Studies in the Coal Oil Point Marine Hydrocarbon Seep Field

where oil and gas meet sea and surf

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Prevention First
Sept 12-13, 2006
Long Beach, California

www.bubbleology.com

Thanks to the support of

California State Lands Commission

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In collaboration with

Office of Spill Prevention and Response

Department of Fish and Game

Division of Oil Gas and Geothermal Resources

University of California Energy Institute

Clean Seas

NASA

National Science Foundation

NOAA

Mineral Management Service

US Geological Survey

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Study Goals

- Estimate total oil and gas emissions
- Identify sources of emission variability
- Predict the fate of emitted oil
- Identify major sources of tar on area beaches

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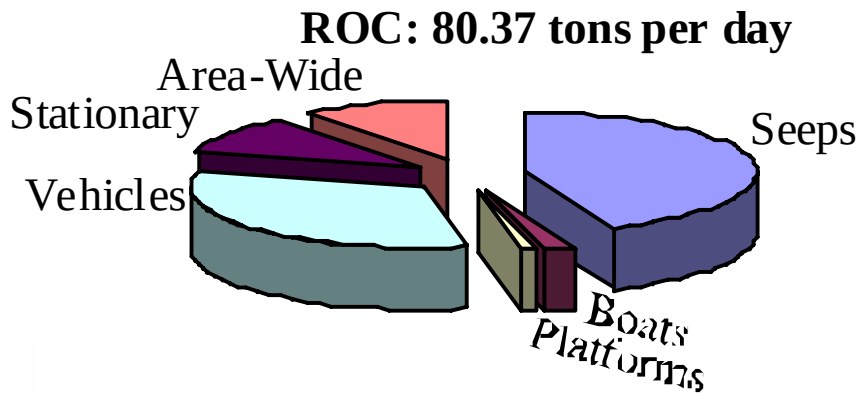
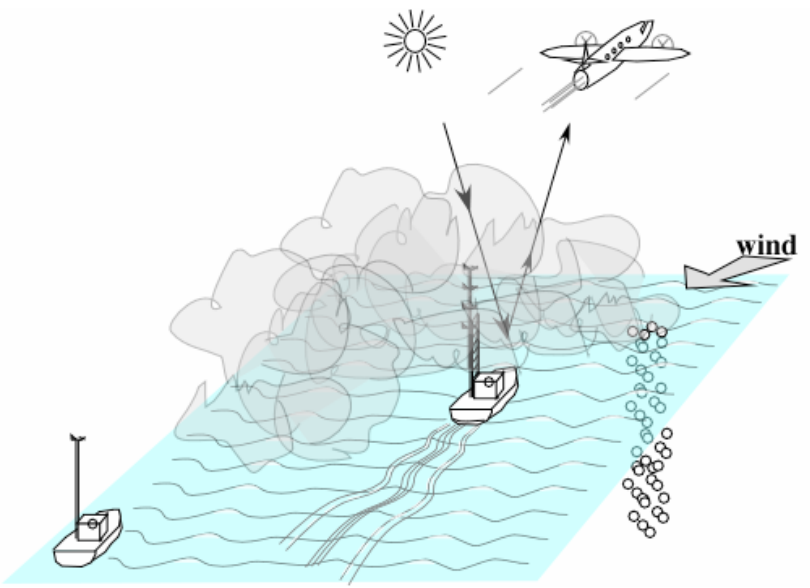
Seep Studies are Relevant!

Seeps are a major pollution source that stresses humans and the environment.





The Coal Oil Point Seep Field is an *ideal* natural laboratory to study oil in the ocean

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Wise words of KK - Its the oil!!

Caveat (it's the methane too - a potent GHG 22 times more powerful than CO2)

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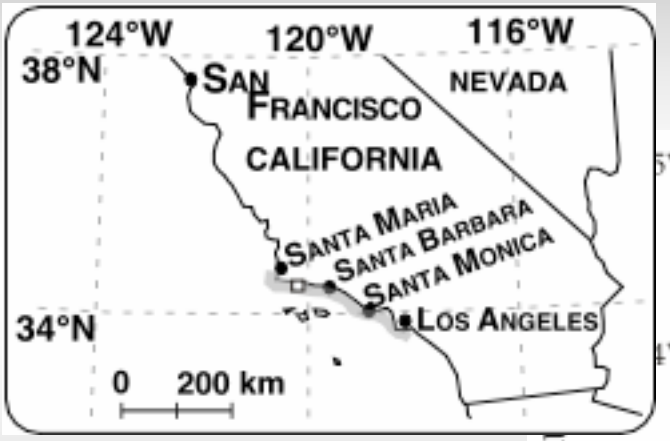
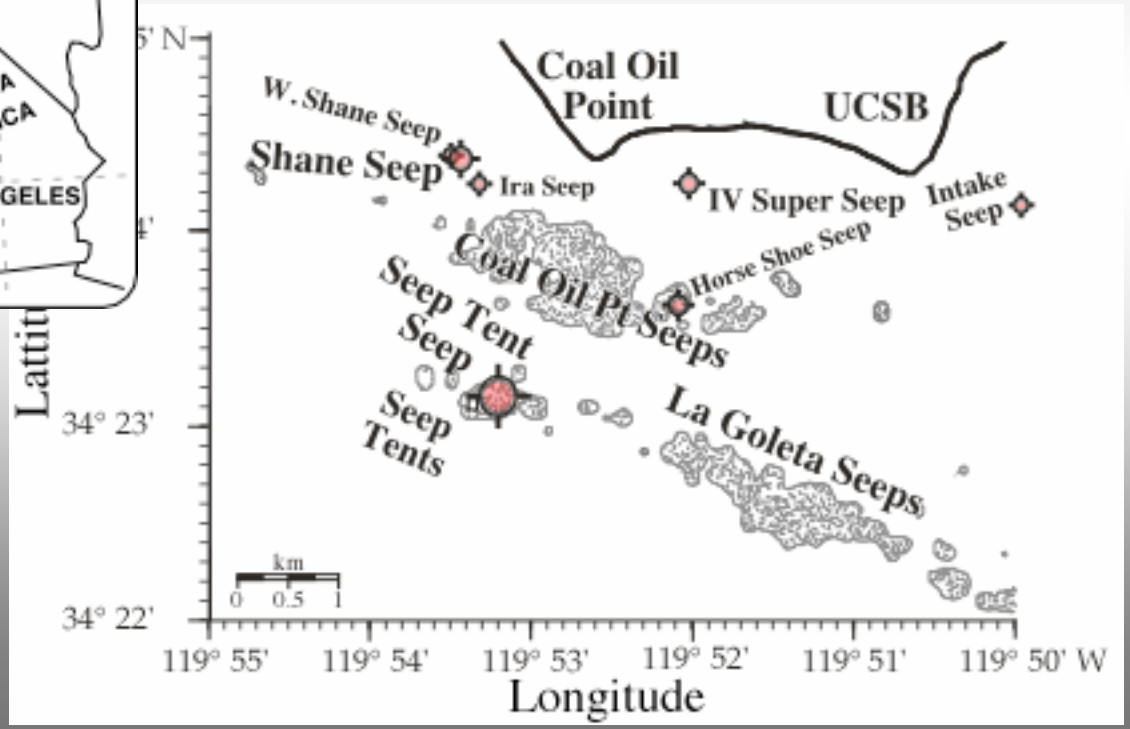
Where is the Coal Oil Point seep field?





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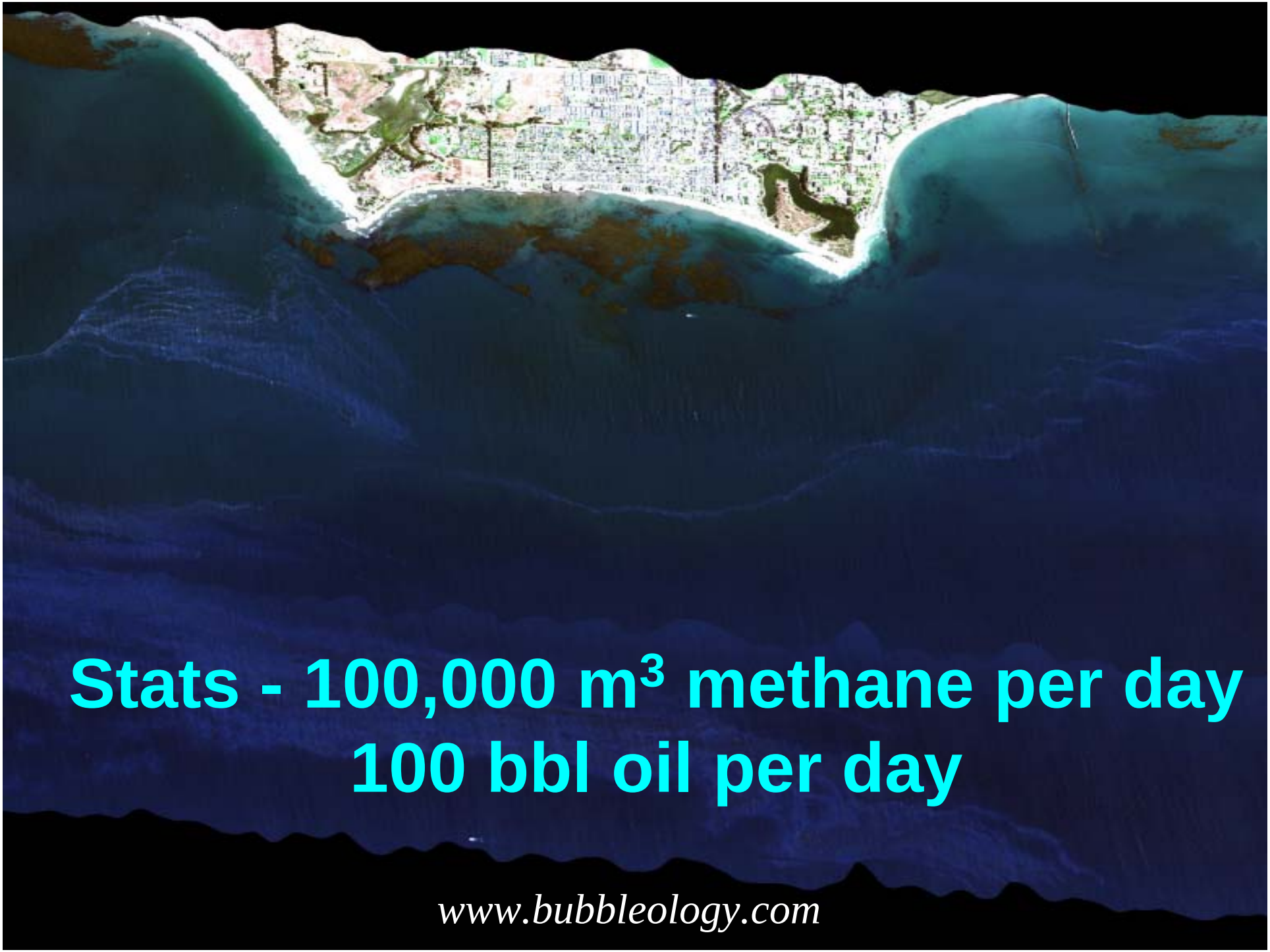
Stats - 100,000 m³ methane per day
100 bbl oil per day
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That’s one exxon valdez every
5-7 years
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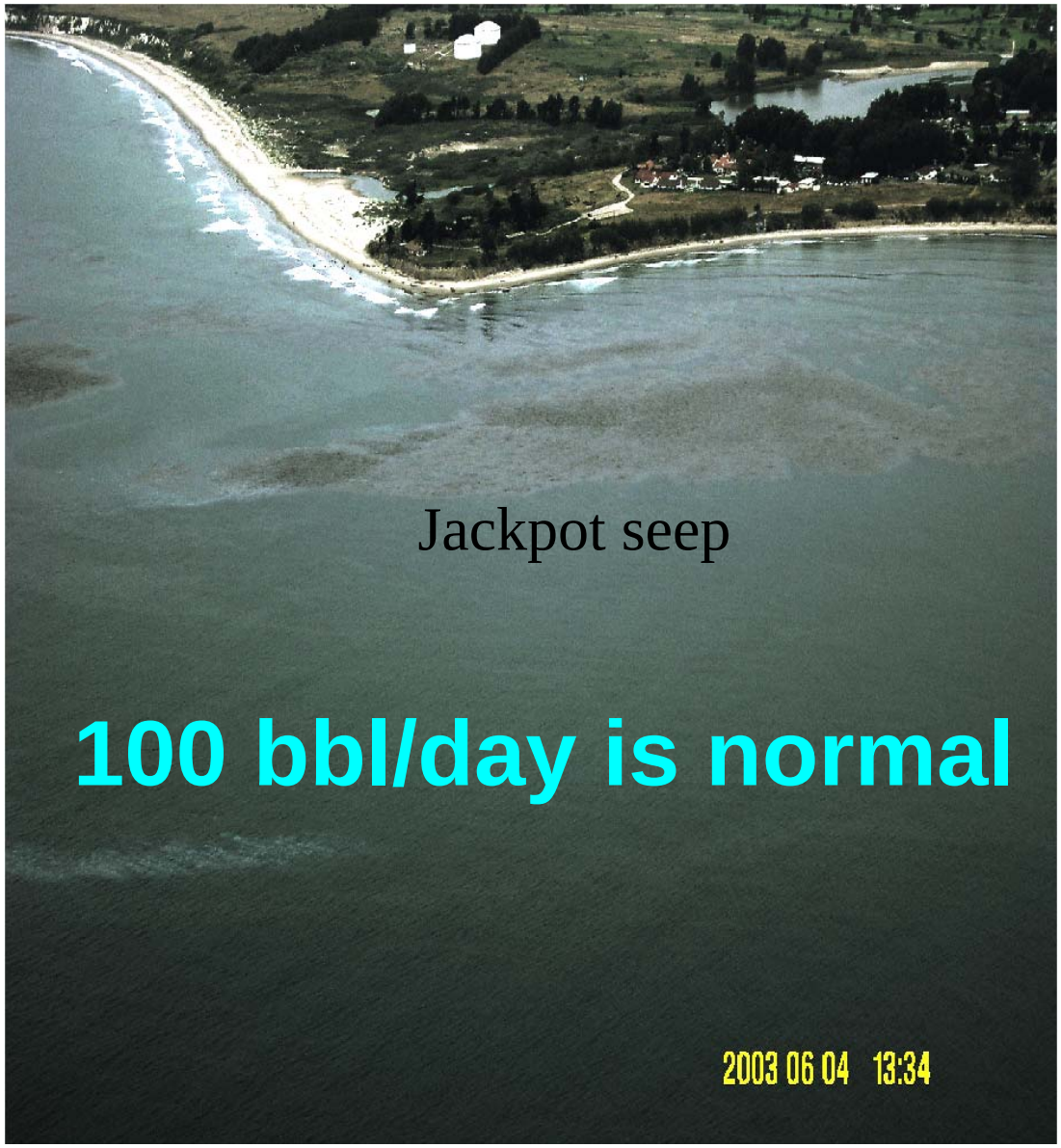

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OIL
Jackpot seep
KELP
Some days are not normal!
Trilogy
GAS SEEP
PLUMES
www.bubbleology.com

So what happens on a bad day?

www.bubbleology.com

Then where does the tar come from?

