SeaMap -Telecon July 12- 2017

Agenda:

9:00- 9:05 - Introduction and Round table - Objectives:

9:05- 9:15 - Overview of Anomaly and Nowcast products, and how produced. owx

9:15 - 9:25 - Examples from Oregon II Seamap Cruise tracks NOWCAST- ANOMALYS sent. owx

9:25- 9:35 - Discussion of data collected on cruise - round table.

OWX - would like list of stations collected and time , if possible.

9:35 - 9:45 - Discussion on Comments of Data sent out (Examples). How used etc.
Plans for future and new products.

Questions the OWX Lab would like to ask.

Do participants have Google earth ?
Would folks like to be shown how to use the DAP Products in Google?
What anomaly and nowcast Products are most useful?

9:55 - 10: 00 - Data availability, in Google Earth

Ocean Weather

Real-time monitoring

Monitoring Abnormal Bio-optical and Physical Properties in the Gulf of Mexico Dynamic Abnormal Properties (DAP)

Robert Arnone, Brooke Jones

University of Southern Miss

Stennis Space Center, MS

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

Gulf Coast Ecosystem Restoration Science, Observation, Monitoring and Technology Program

NOAA RESTORE Act Science Program

July 2017

R. Arnone and B. Jones " Monitoring abnormal bio-optical and physical properties in the Gulf of Mexico ", *Proc. SPIE* 10186, Ocean Sensing and Monitoring IX, 101860O (May 22, 2017); doi:10.1117/12.2266789;
http://dx.doi.org/10.1117/12.2266789

Ocean Weather Laboratory – Identifying Events and Abnormal Bio-optical and Physical Properties in the Gulf of Mexico

Objective:

1. **Ocean Weather Laboratory → Nowcast of environmental bio-physical properties in the Gulf of Mexico**
   - **Satellite → Chlorophyll, Euphotic depth, particle backscattering, SST**
   - **Models → Currents, Salinity, temperature.**

2. **Identify regions in Nowcast which are dynamically changing! "normal" and " abnormal" .**

   How typical is the Nowcast condition?

   Identify EVENTS and HOTSPOTS

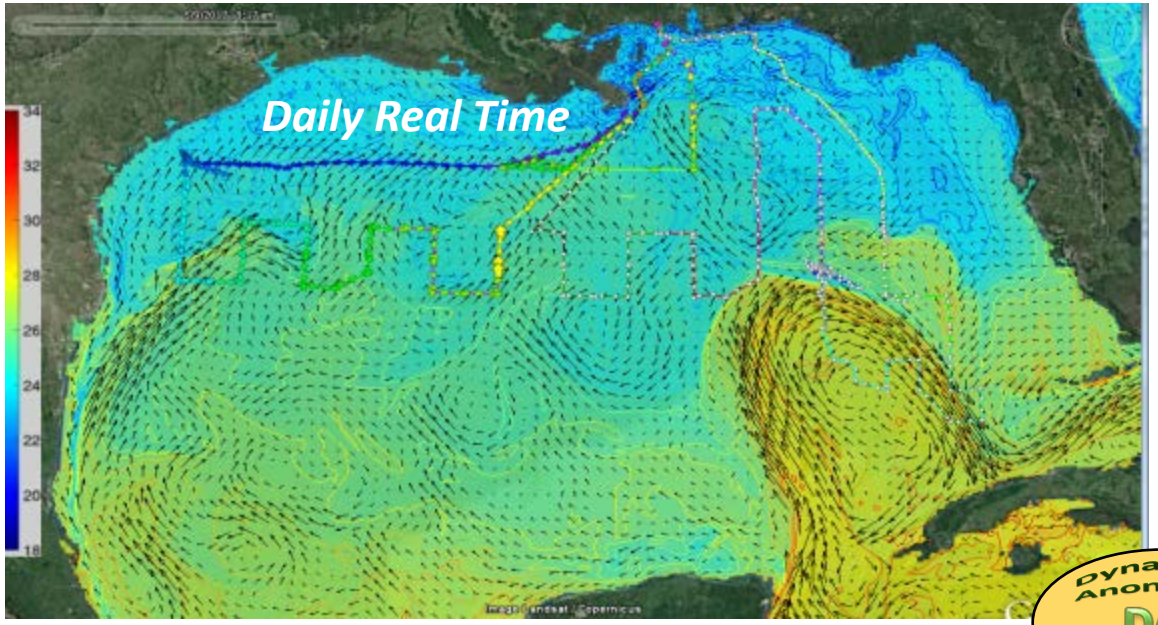
3. **Determine the "degree" of environmental change.**

4. **Dynamic Anomaly Tool for spatial and temporal variability of normal and abnormal conditions.**
   1) **Identify why a station is behaving as it is ?**
   2) **Locations for Adaptive Sampling 3) Locate Data Collection Gaps**

Ocean Weather Laboratory

http://www.usm.edu/marine/research-owx

Daily Nowcast 2013- Present



Satellite Products

VIIRS - Color / SST

750m

- Biology – Chlorophyll
- Light attenuation
- Particles – Backscatter
- Absorption
  - CDOM
  - Detritus
  - Phytoplankton
- Sea surface Temperature
- Sea surface Salinity

Euphotic Depth

Model Products

HYCOM and, NCOM (4, 1 km)

- Sea Surface Temperature
- Sea Surface Salinity
- Mixed Layer Depth
- Intensity of Mixed Layer
- Sea Surface Height
- Current Vectors
- Current Magnitude
- Model Differences
- Regional Cross Sections

New Products --- "Hotspots"
Abnormal Environmental Conditions

Dynamic Anomaly DAP Properties

Dynamic Anomaly Products (DAP)
Weekly and - Moving Averages
Anomaly, Standard Deviation Masks (1,2,3)

- **NOWCAST - Daily Products support adaptive sampling, decision making**
- **ANOMALY- Products - What has changed in last 2 months ?**
- **Integration of Models and Satellites**
  Determine uncertainty / anomalies.
- **Adaptive sampling by identifying processes,**
- **Integration models and satellite to improve product validation**

Satellite Products 6 :

1) Chlorophyll - chl **2) SST - mcsst**
3) Euphotic Depth – ZEU **4) Absorption 443 a443**
5) Backscattering (particles) **6) Salinity -sal**

