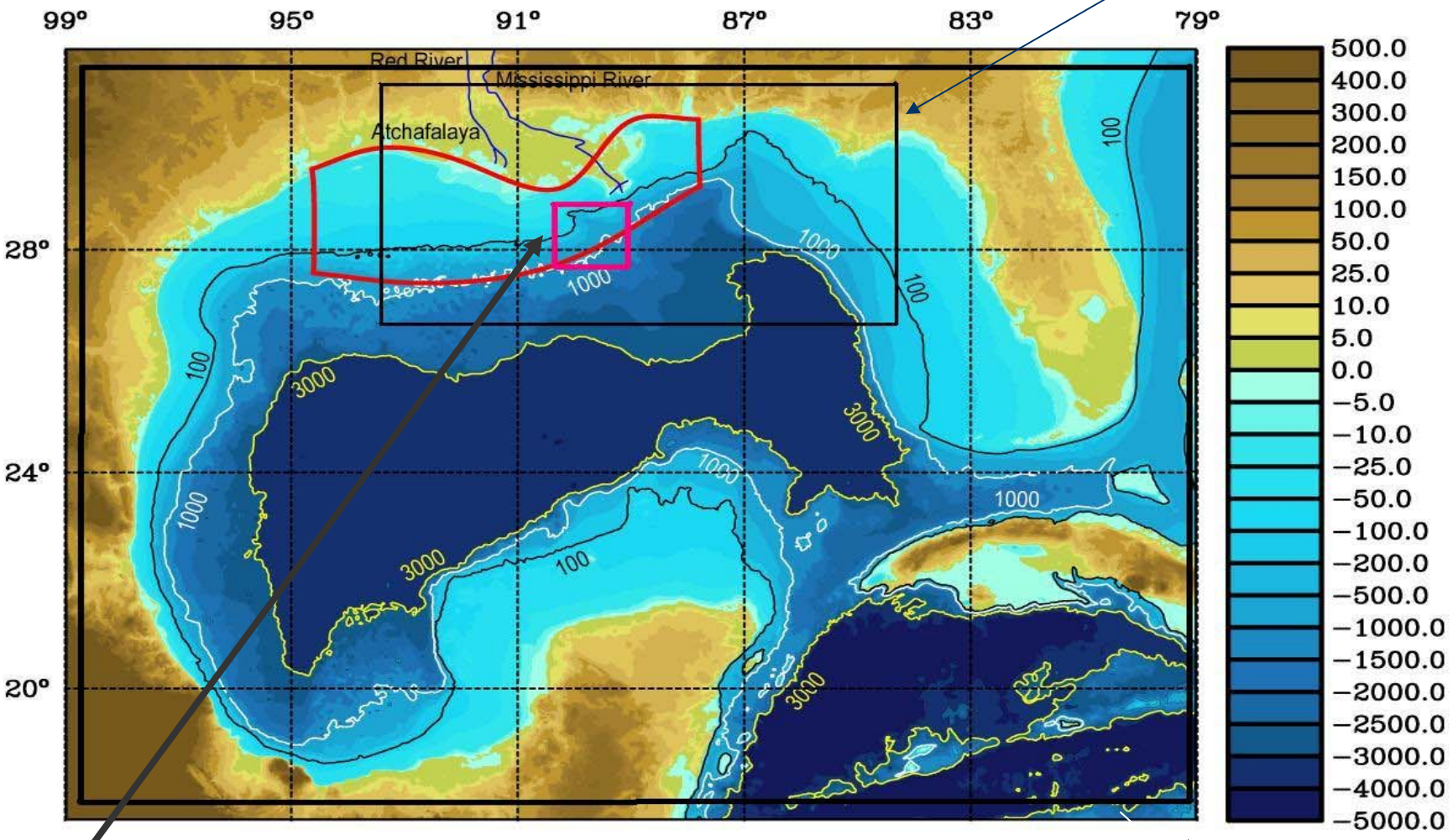
-> NSF funds the CSDMS

CSDMS
COMMUNITY SURFACE DYNAMICS MODELING SYSTEM

-> CSDMS is providing supercomputer time and coupling software

-> NOAA has been funding the coupling of of ROMS' sediment and biogeochemical models.