Where does the tar come from?

Oil slicks advected by winds and currents and aged by the sun and evaporation and other processes

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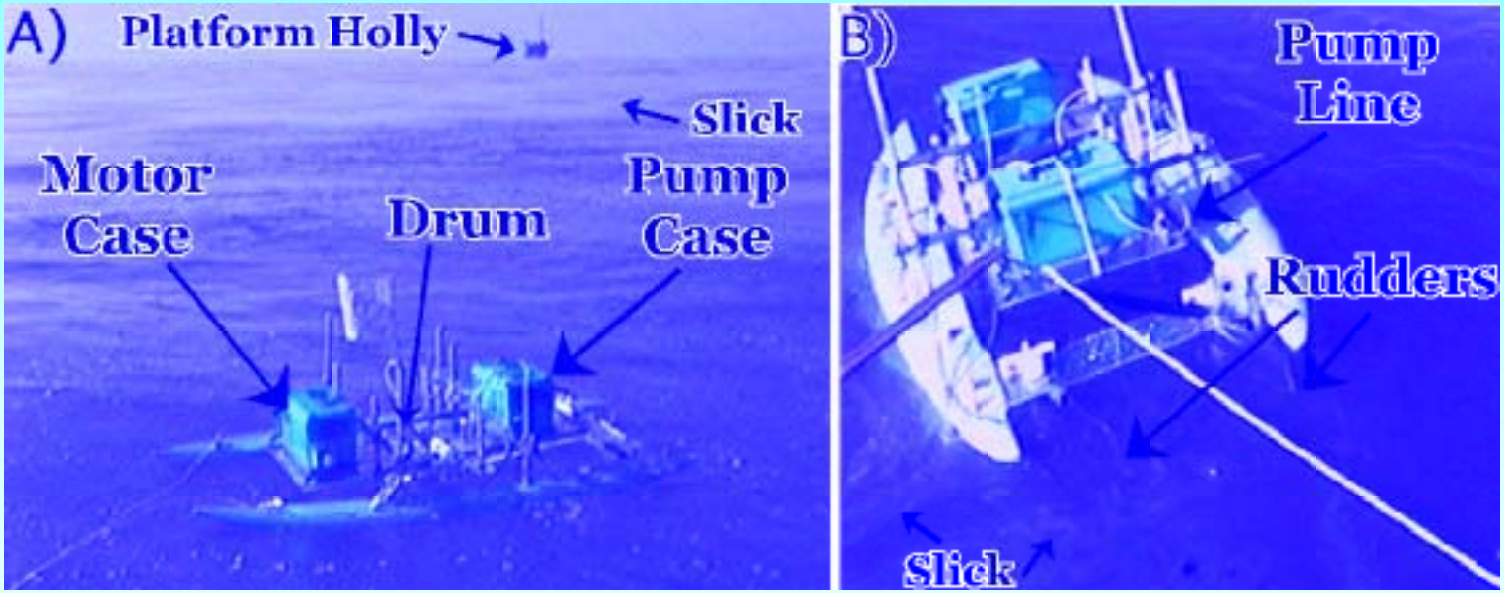
Tool for studying oil slick evolution CATDRUMs - Catamaran Rotating Drum Slick Sampler



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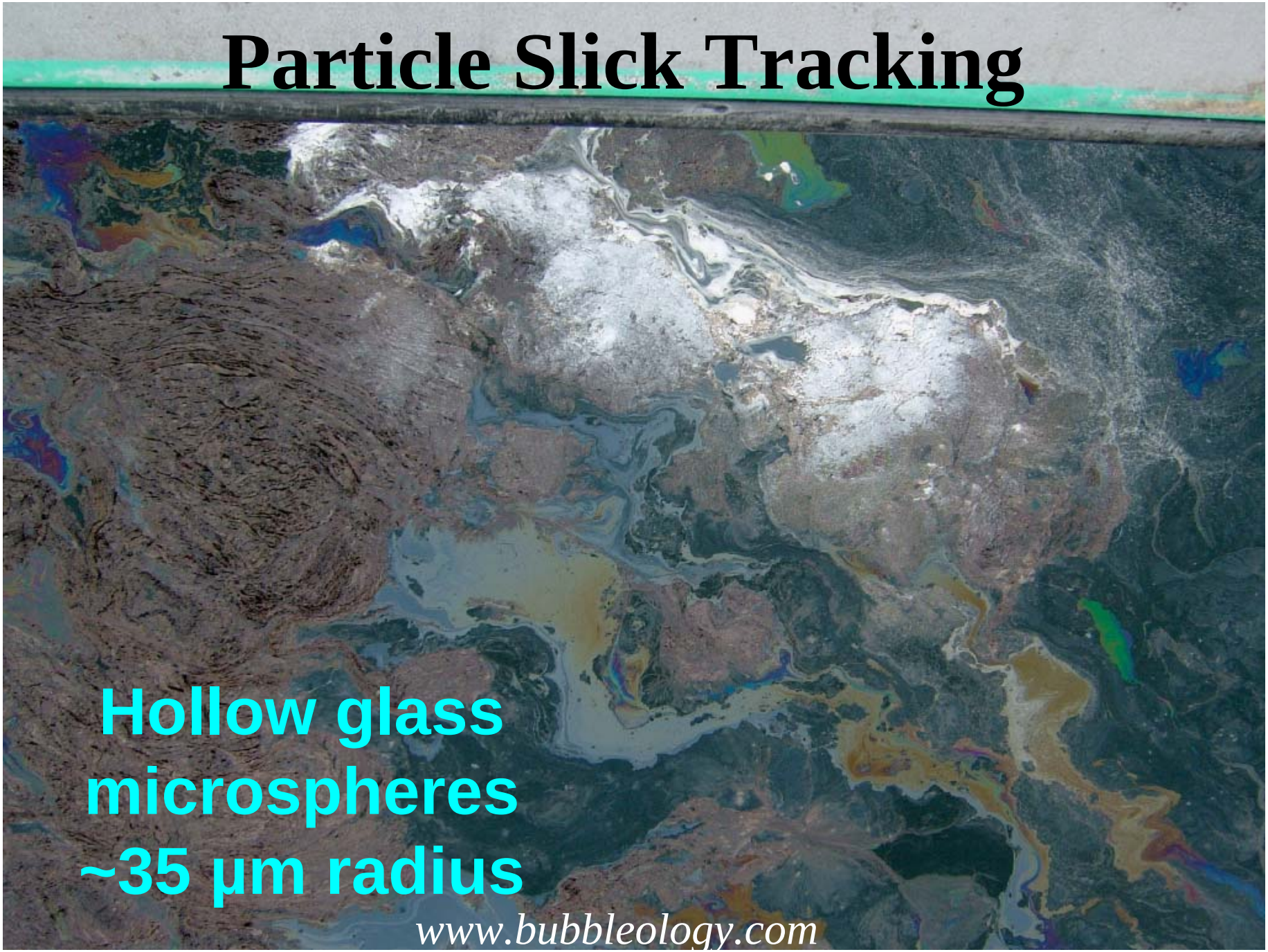
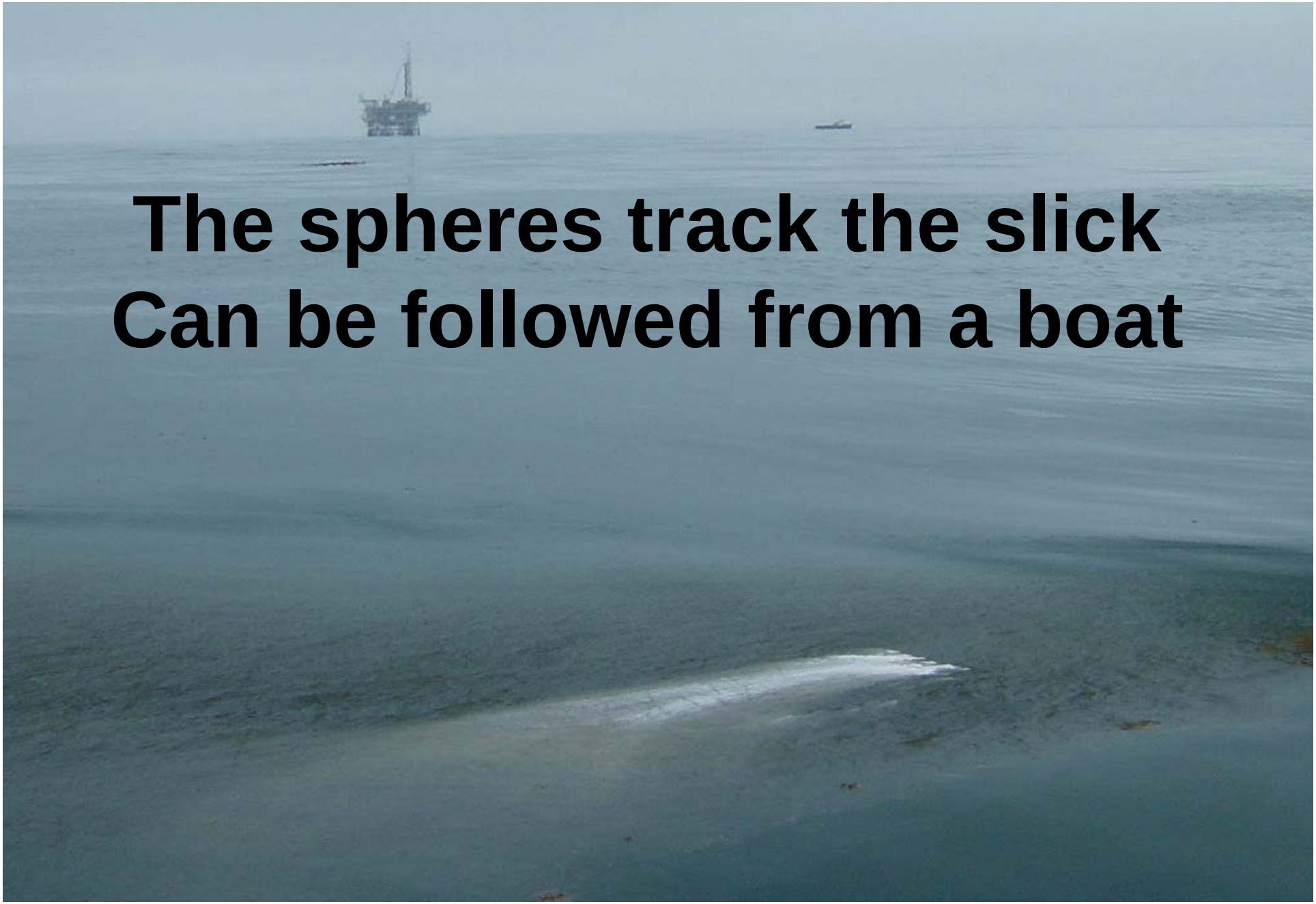
Particle Slick Tracking





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and are visible from the air