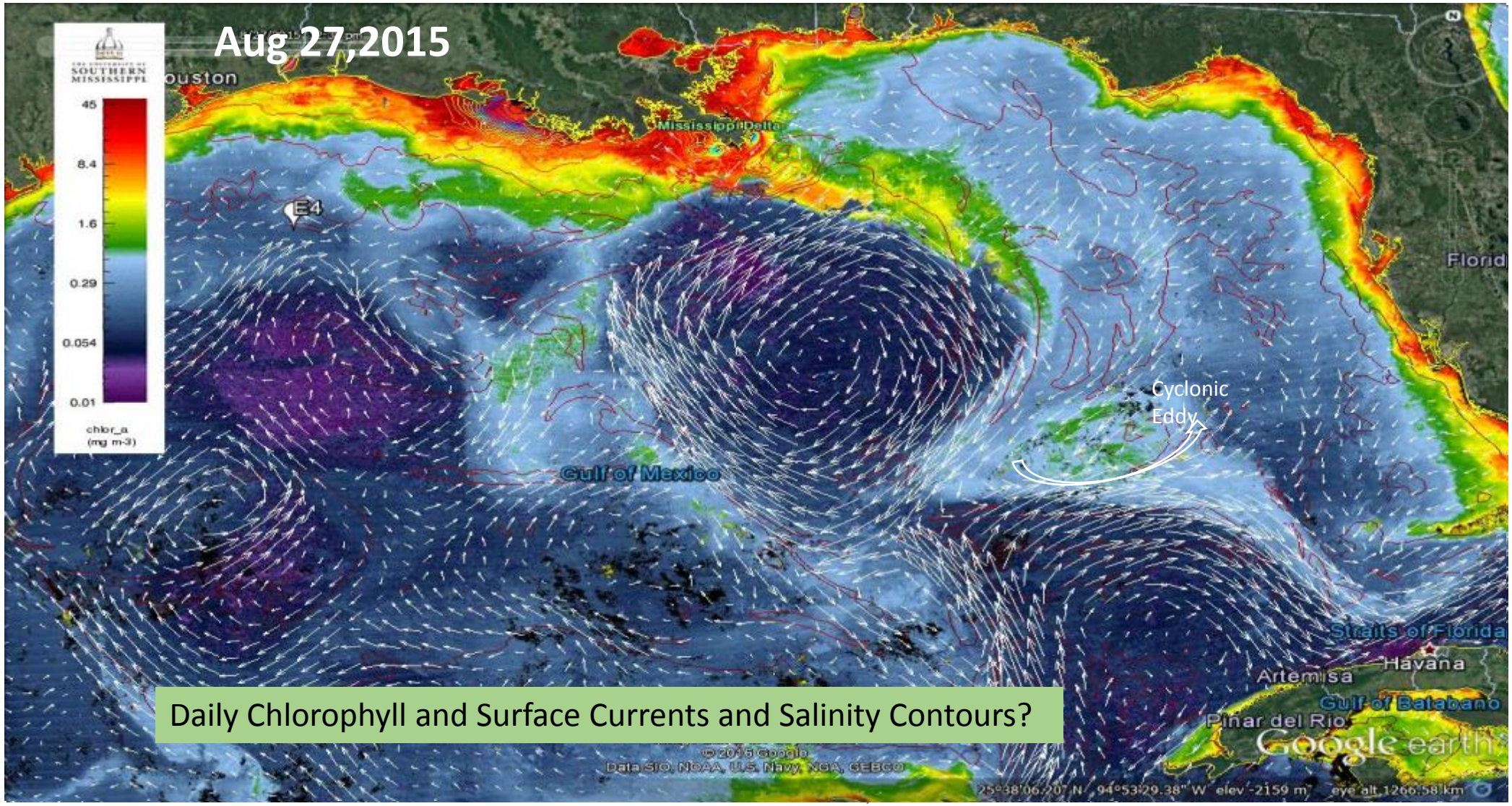
Circulation Model *–America Seas Model*

1) Sea Surface Temperature - 2) Surface Salinity –
3) Surface Current magnitude 4) direction

Event - Mississippi Plume to Key West Aug 2015
LOOP Current

Plume to Key West

How Abnormal was this advent in last few months?
What regions were affected? Define Level of Uncertainty?

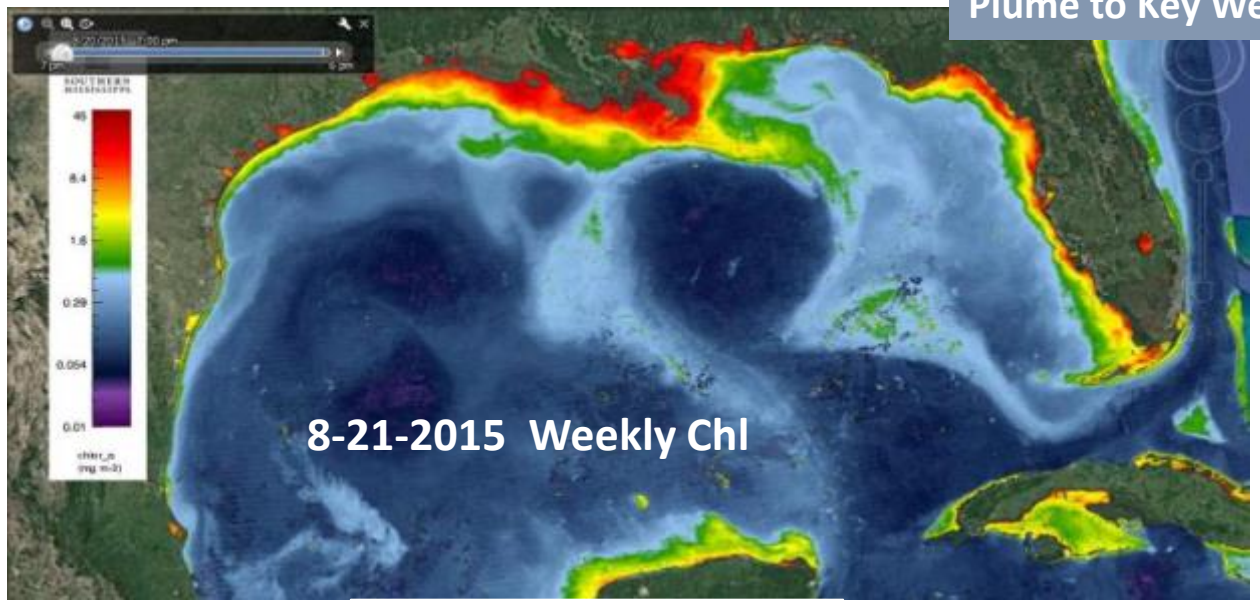


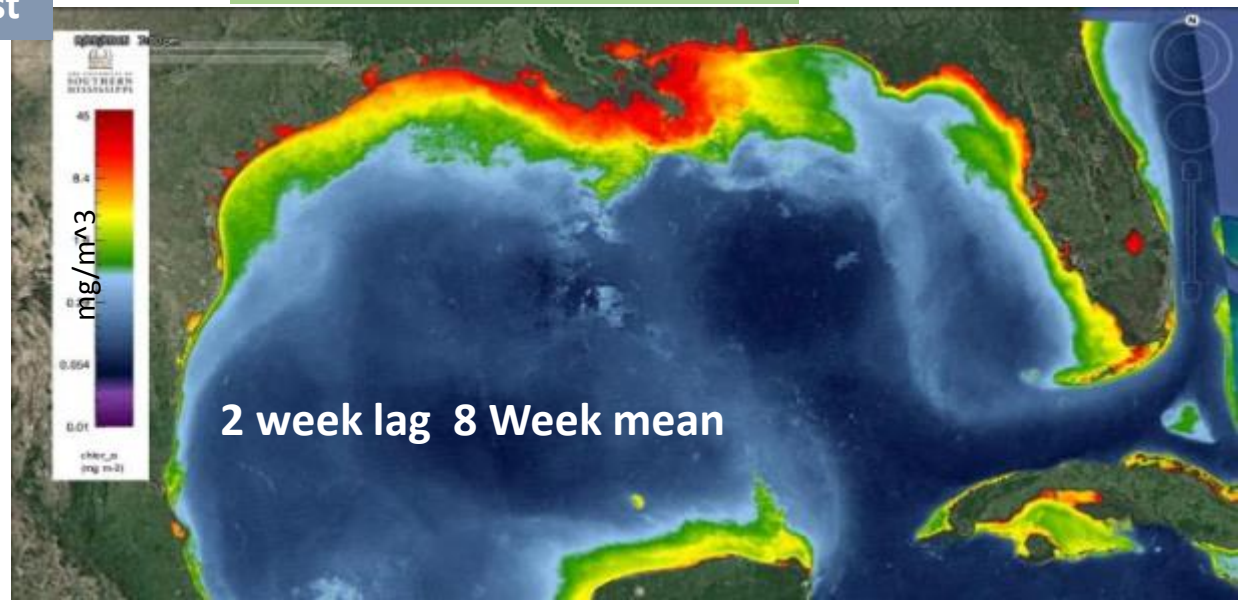
Defining Dynamic Anomalies Properties –DAP