TENTATIVE GRID AND RESOLUTIONS



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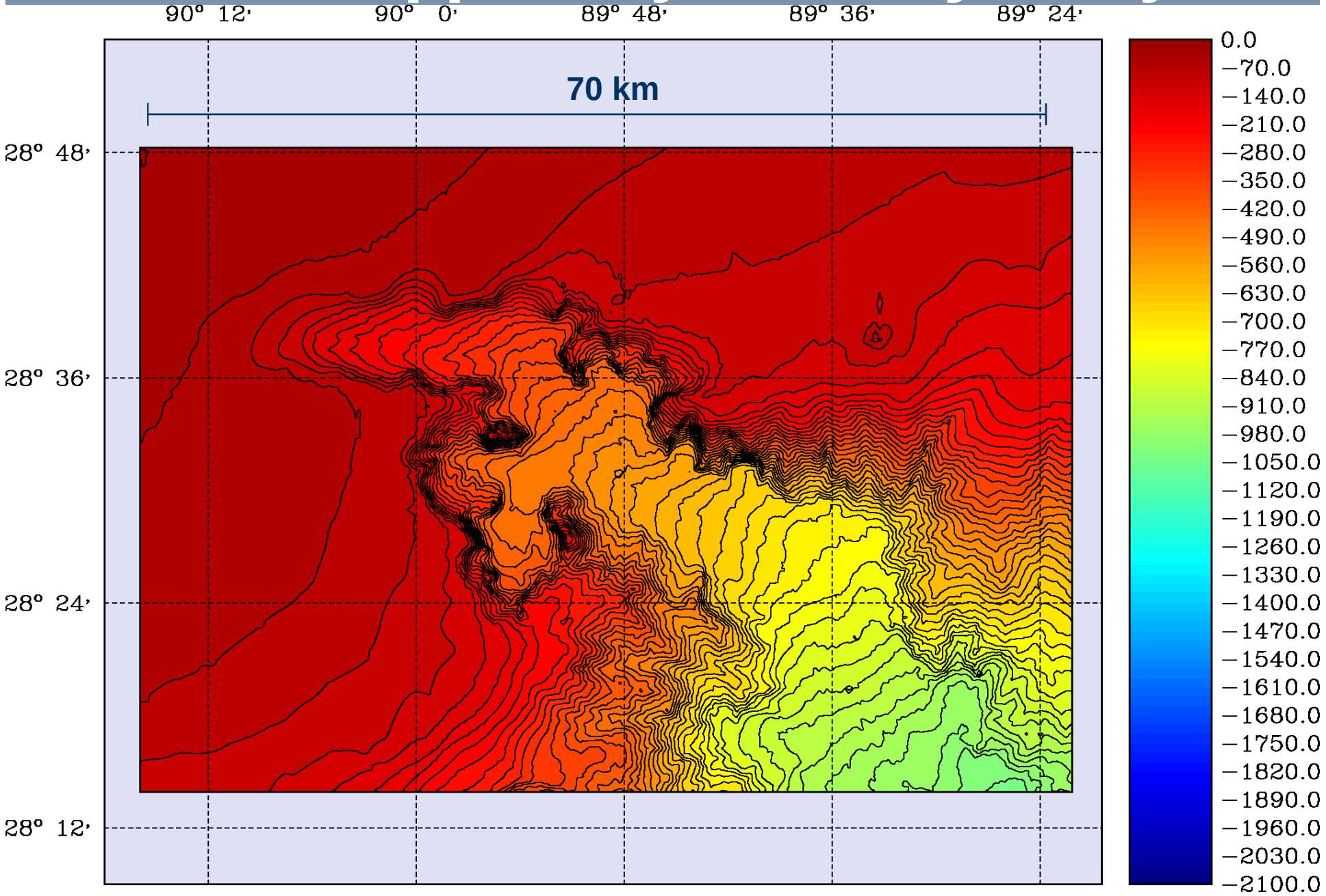
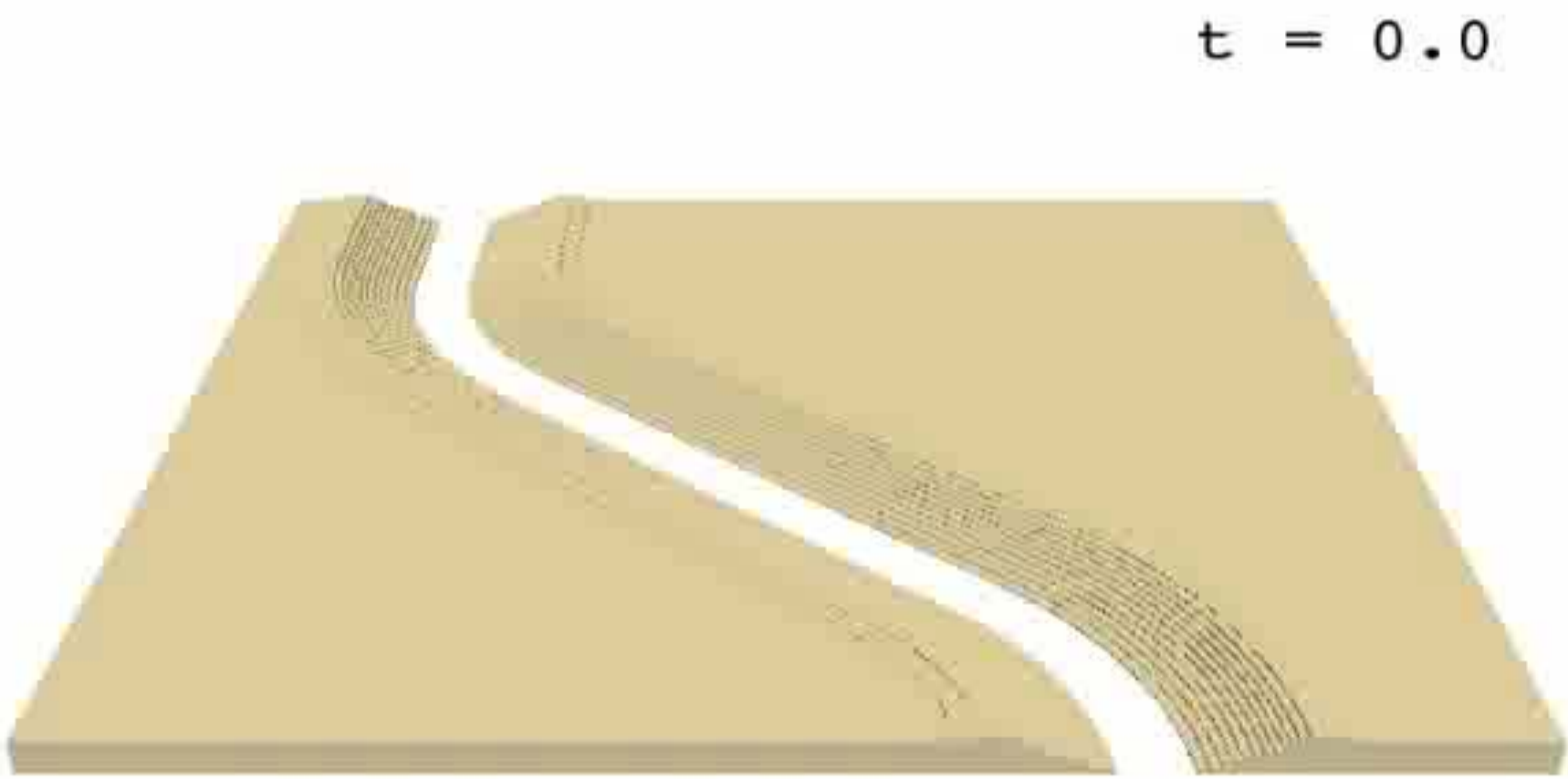
Mississippi Canyon Bathymetry



Turbidity Current down a submarine canyon

Model simulation by Prof Meiburg's lab (UCSB)

(Generic Canyon)



What's in the works in Physical Oceanography at BOEM ?

Many studies in all regions of the OCS, e.g., multi-disciplinary, 4D, integrated study with gliders somewhere in the OCS.…partners sought!