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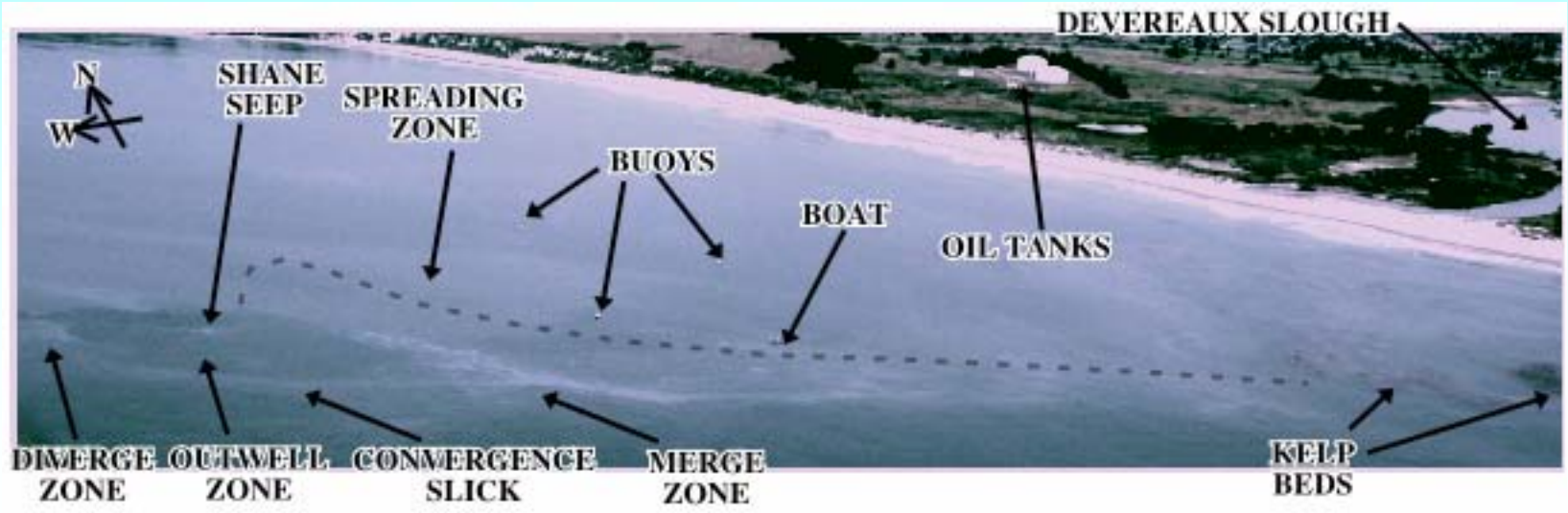
On this day, the slick tracked almost due east



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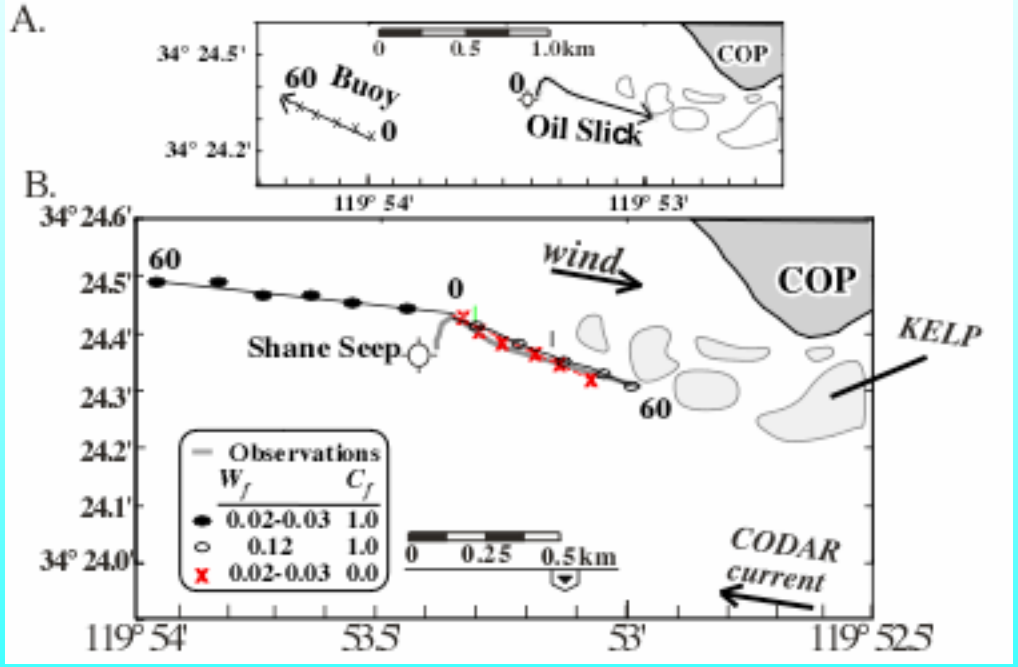
while the slick tracked east . . . a drift buoy tracked NNW



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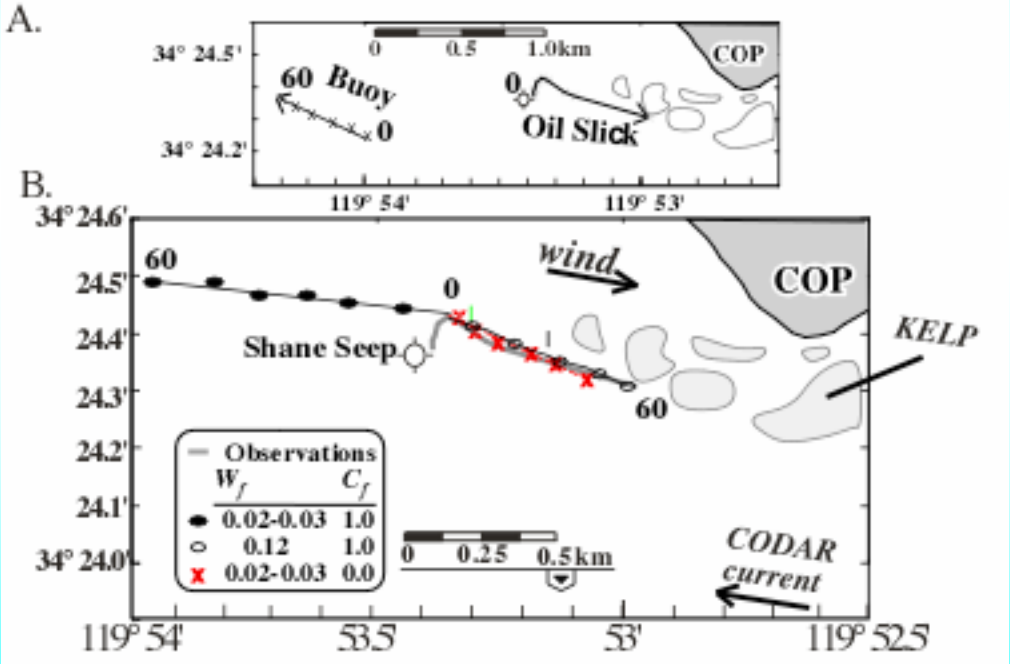
Standard model run
Predicted slick to track WNW



Model - NOAA GNOME

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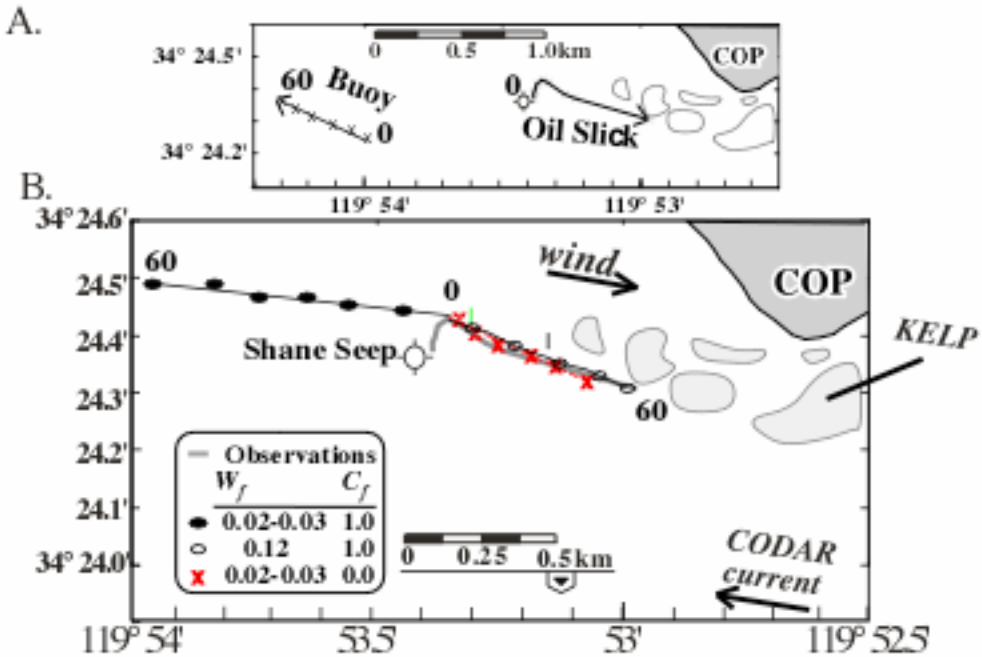
Introduction of a current factor allowed model to track the true slick trajectory



Slick tracking studies improve modeling capabilities.

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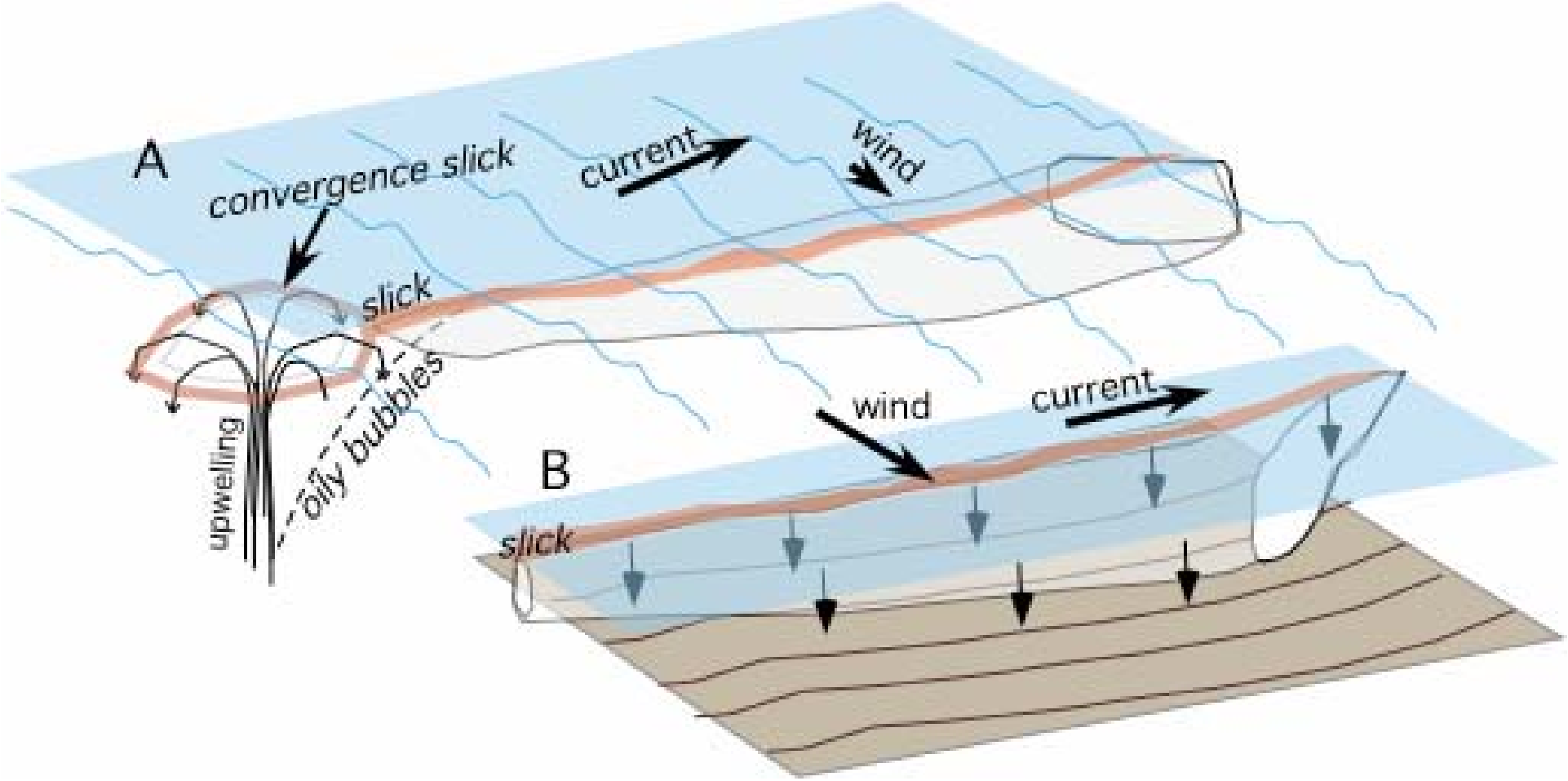
So what happens on a bad day?

Conditions favorable for beach tar



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Step 1 - Convergence Zone Accumulation
Trilogy Seep
www.bubbleology.com

Step 1 - Convergence Zone Accumulation
Seep Tent Seep
www.bubbleology.com

Step 2 - Currents draw into long slicks

www.bubbleology.com

Sea breeze pushes oil slicks towards shore and weathers oil

Very weathered oil begins sinking
www.bubbleology.com

and what doesn’t sink . . .

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beaches!
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When and why are there bad days?