Where are the abnormal Hotspots in 8-21- 2015

Chlorophyll Hotspots

Plume to Key West



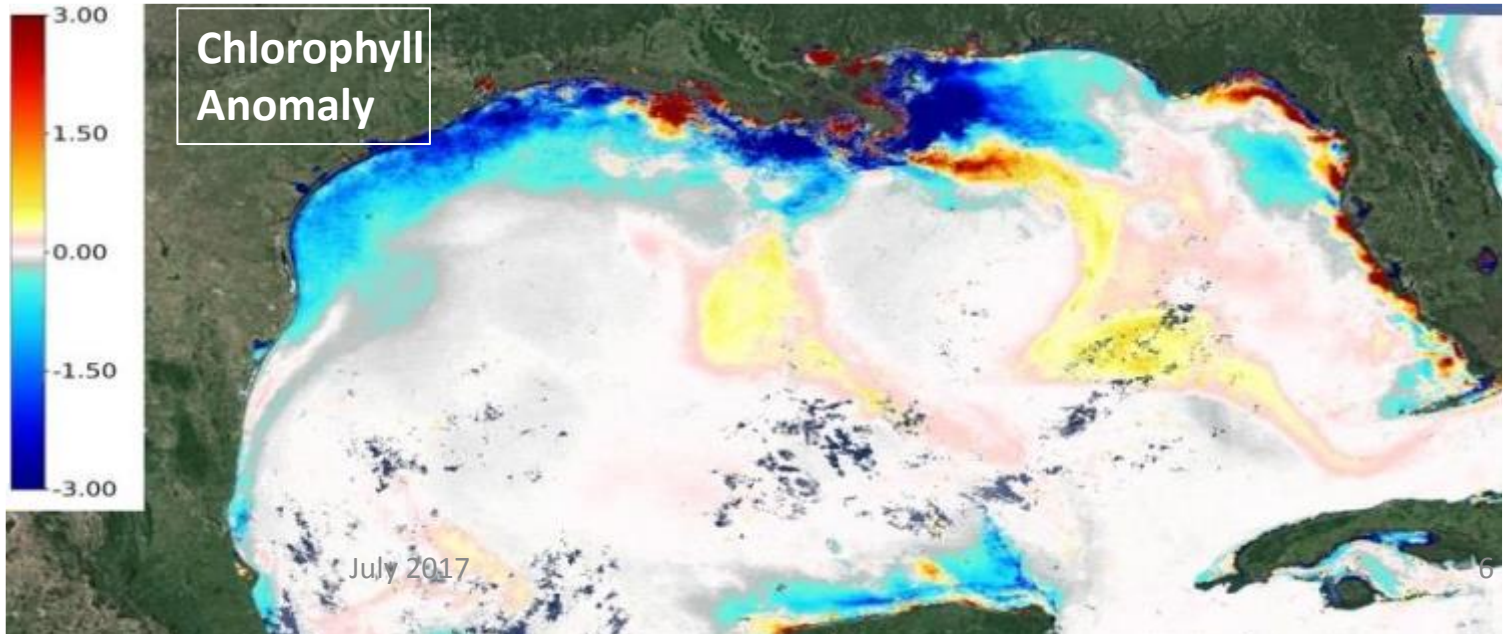


Difference

Higher

None

Lower



Chl, Eu, bb, Salinity, SST, Currents

Defining the Level of Abnormality
Is the Anomaly within the Variance of the Region

Plume to Key West

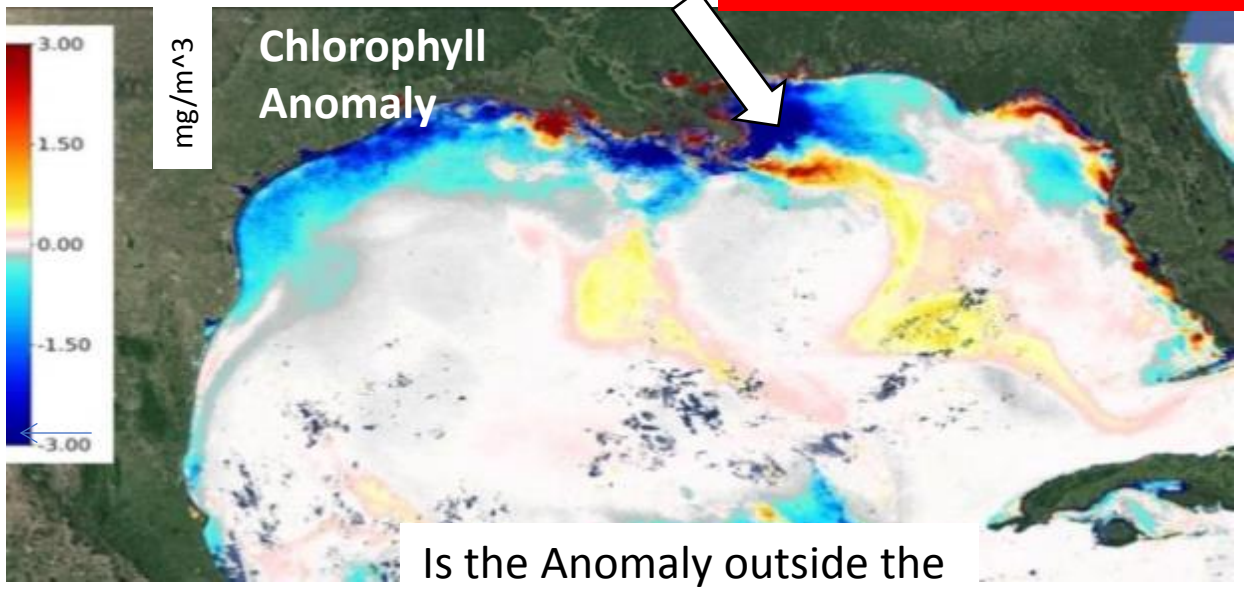
8-21-2015 Week

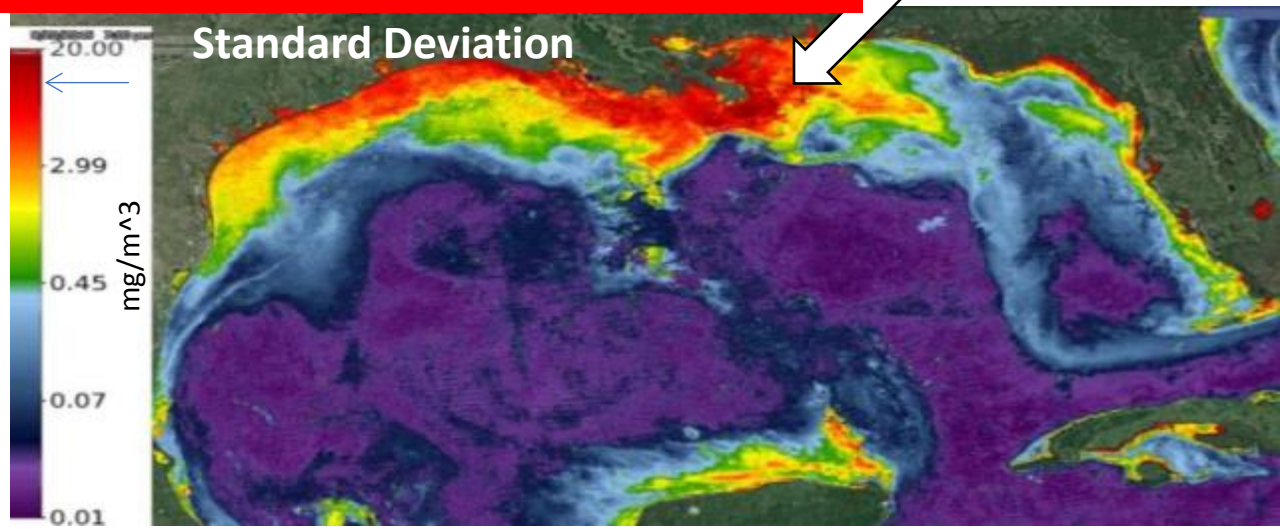
Dynamic Anomaly DAP Properties

For each pixel, how far is the anomaly outside the Standard Deviation

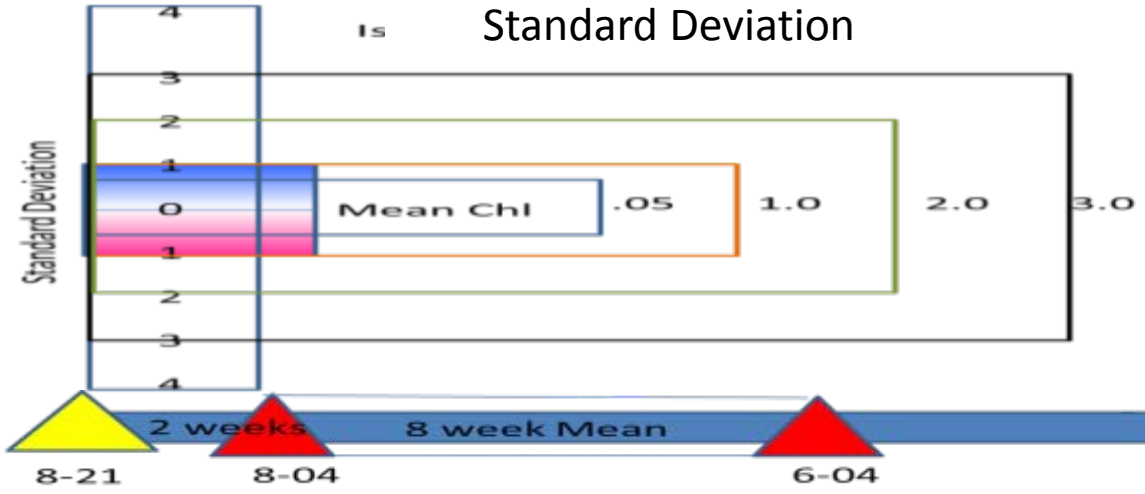
-3 mg/m

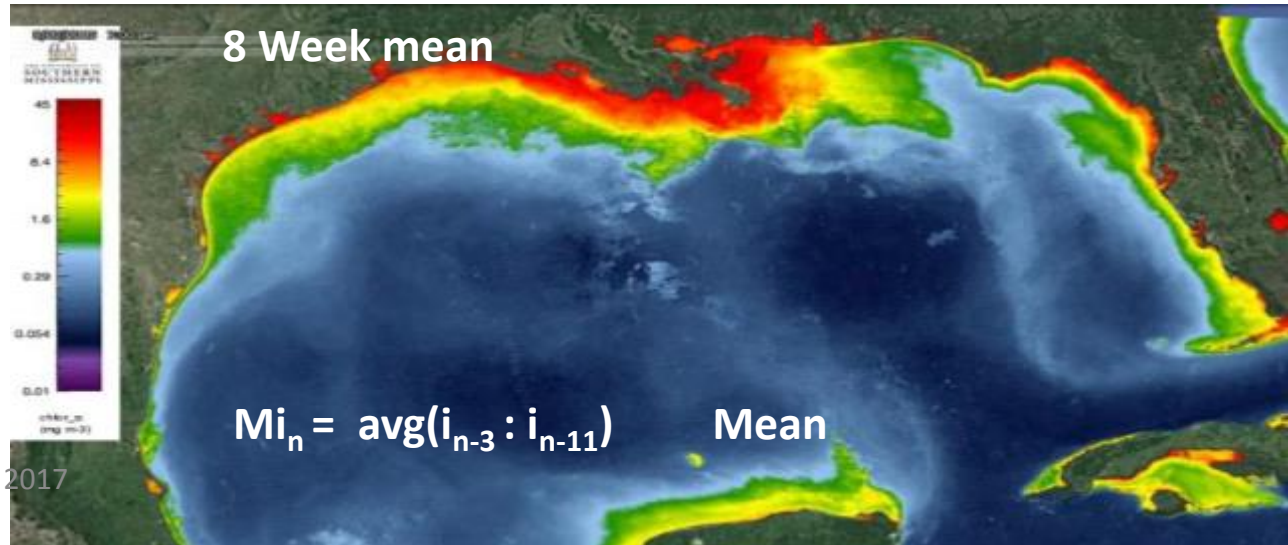
+/- 10mg/m3





Is the Anomaly outside the Standard Deviation





Chl_ Anomaly_8-15- 2week lag – 8 week average

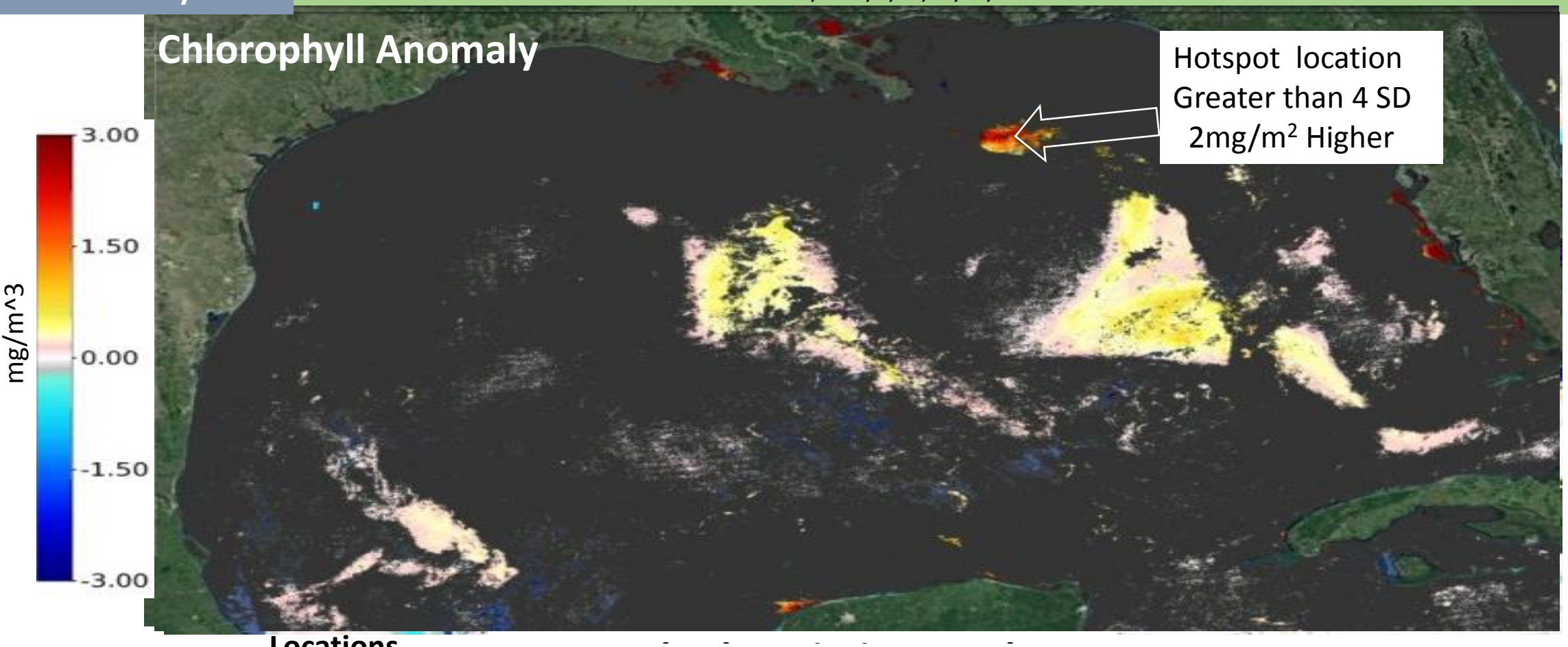
8-21-2015 Week

HOW ABNORMAL IS THE DYNAMIC HOTSPOT ?

Masking the Different Level of the Standard deviation

0 , 1, , 2, 3, 4,

Plume to Key West



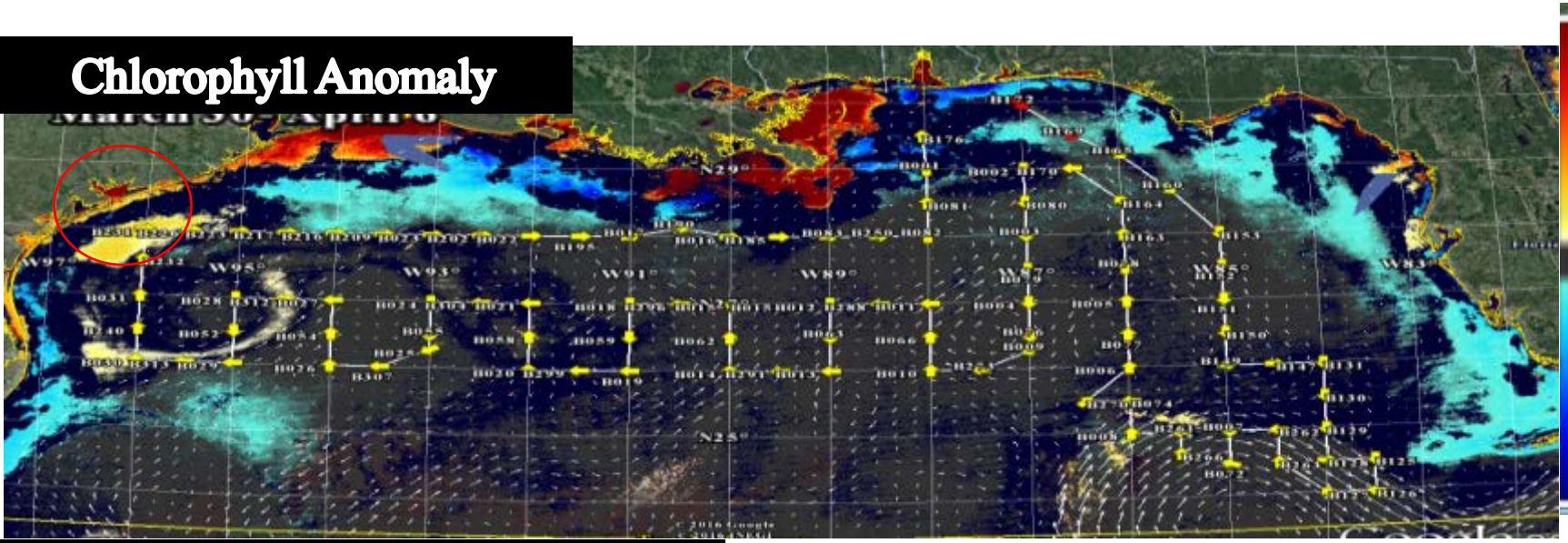
Locations Greater than → **4.0 Standard Deviation Mask**