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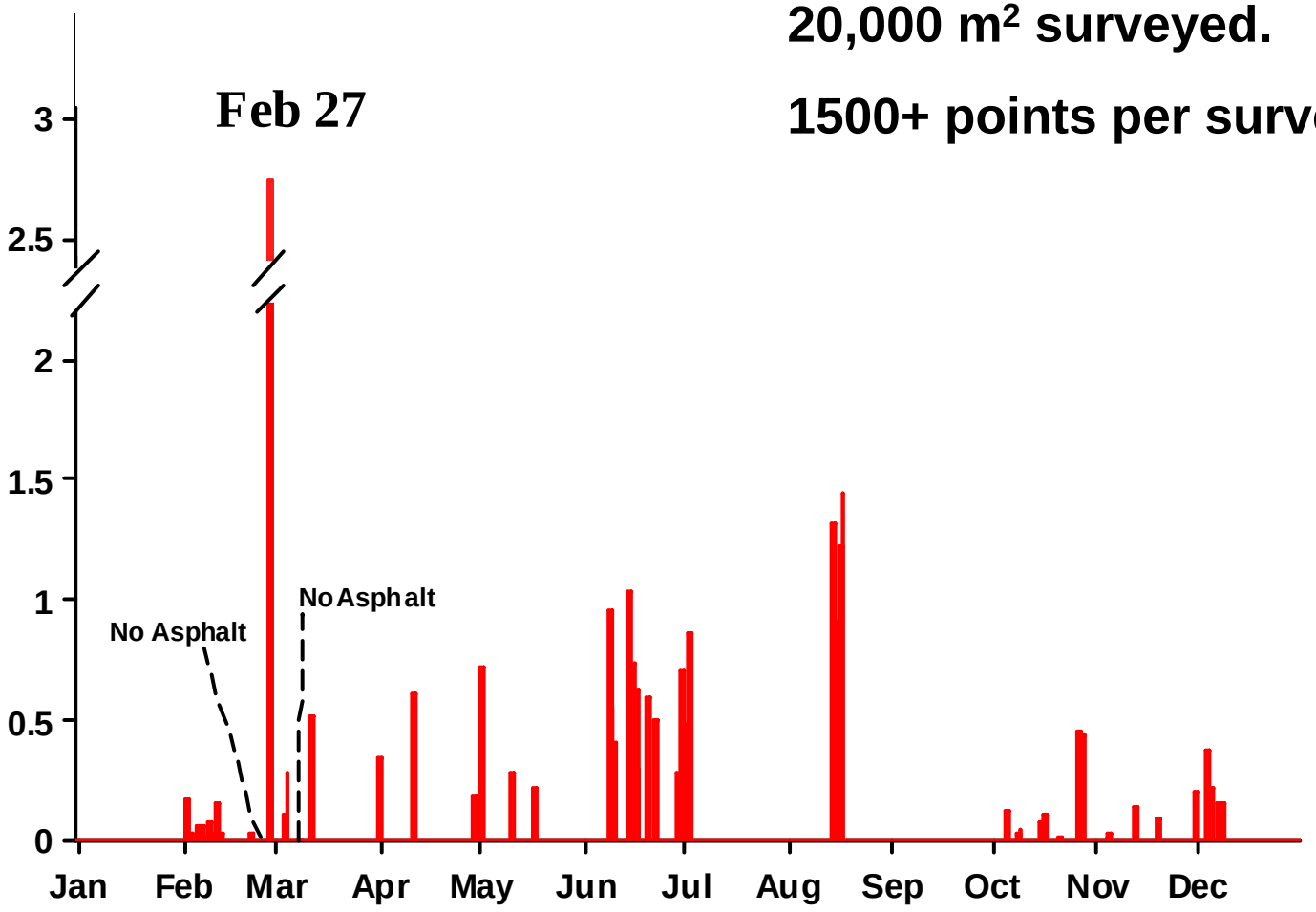
Beach tar in study area at Coal Oil Point

20,000 m² surveyed.

1500+ points per survey



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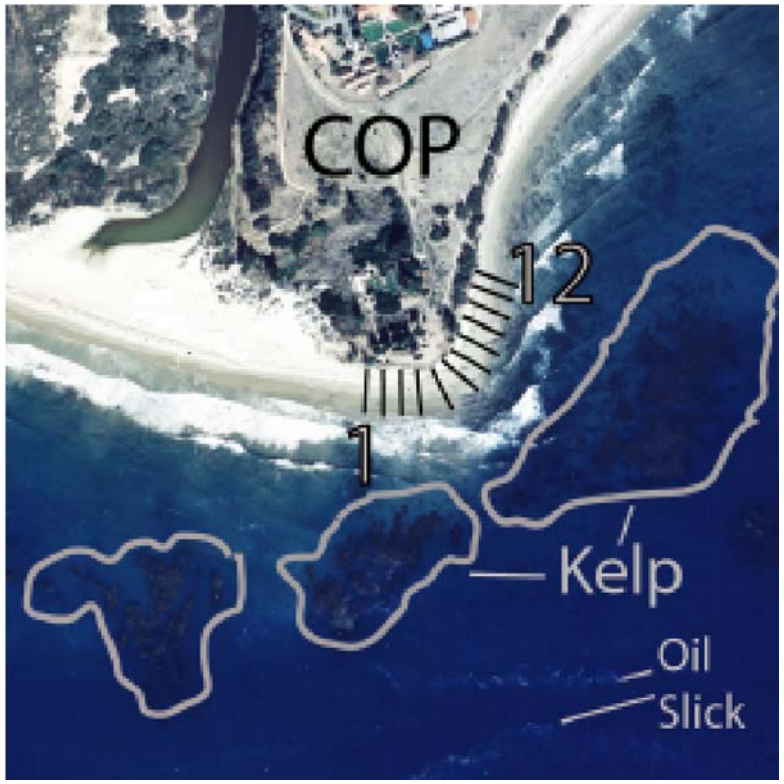
Tar was classified by size



during surveys along 12 transects

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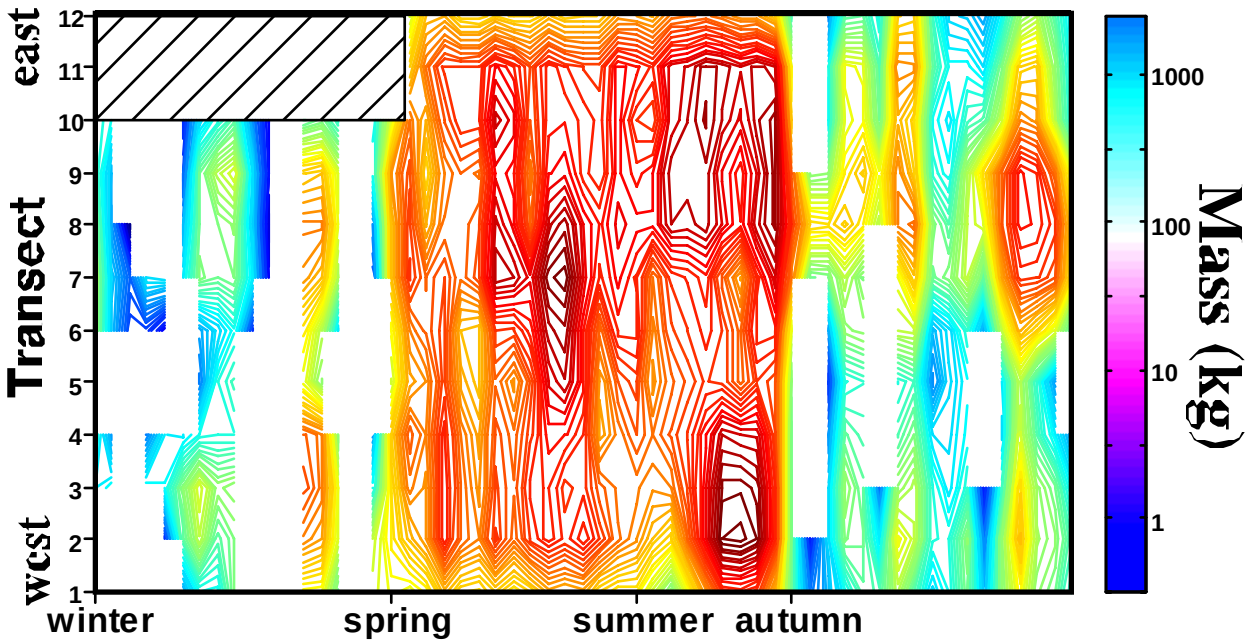
A clear seasonal variation



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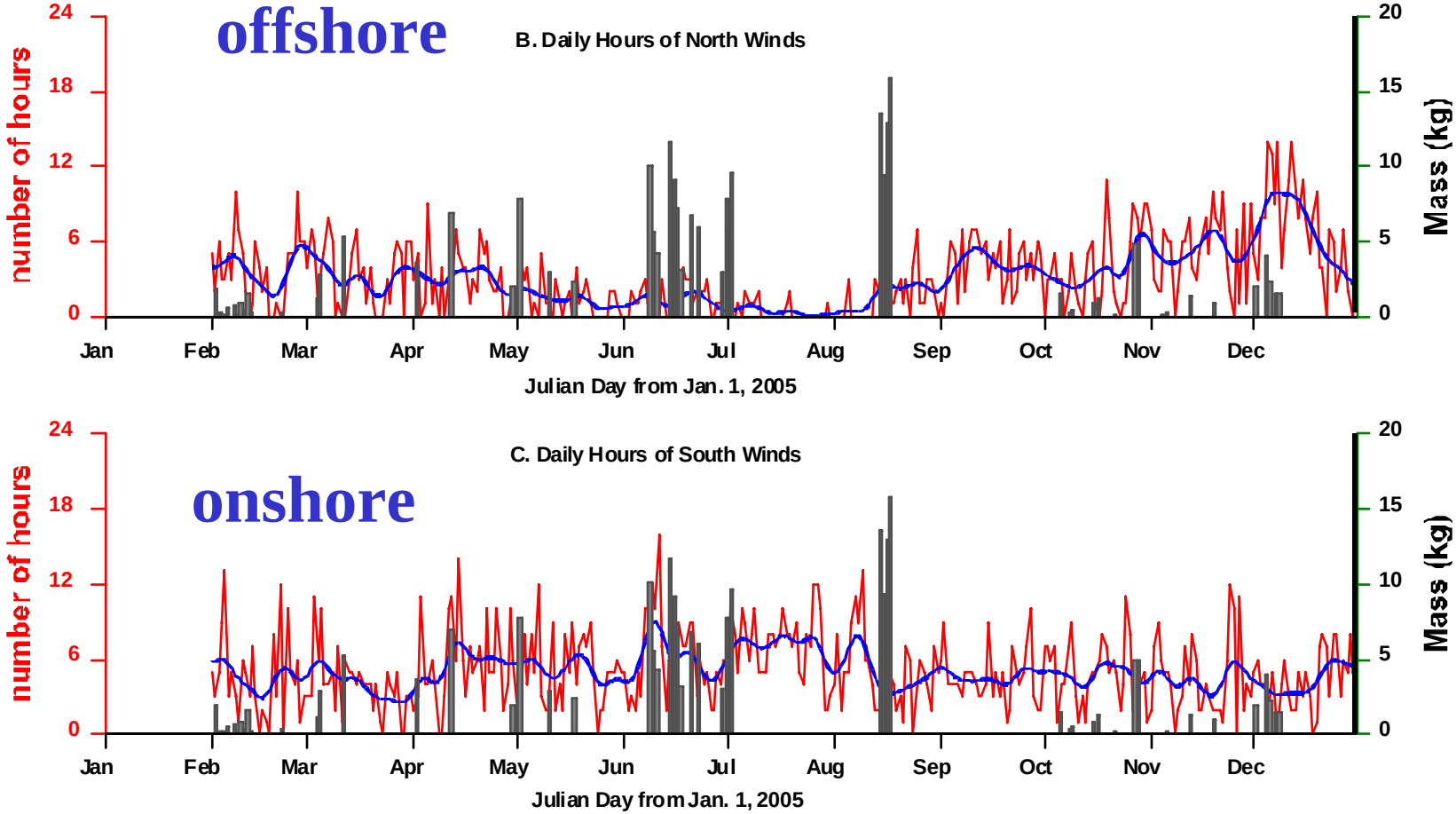
Some conditions unfavorable



Some conditions favorable

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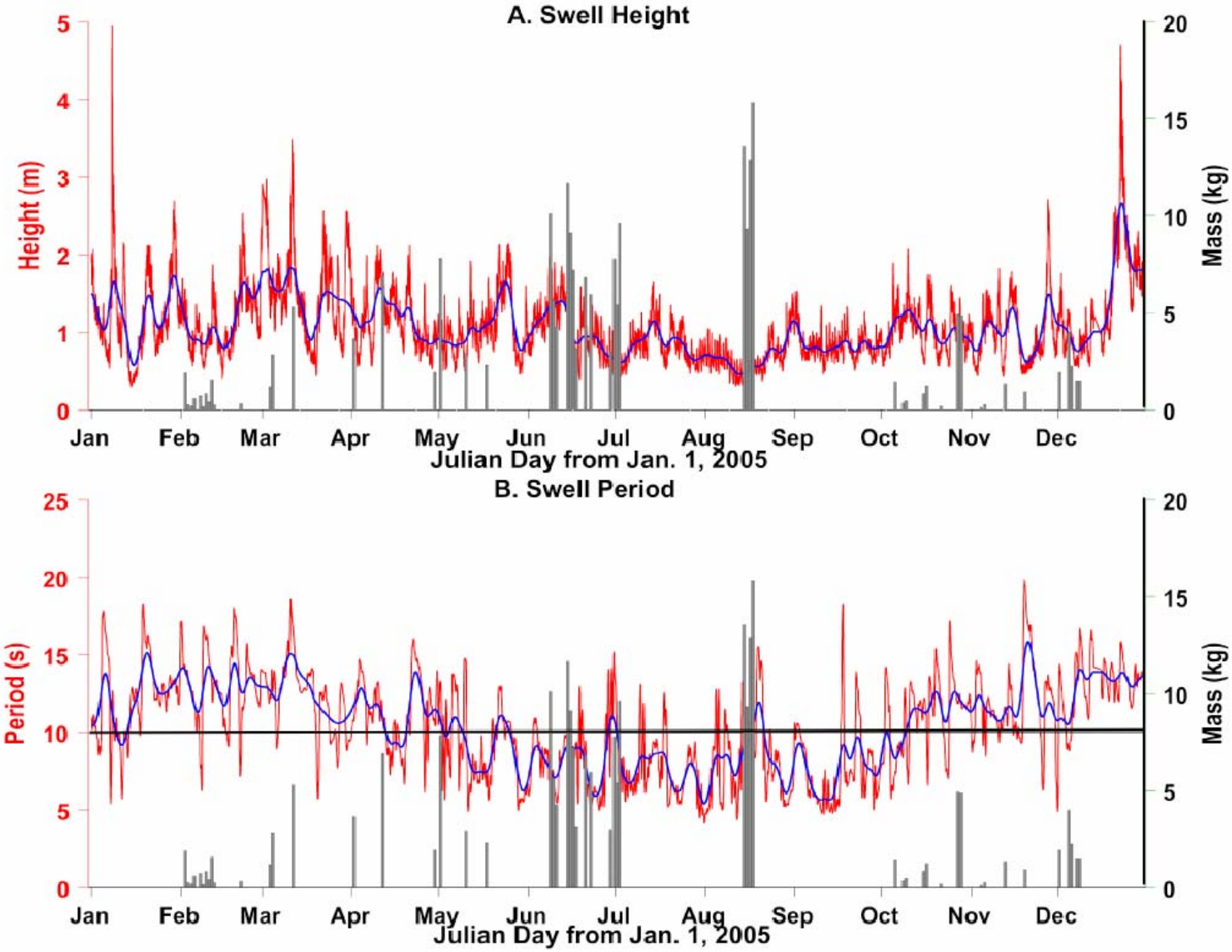
Swell seems related too. . .