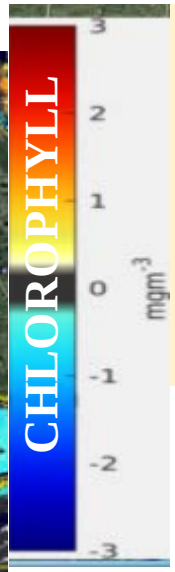
Levels of Abnormal Chlorophyll outside the Standard Deviation Location of Hotspots

Gulf Of Mexico - Ocean Events – HOTSPOTS
NOAA SeaMap Spring Cruise 2017

APRIL 15 2017

Chlorophyll Anomaly



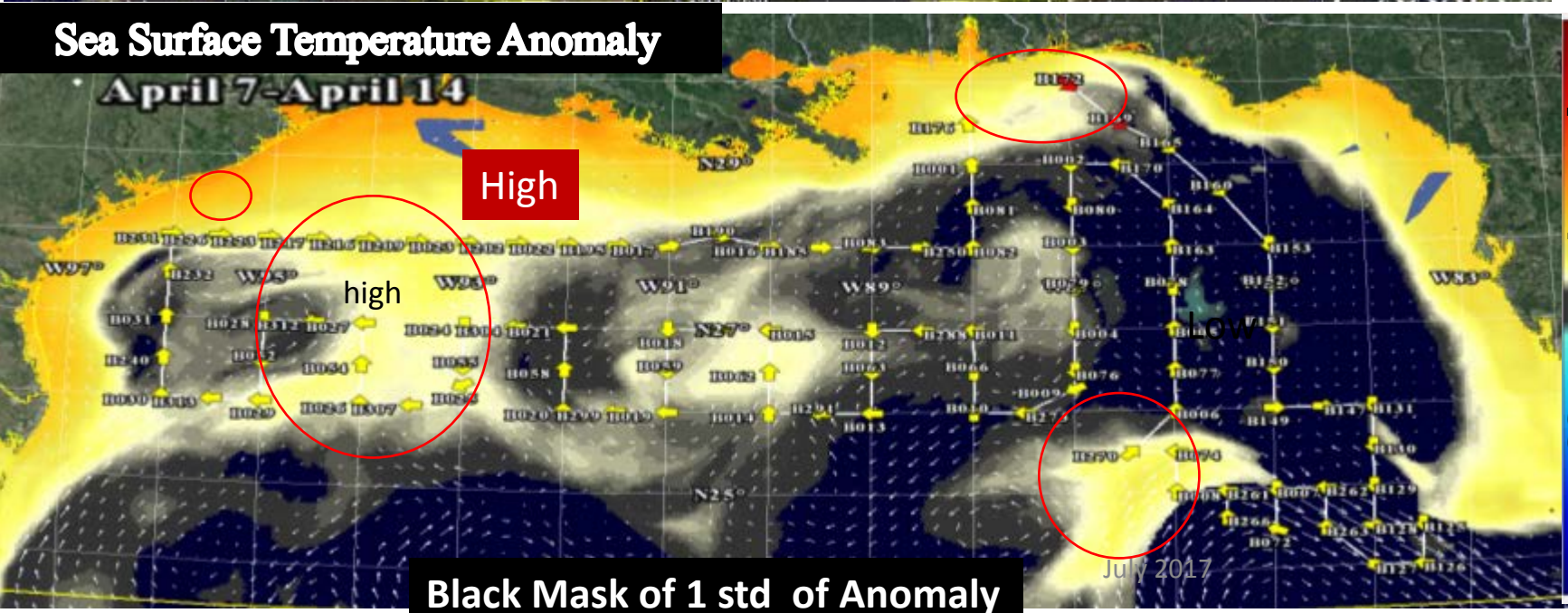


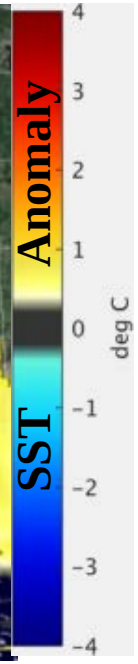
- Chl Anomaly - Stations normal Coastal MS plume

- SST – Heating in coastal regions Plume from Texas/Mexico shelf persisting

-

Sea Surface Temperature Anomaly





Positive(+) An Warming

GULF Is Warming!!

Stations-
B007
B025
B026
B027
B029
B054
B055
B176
B231
B261
B266
B307

Negative (-) Anomaly Cooling

Black Mask of 1 std of Anomaly

Gulf of Mexico
Hotspots - Environmental Products

Anomaly Products 2013 – Present

Bio-physical Properties

VIIRS – Satellite

1. Chlorophyll
2. Backscatter Particles
3. Absorption
4. Euphotic Depth 1% light
5. Sat-Temperature
6. Sat-Salinity

America Seas Models

7. Current Magnitude
8. Current direction
9. Model-Temperature
10. Model-Salinity

Water Quality

Products For Each property

1. Anomaly
2. Weekly Conditions
3. 8-week average
4. Standard Deviation
5. St. Dev Mask 1,2,3,4

GOOGLE Earth Display Tool
Interactive

Identify how different Abnormal Products affect the ecosystem.

What level of abnormality Affects different Part of the ecosystem?