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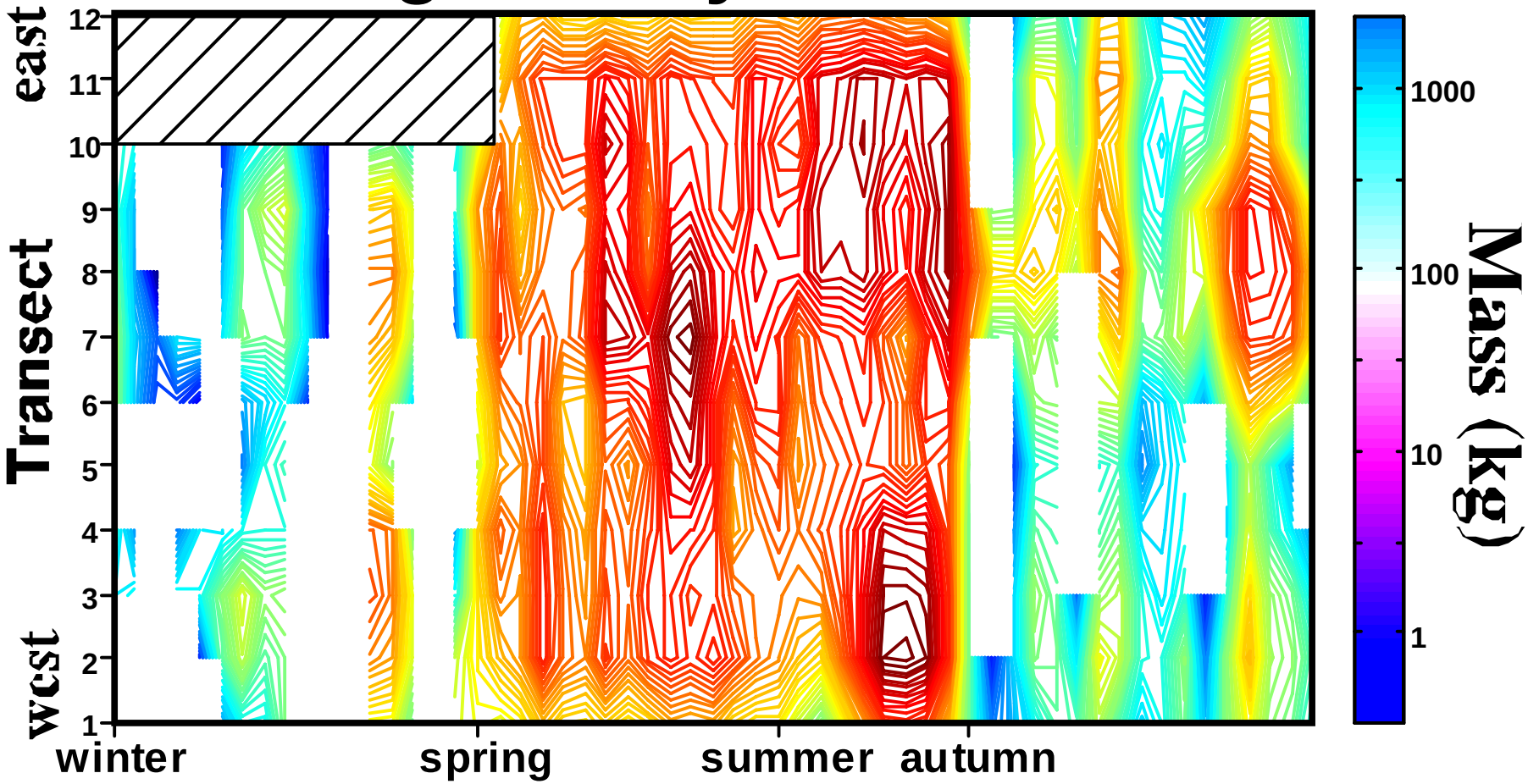
but other factors seem largely and generally unrelated



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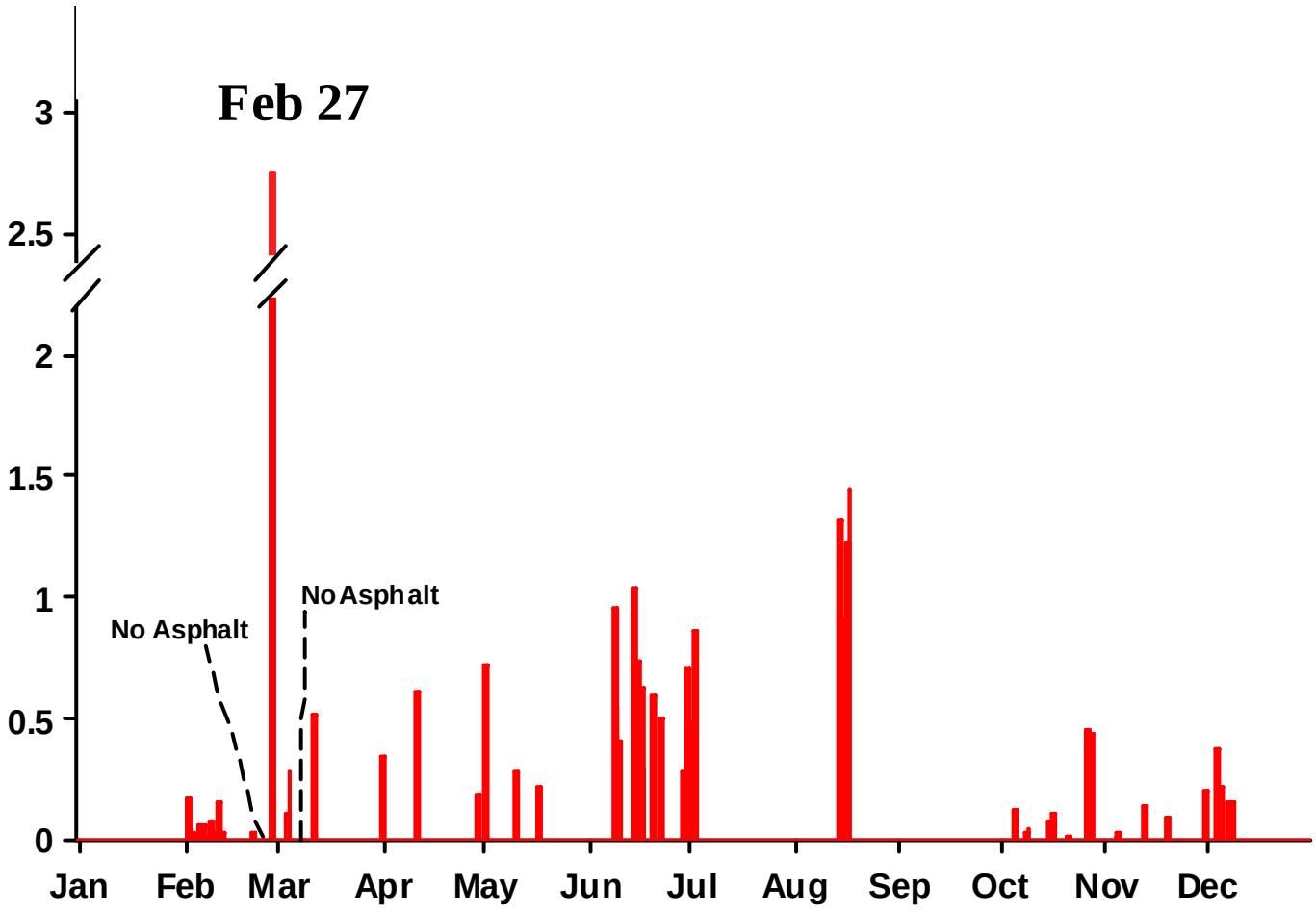
And then there was Feb 27 . . . .



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How to quantify field-wide emissions?

Sonar Survey!

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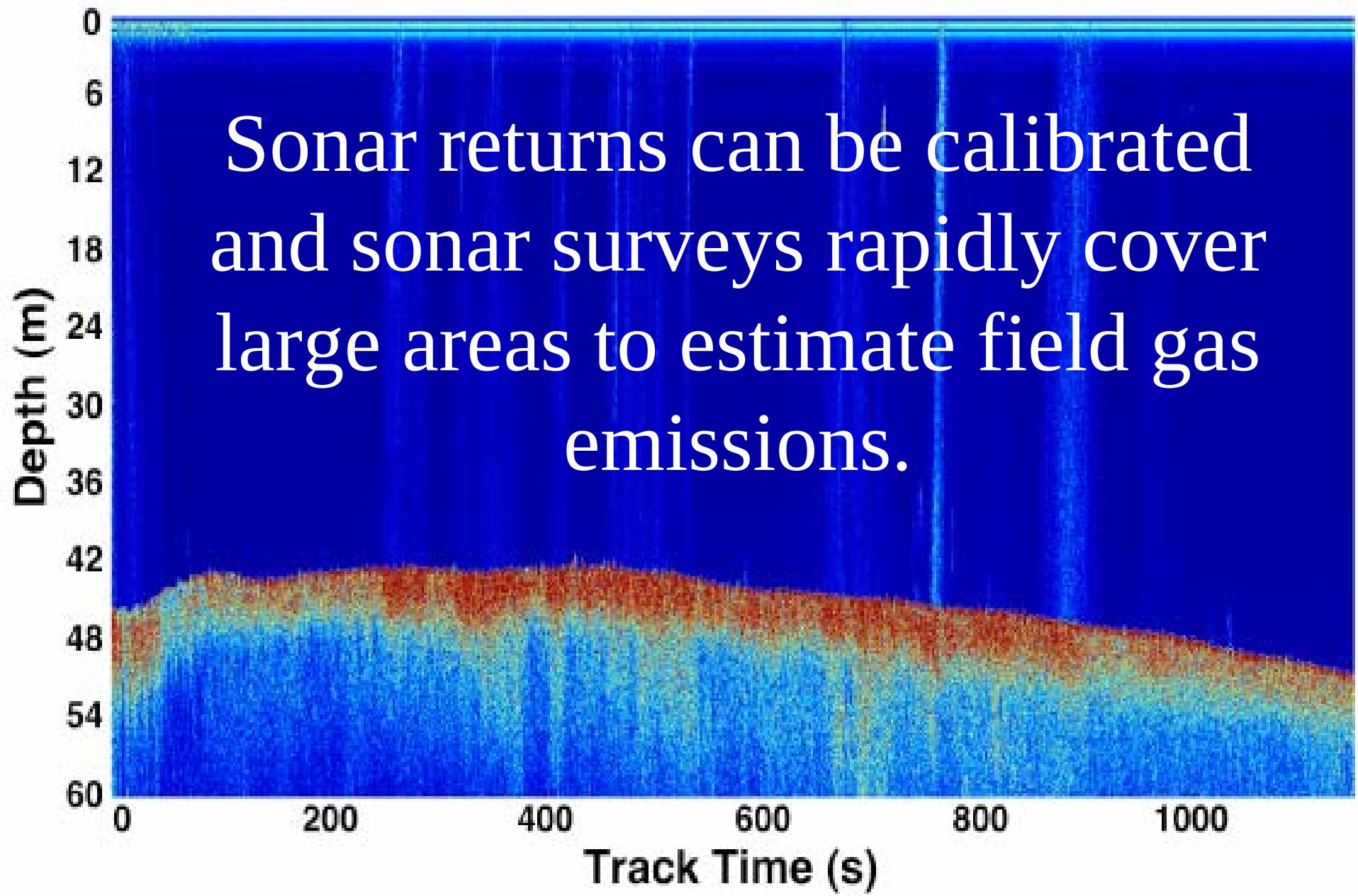

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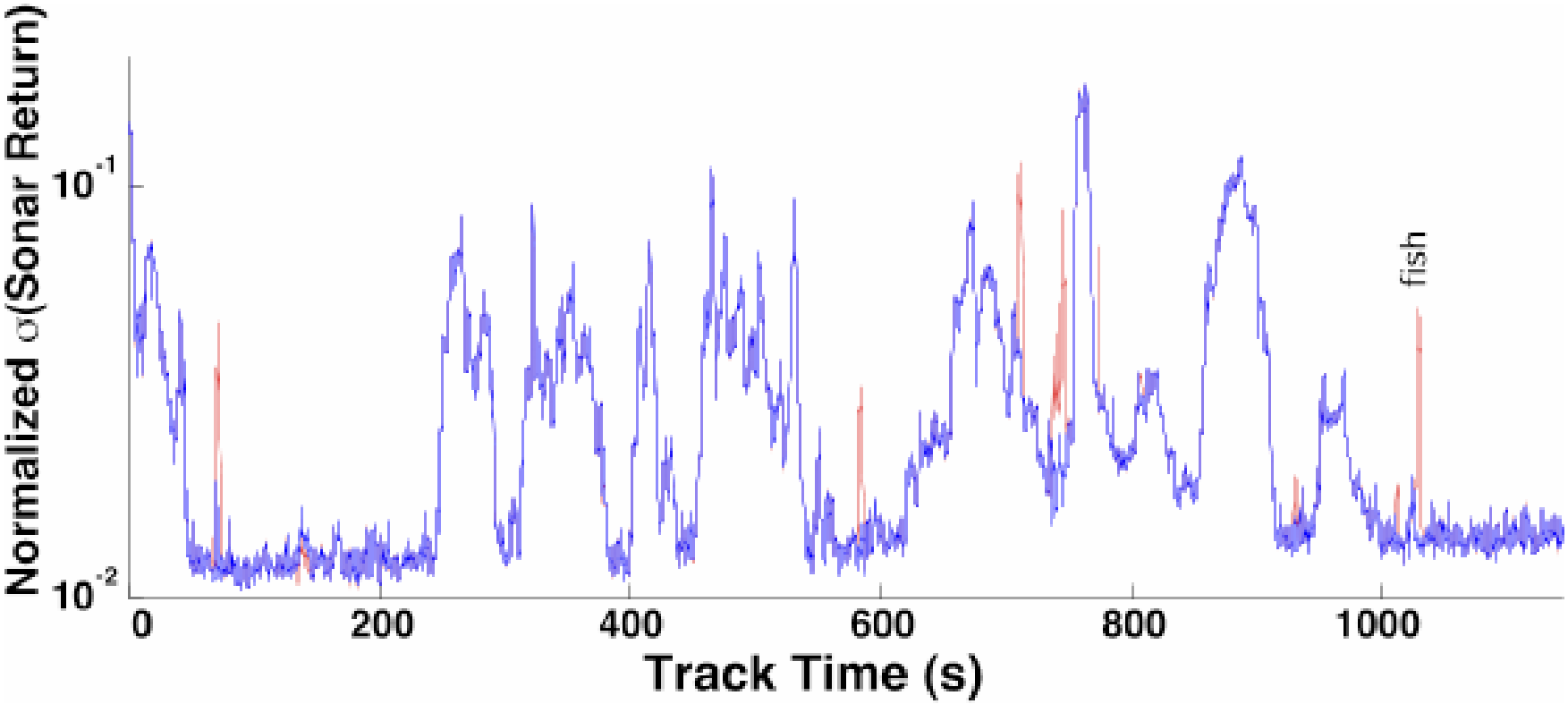
Fish and noise (red) are removed and for a selected window, sonar returns are calculated.



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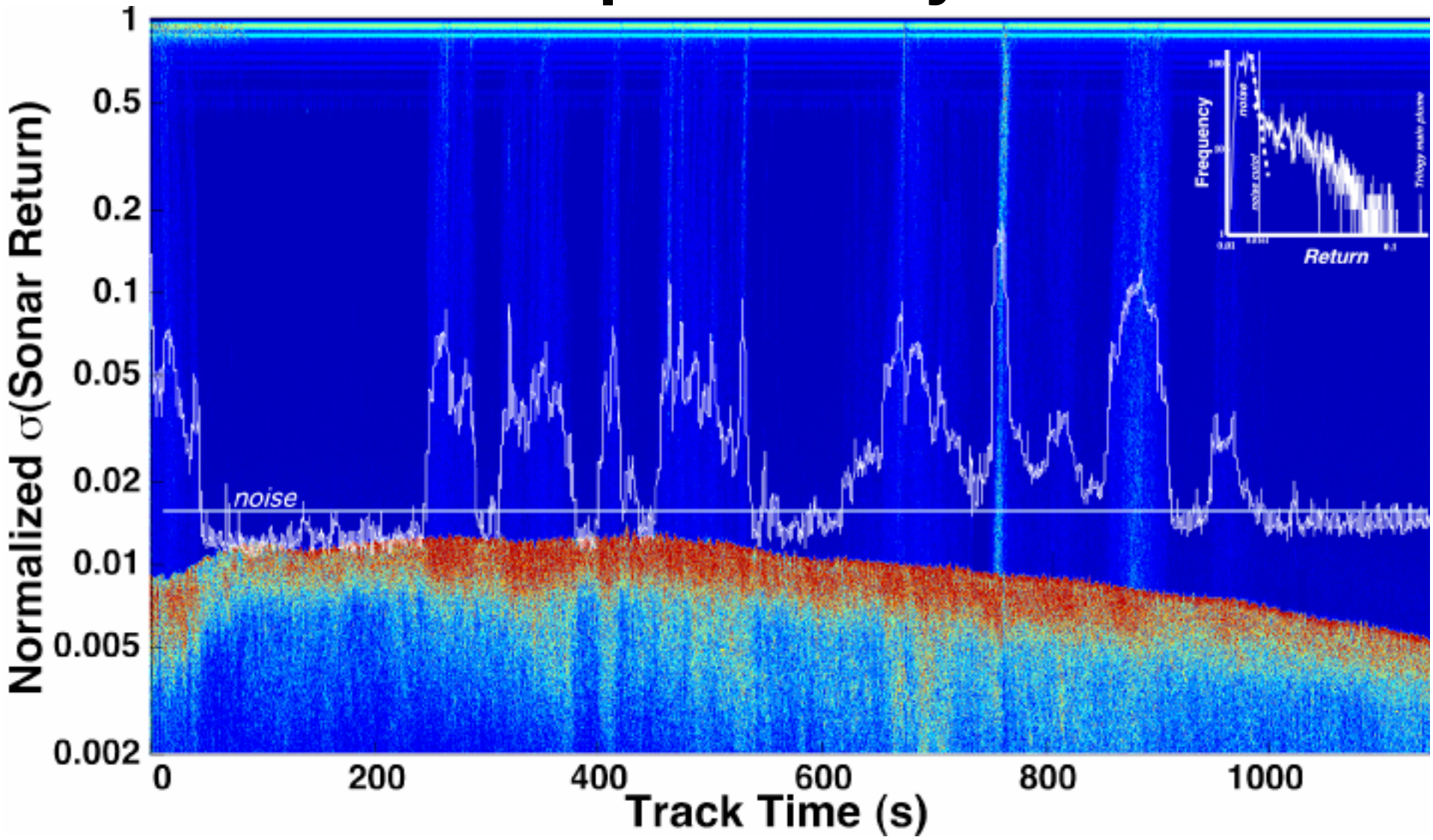
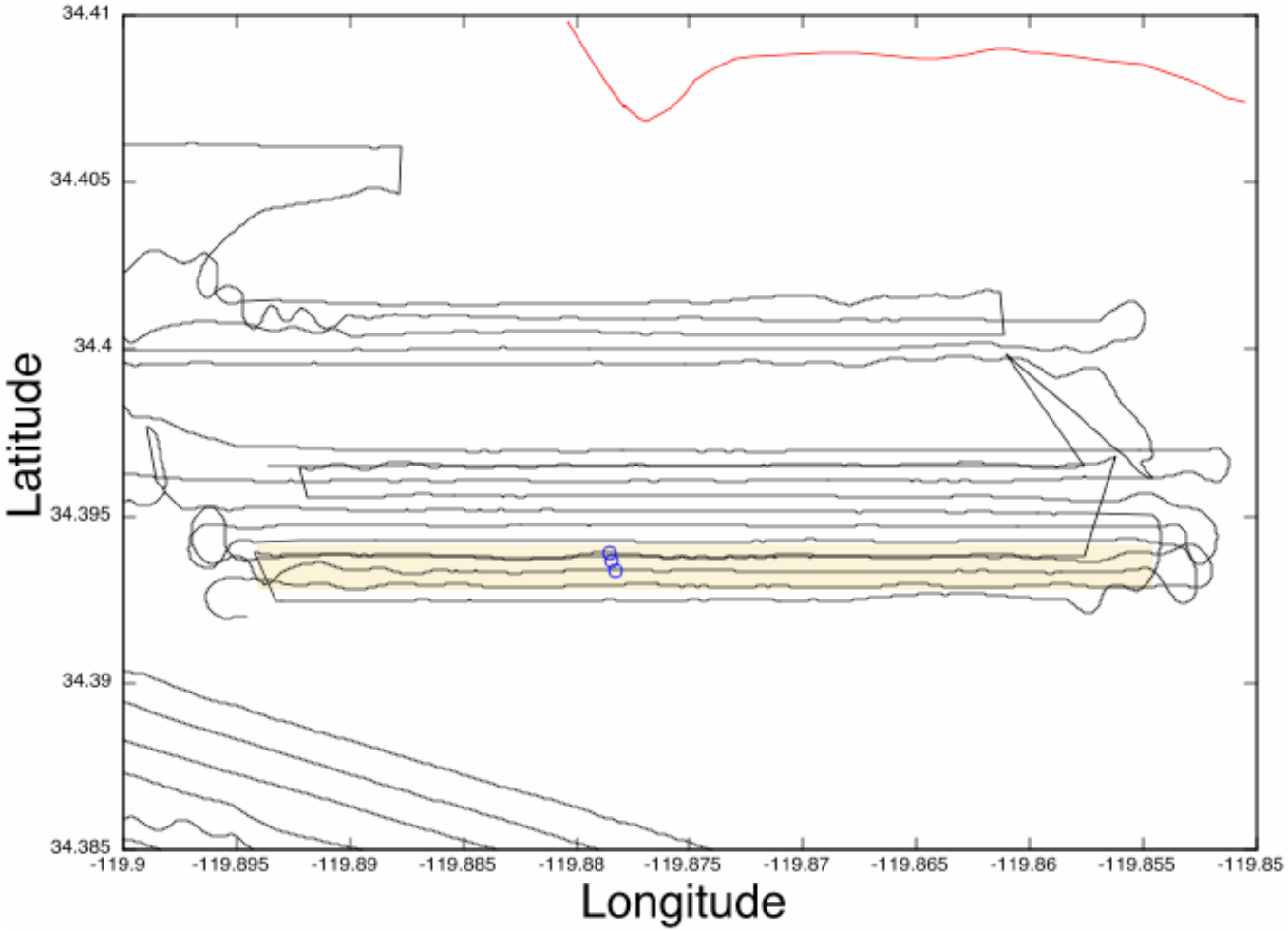
They noise level is set based on the sonar return probability function