Similar products Used In HABS for data collection

Anomaly Products

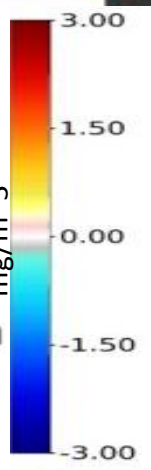
Plume to Key West Event
Sept 21- 2015

Products

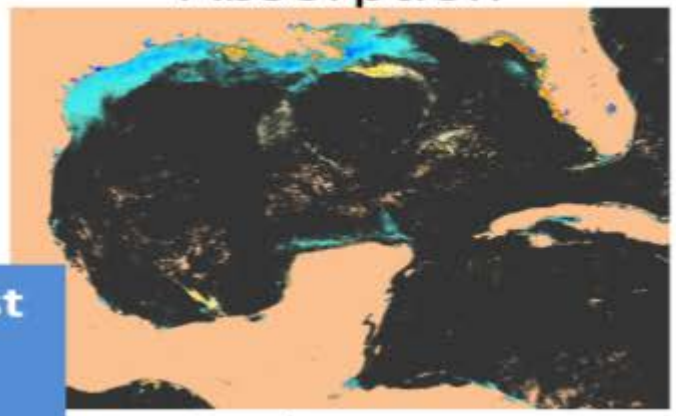
Anomaly

Weekly
8Week Avg
Anomaly
Stand Deviation

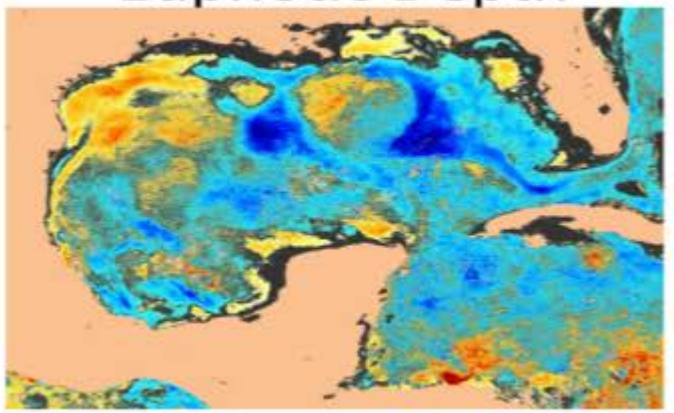
Animation



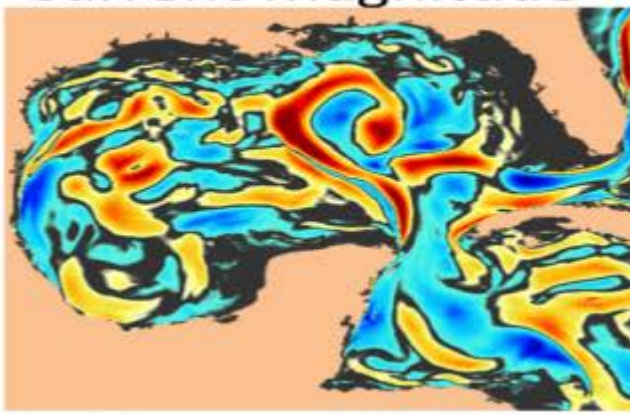
Absorption



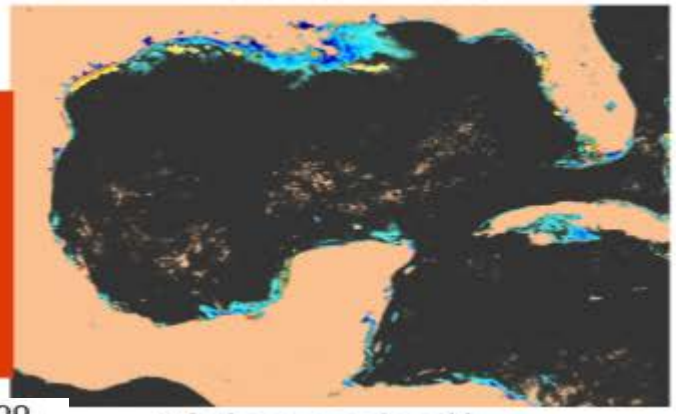
Euphotic Depth



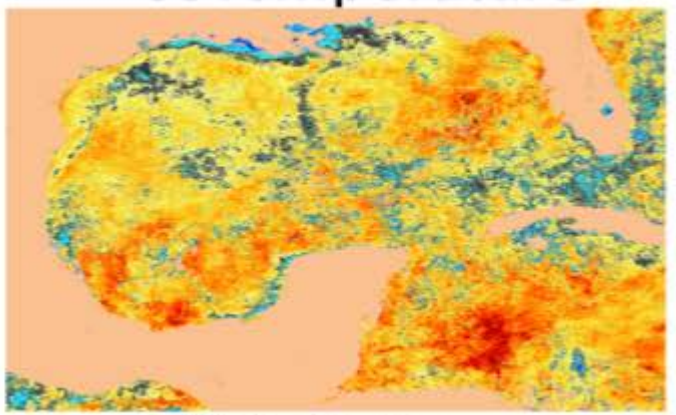
Current Magnitude



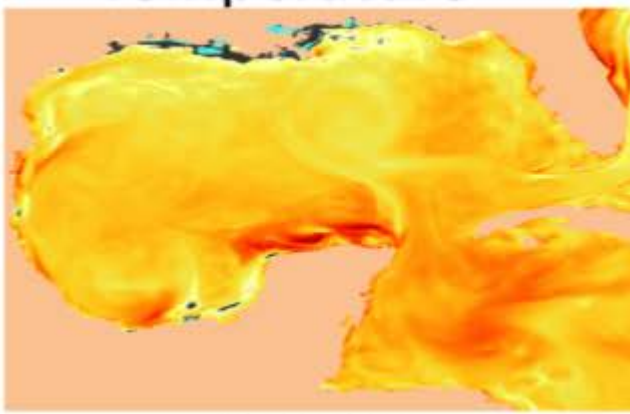
Backscatter



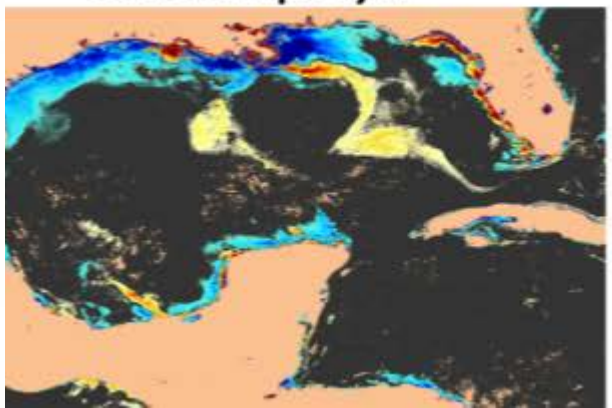
SSTemperature



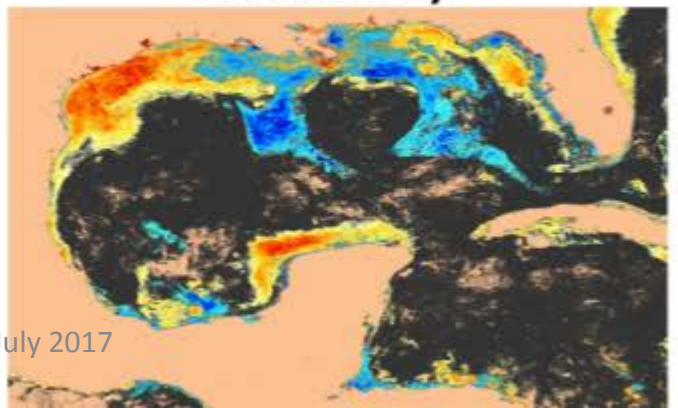
Temperature



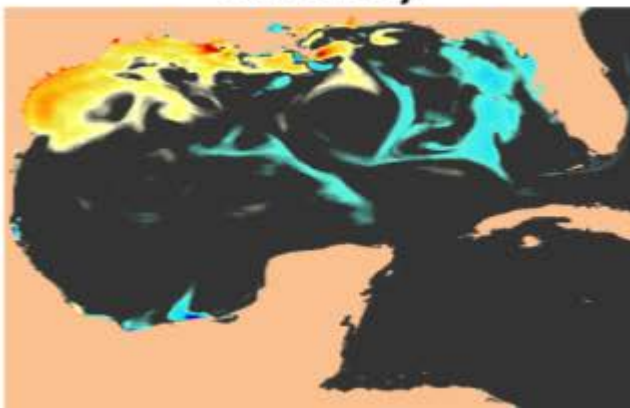
Chlorophyll



SSSalinity



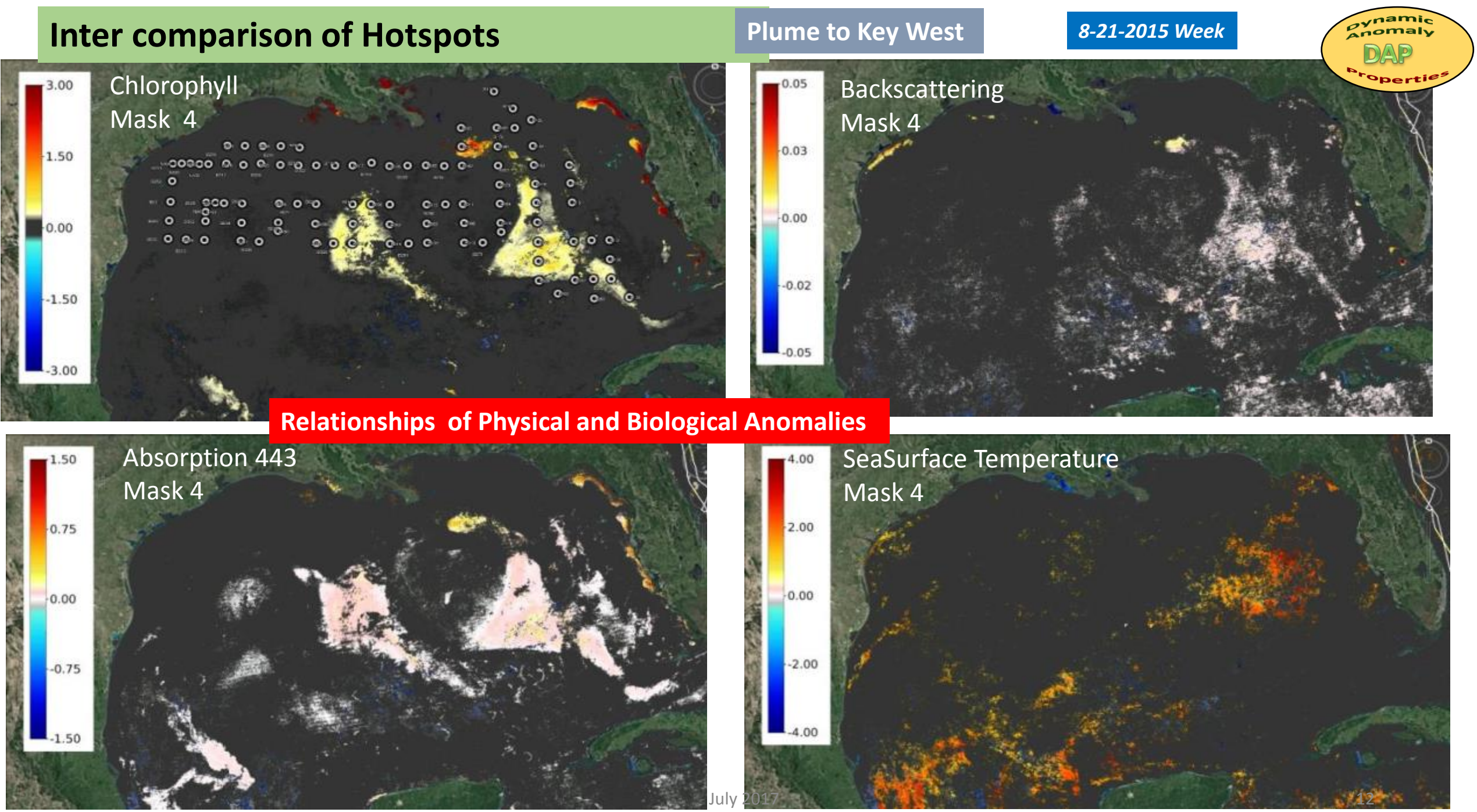
Salinity



Inter comparison of Hotspots

Plume to Key West

8-21-2015 Week

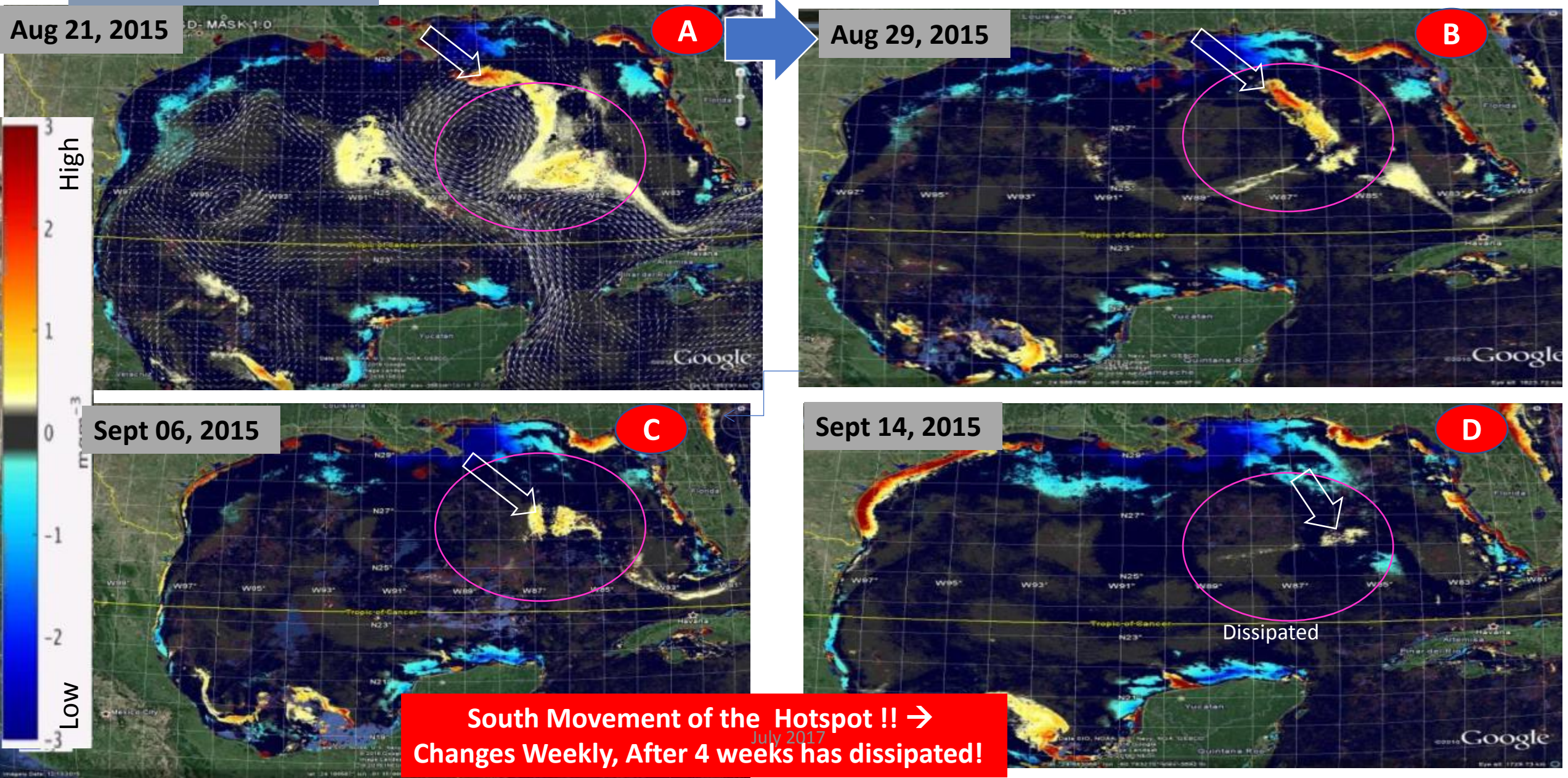


How Does the Chlorophyll Anomaly Change Weekly?

Dynamic Anomaly DAP Properties

MS Plume to Key West

Mask 1 Std Deviation



South Movement of the Hotspot !! →
Changes Weekly, After 4 weeks has dissipated!

July 2017

Decision Tools for DAP Products

Interactive "Google Earth Tool" for Displaying and overlaying real time and different Anomaly DAP data.

1) Can select specific Region of Interest
2) Comparison of the NOWCAST and ANOMALY -
3) How Normal is the NOWCAST
4) Can decide the level of Anomaly - St Dev MASK
   How abnormal is a location to different properties? "HOTSPOT"
5) Overlay ship and station data .
6) Data Gaps - Identify if collected environmental data represent the normal or abnormal events.
7) Identifies weekly events and provide researchers and managers a forecast for optimal data collection during events.

NEXT Examples Applied to SeaMap Cruise May 2017

R. Arnone
B. Jones , I. Soto

OWX Oregon II Cruise Tracks Nowcast – Anomaly

4 - Examples that were Sent out.