Next we compare three trilogy lines surveyed April 2005 and Sept 2005



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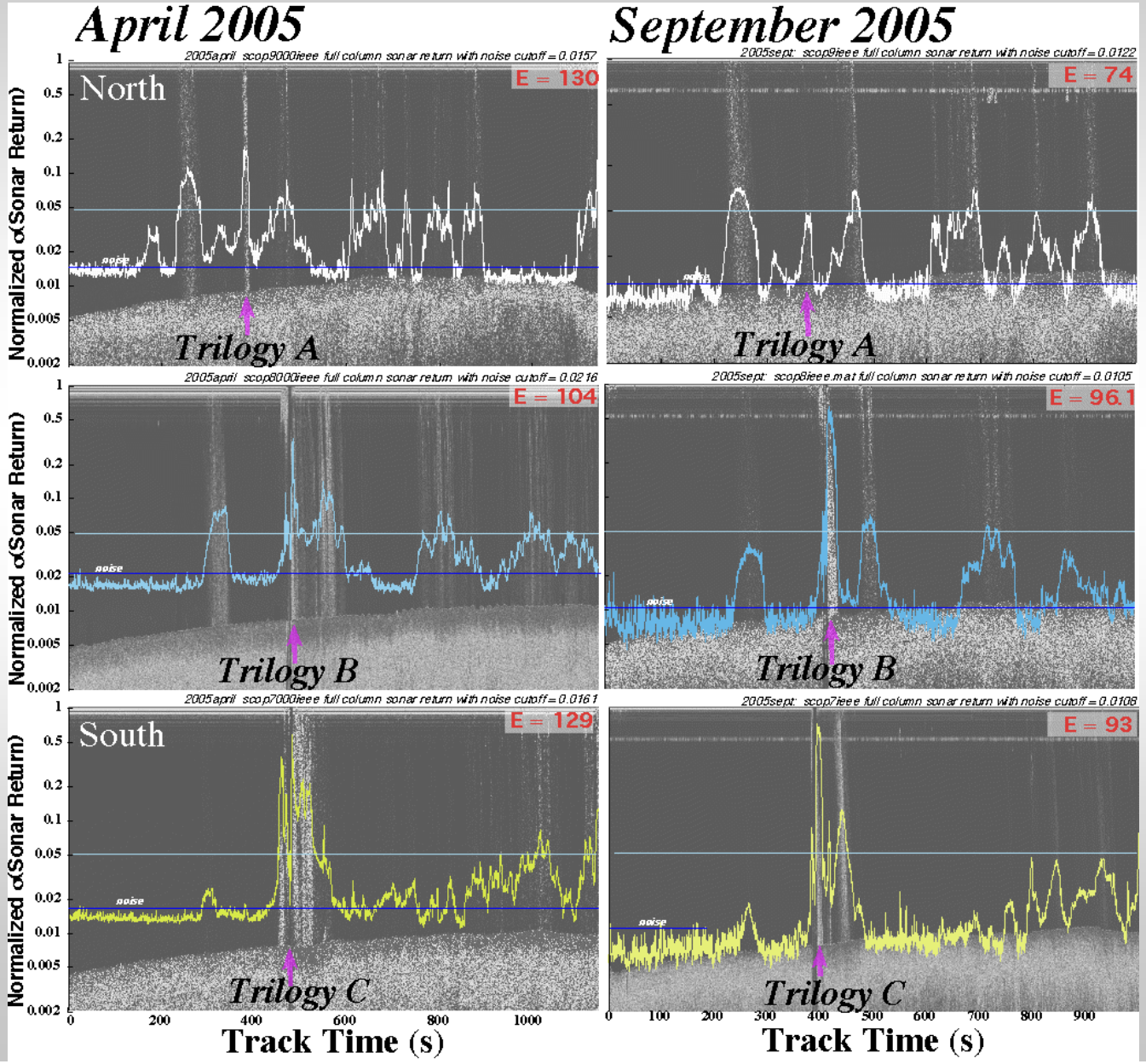
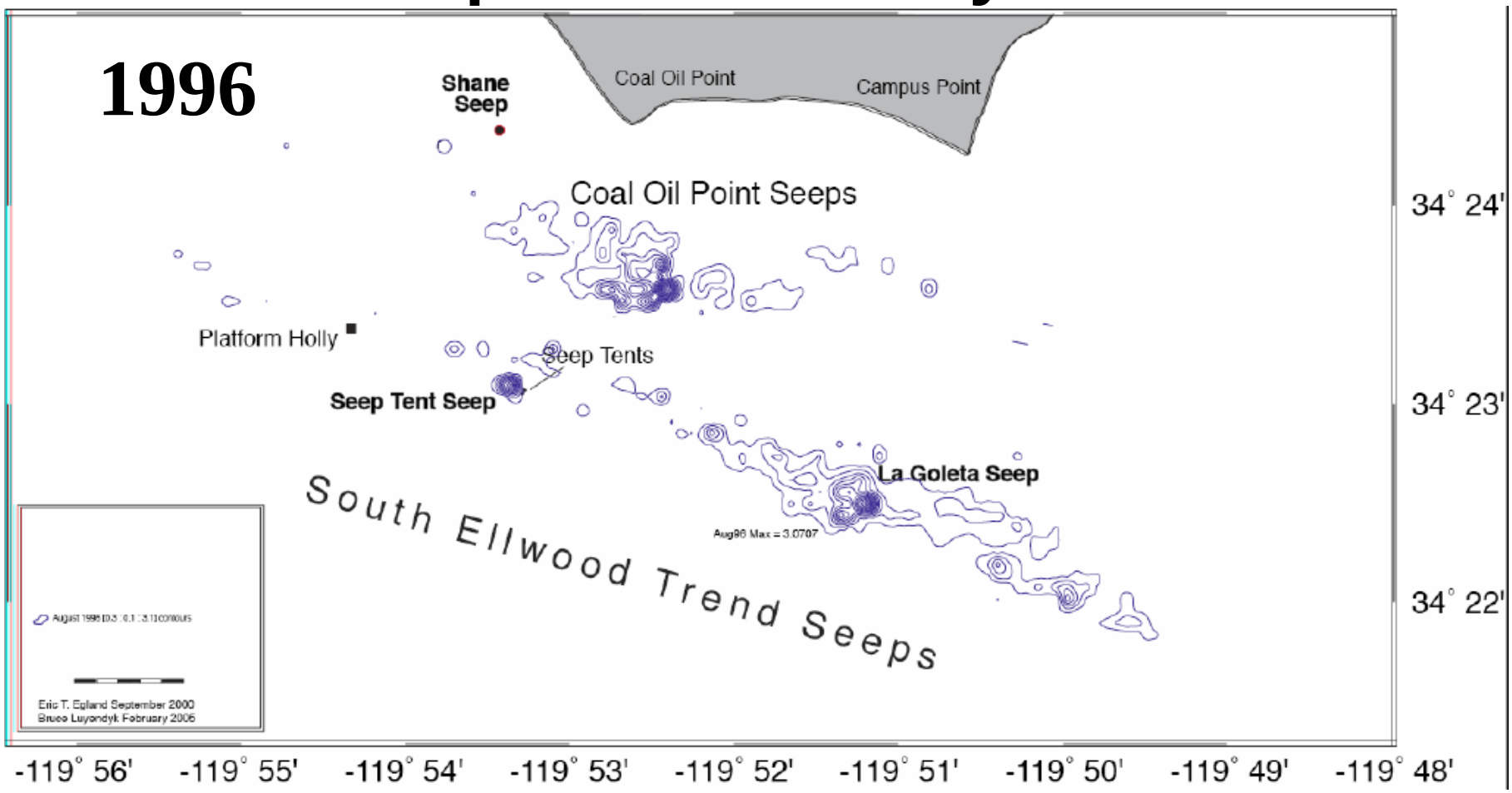
The Trilogy lines show significant differences spring to fall



Analysis of 2005, 2006, & 2007 data will produce contour maps to compare with previous surveys



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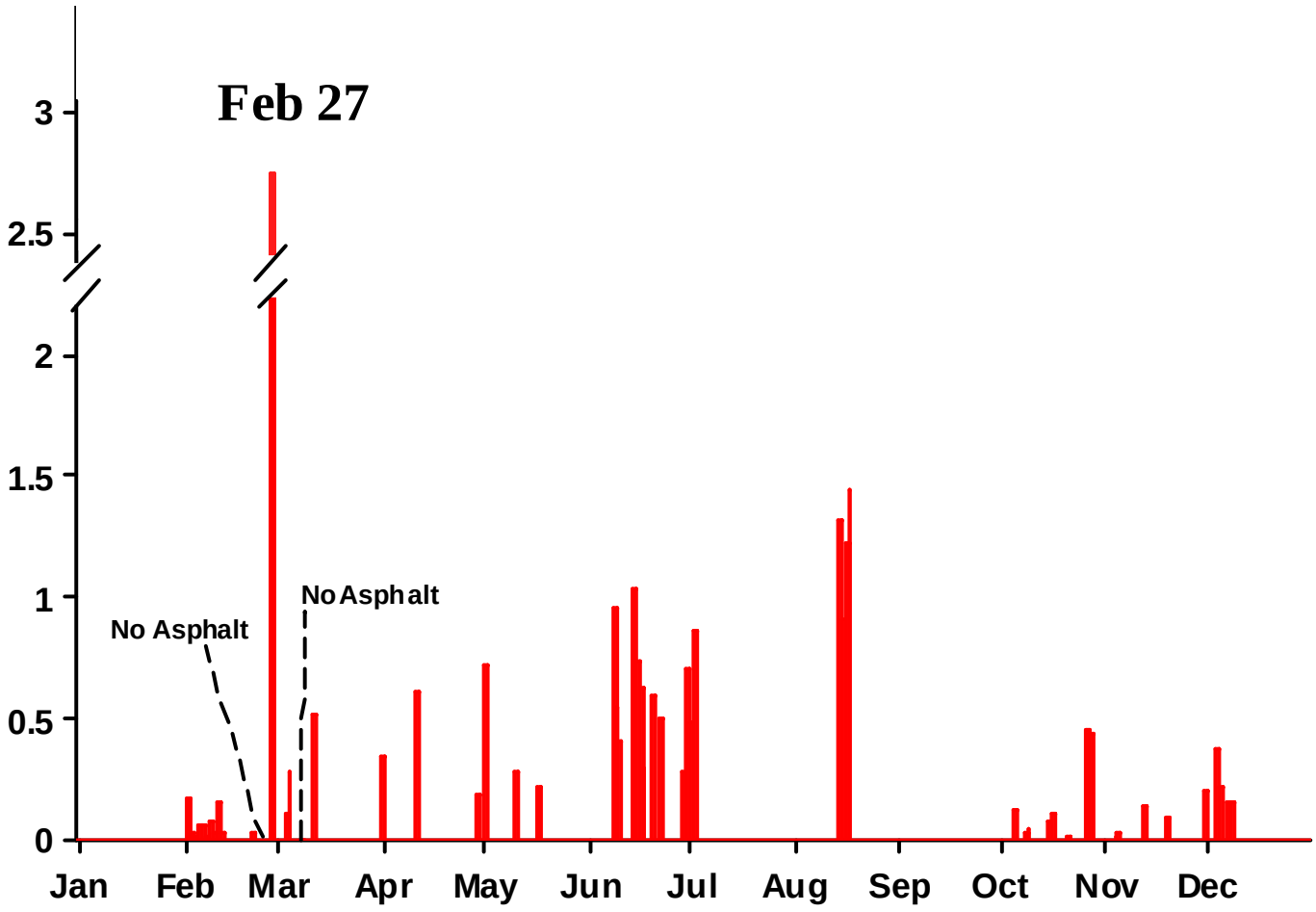
and then there are those exceptional days

One of which was Feb 27 . . . .



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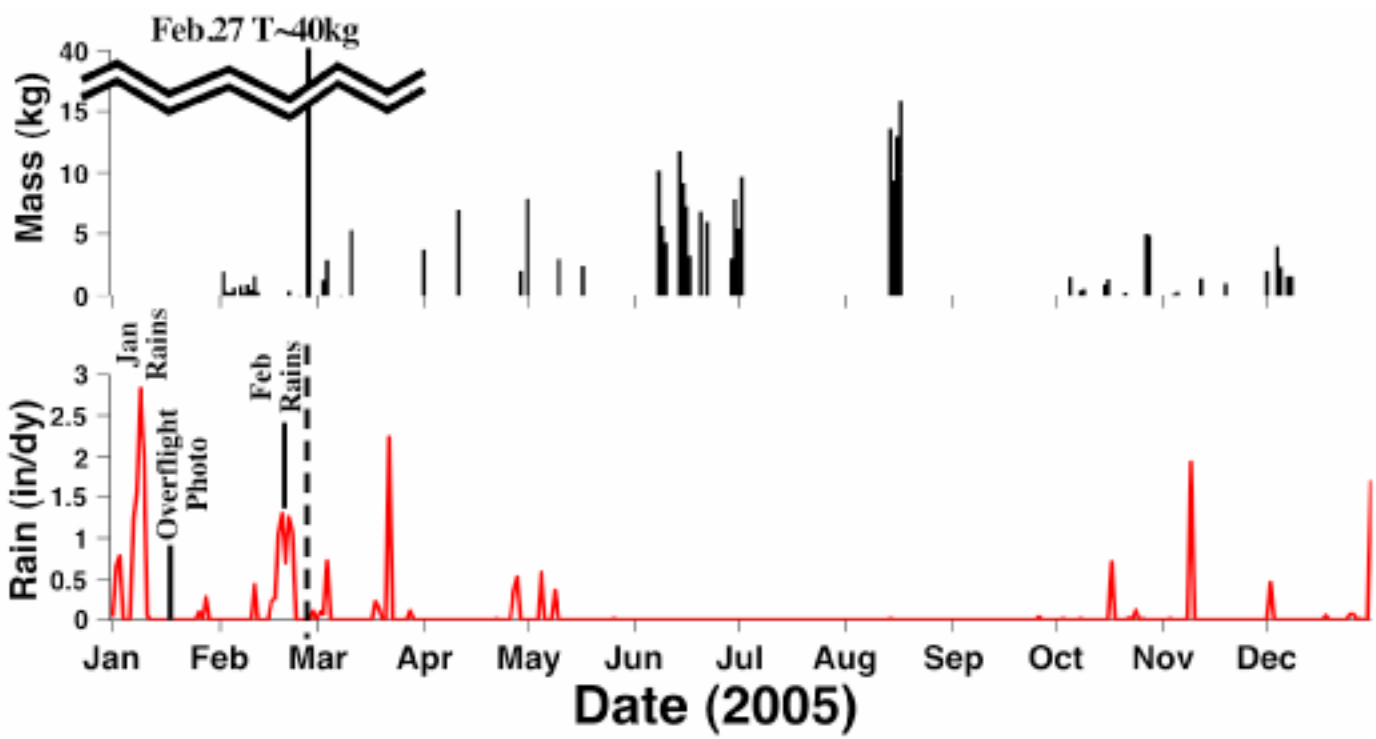
What was unusual winter 2005 were the exceptional rains



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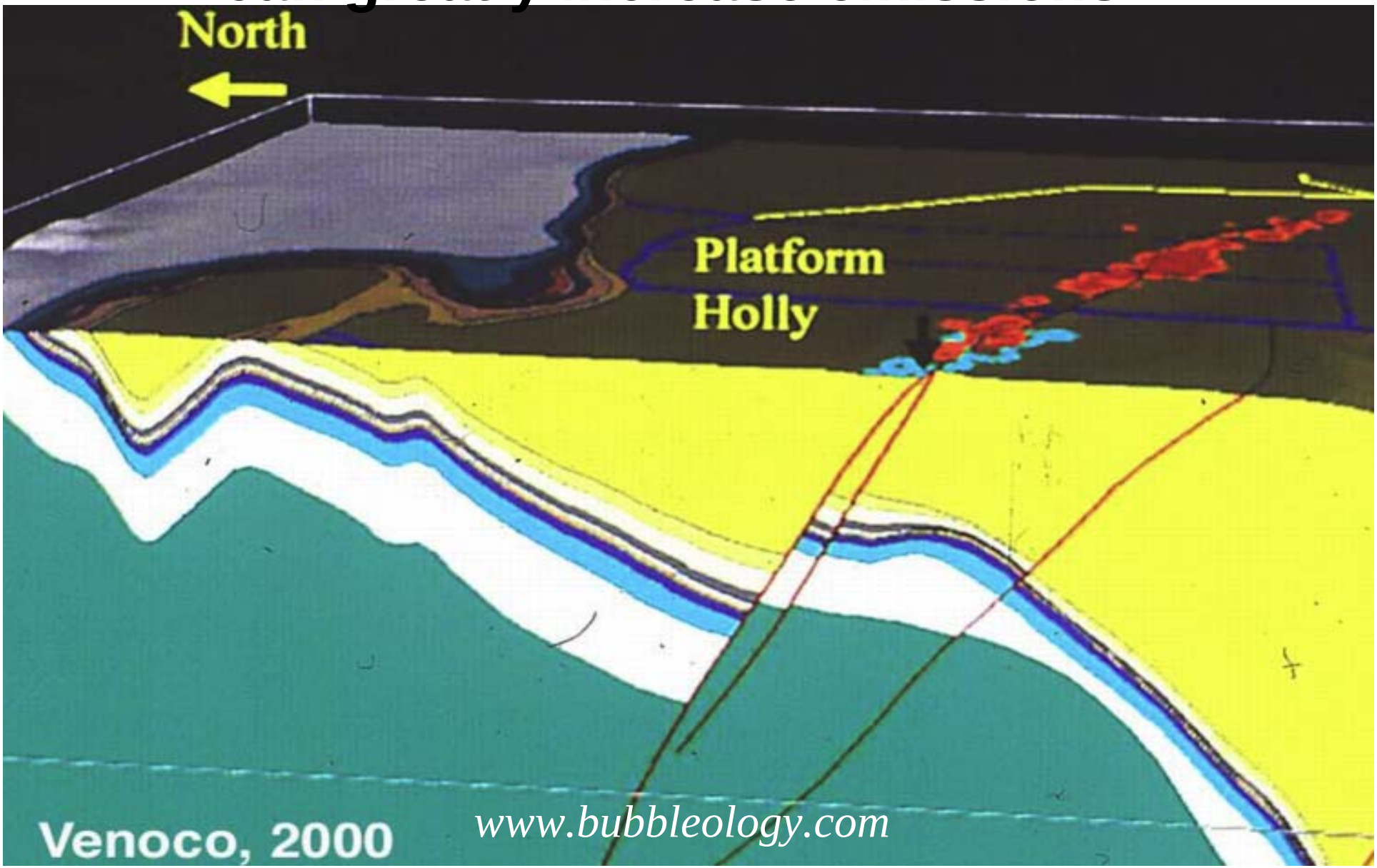
Propose: Hydraulic pressure via aquifers can greatly increase emissions



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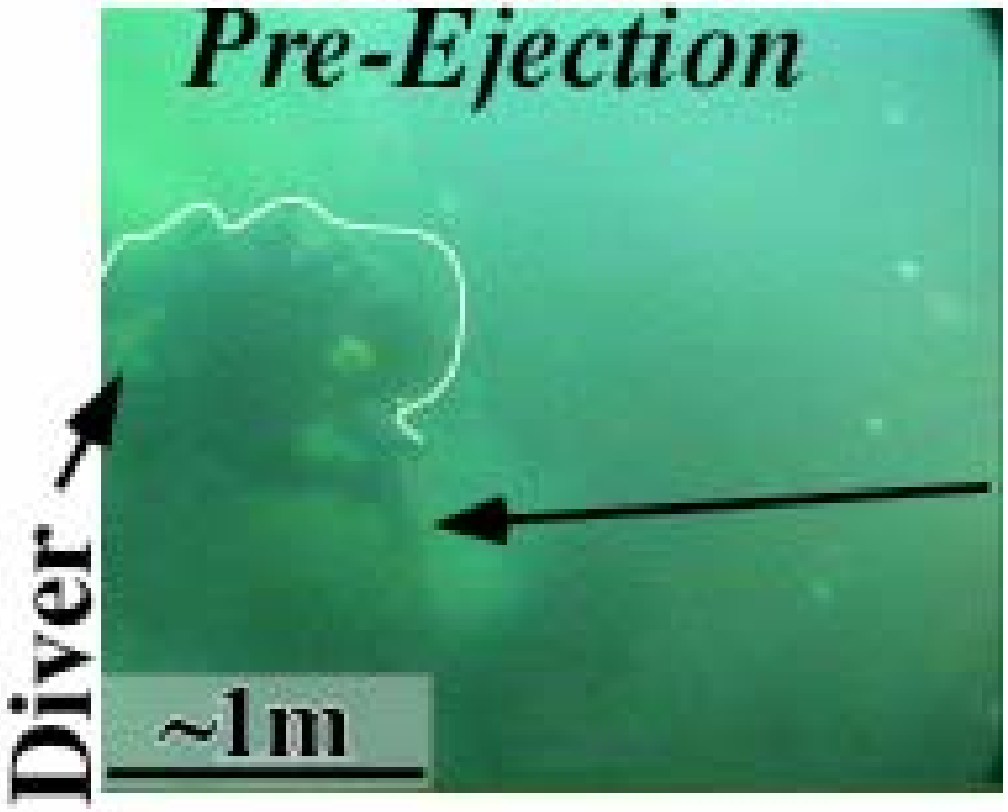
Including perhaps . . .



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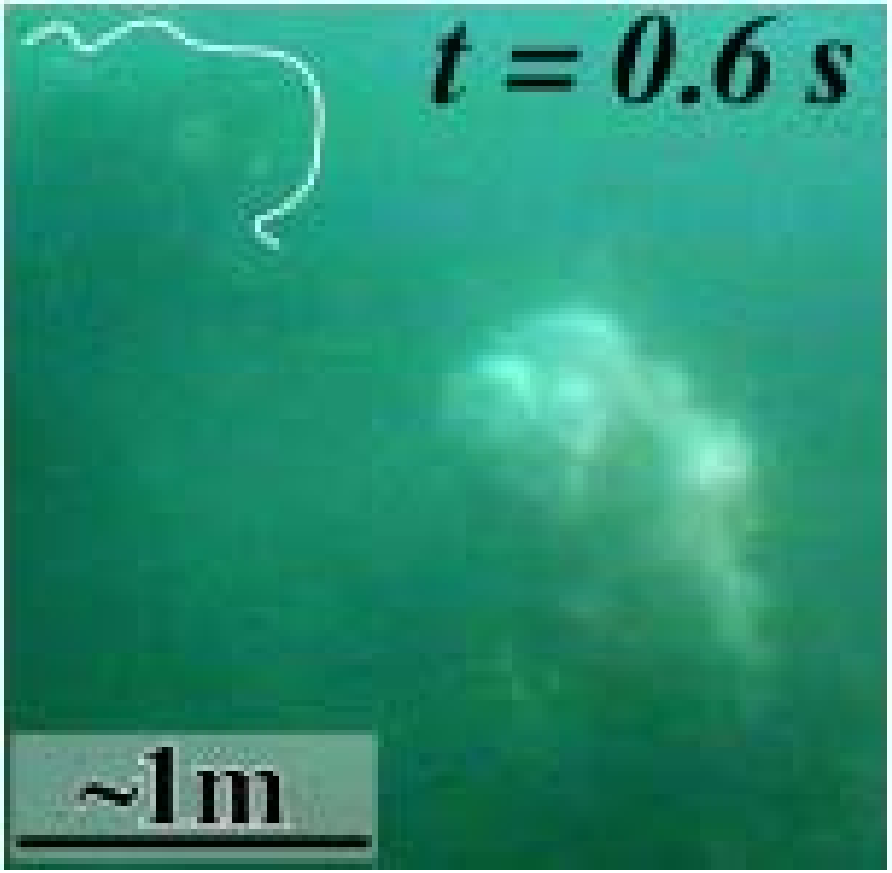
. . . . by submarine . . .



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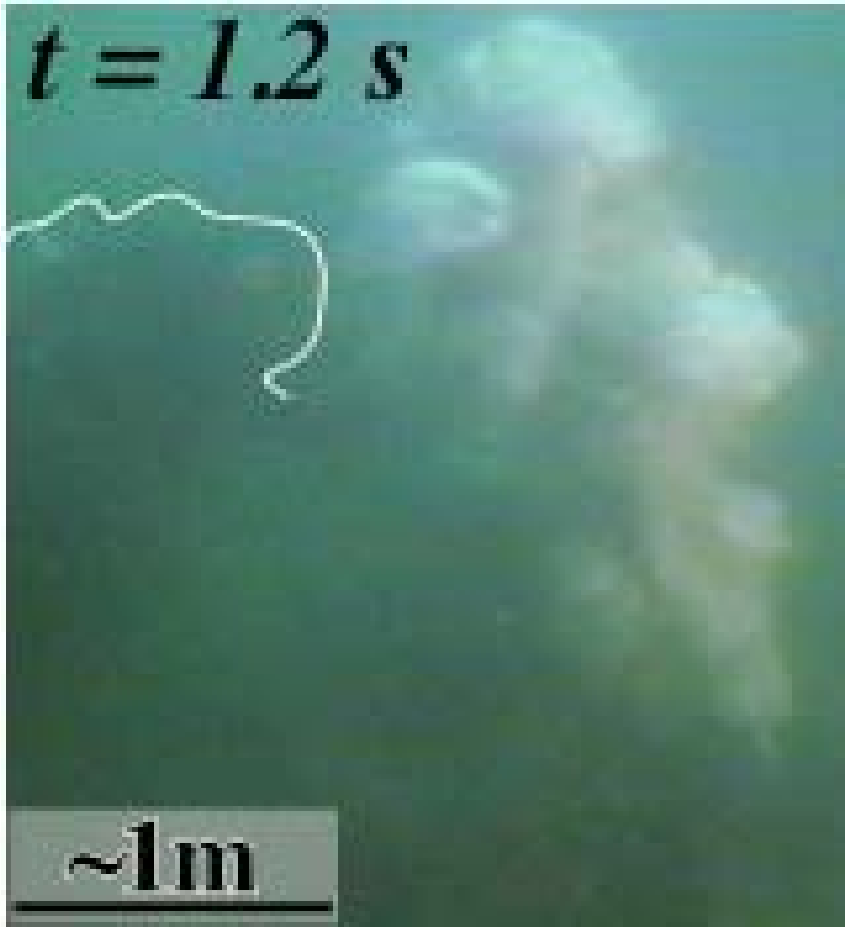
. . . . blowouts



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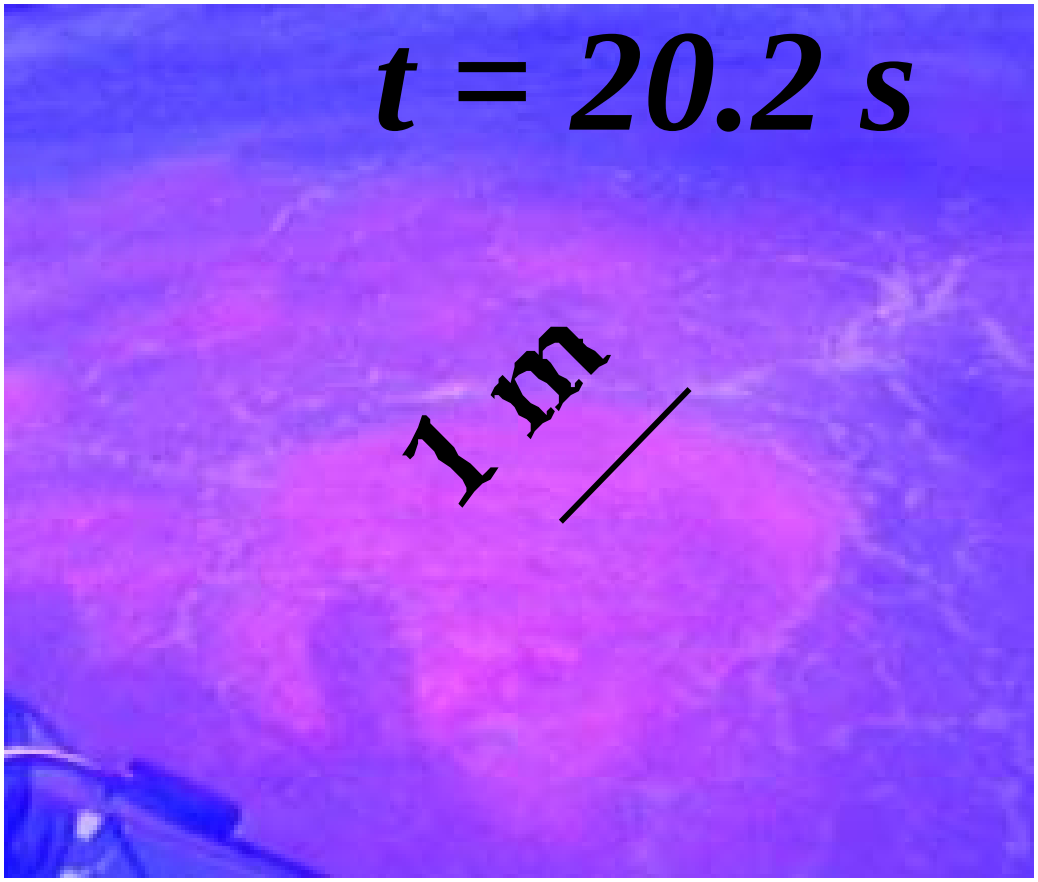
. . . when aquifer pressure . .



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an extraordinary natural laboratory and scientific play field

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