Leg 1

May 3, May 9,

Leg 2

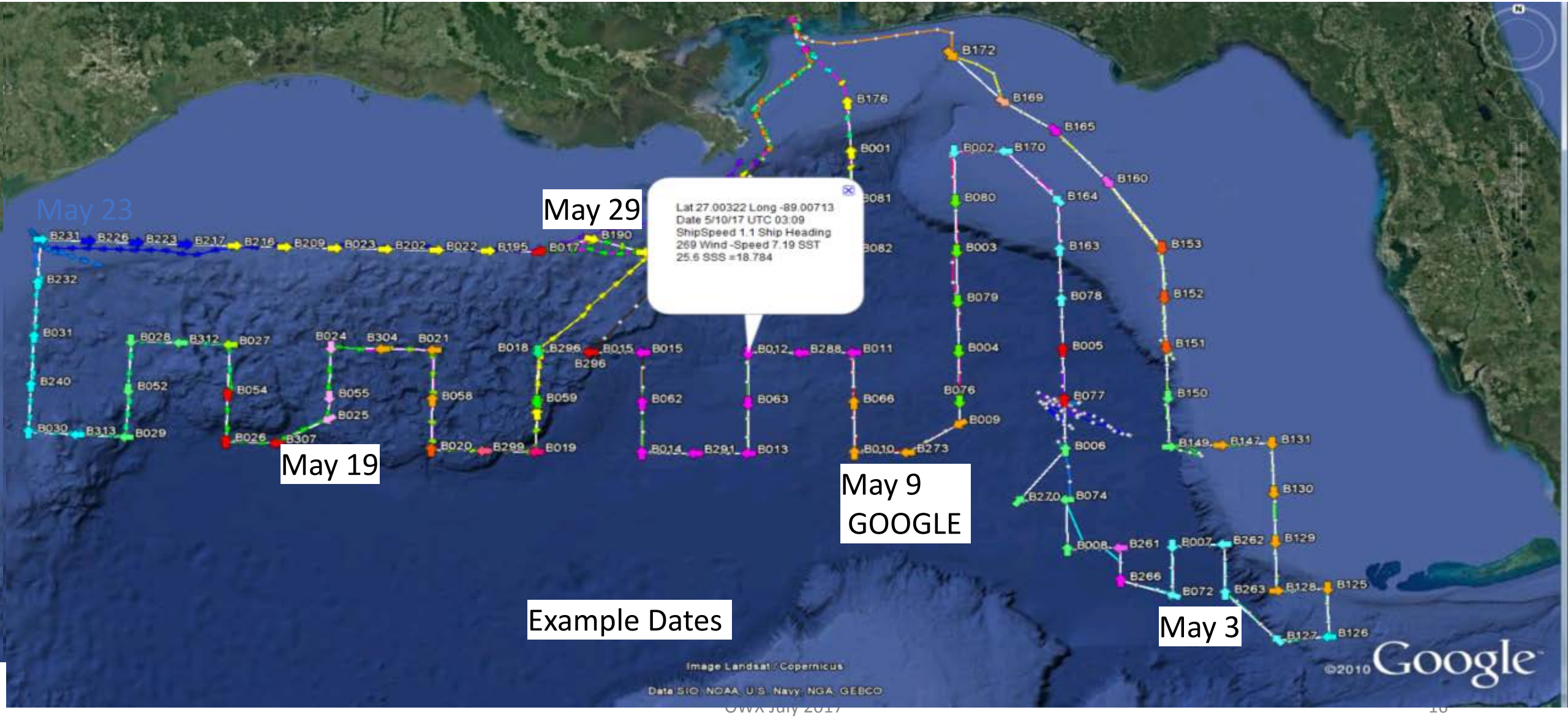
May 19, May 29

Roffers – Suggest Fisheries like: " Clear and Warm" waters

GOOGLE Earth

Oregon Cruise Track - with points Ship date time, Winds, SST SSS, etc

SeaMap Stations Can See the Time / date when at Station



#1

LOOP Current
May 3 SST- and Water Clarity Photic Depth

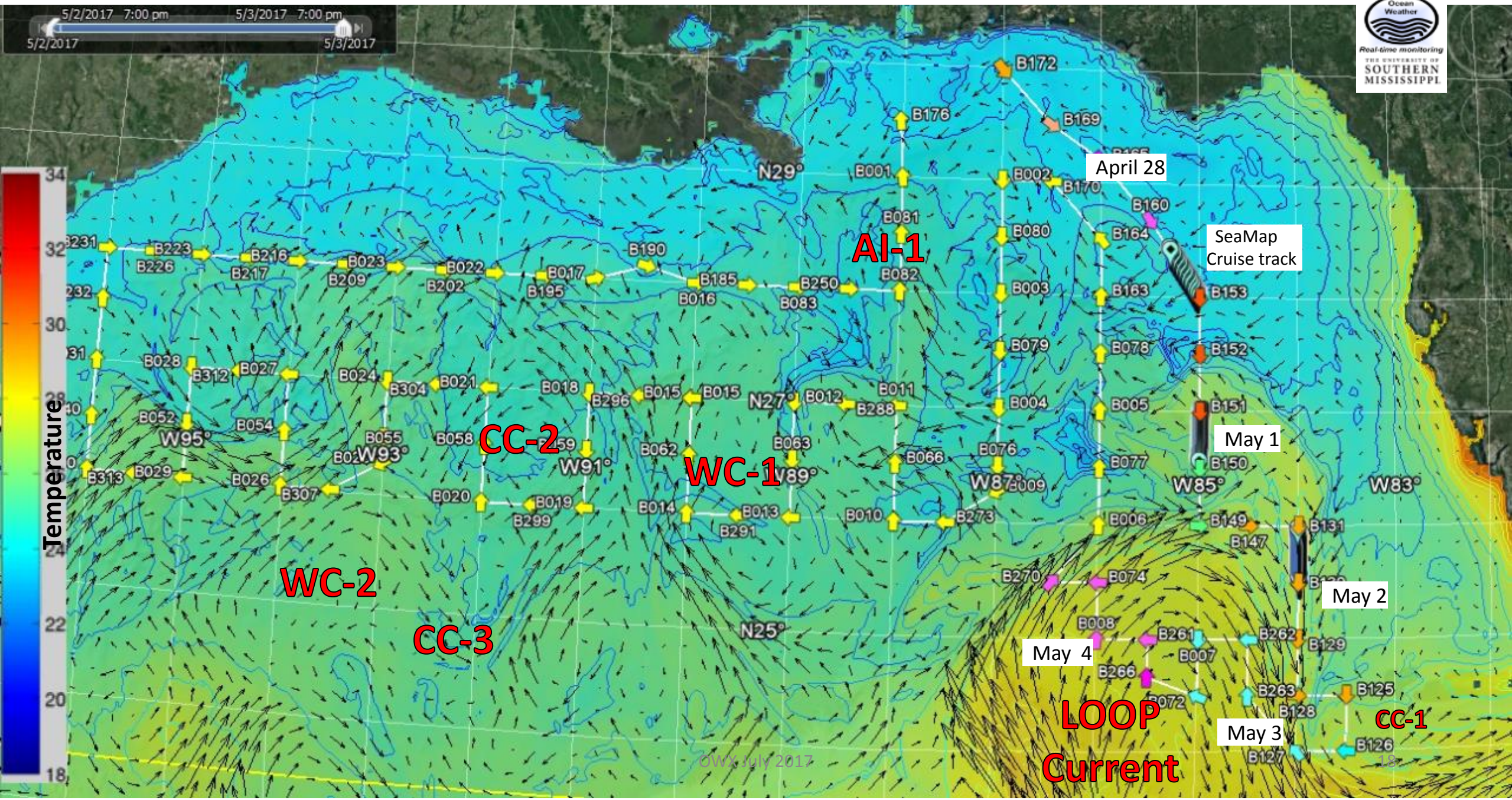
Leg 1

WC= Warm Core Eddy

CC= Cold Core Eddy

State of the Gulf -- Surface Temperature May 3, 2017 NOWCAST DAP

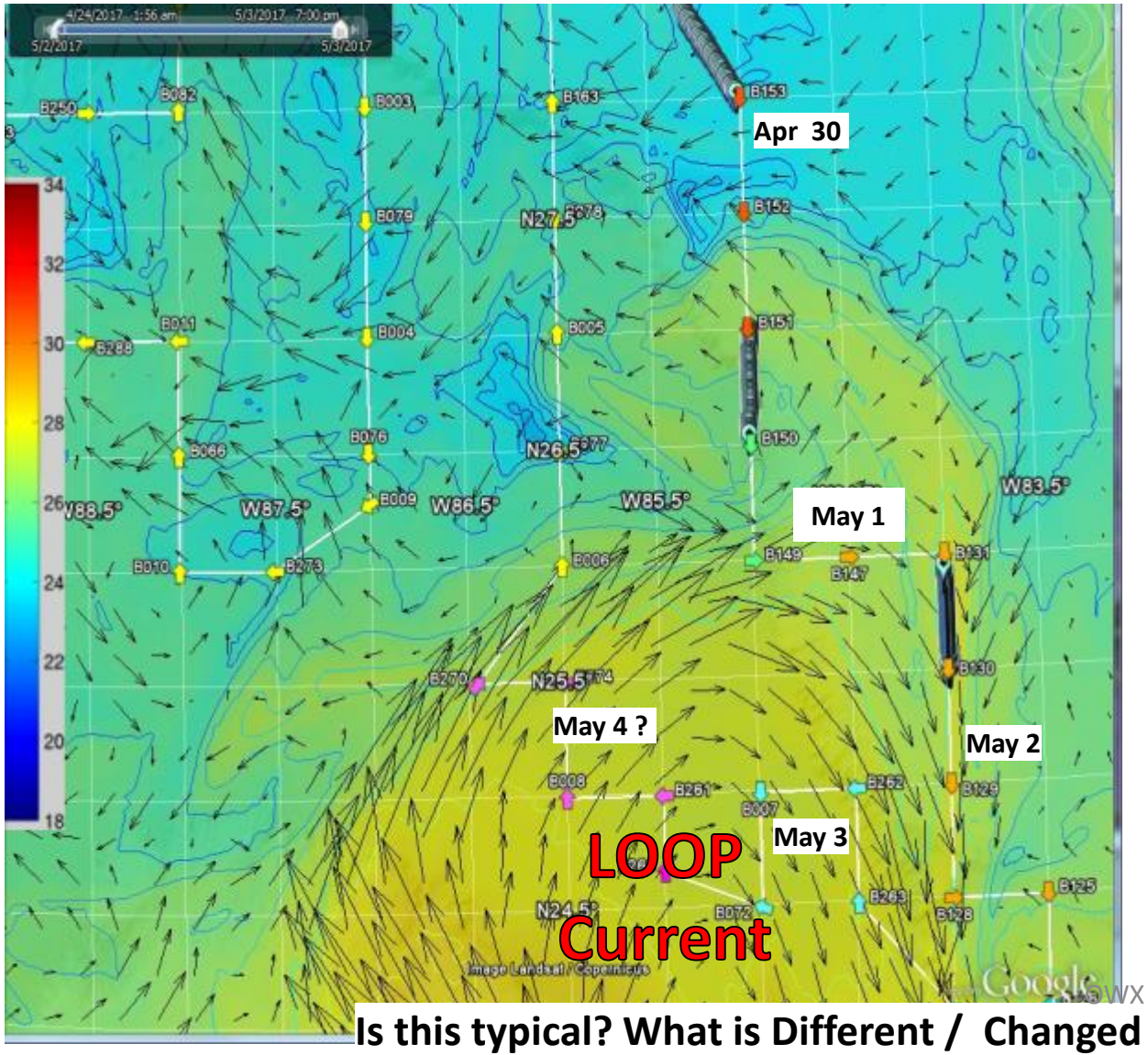
R. Arnone
B. Jones , I. Soto



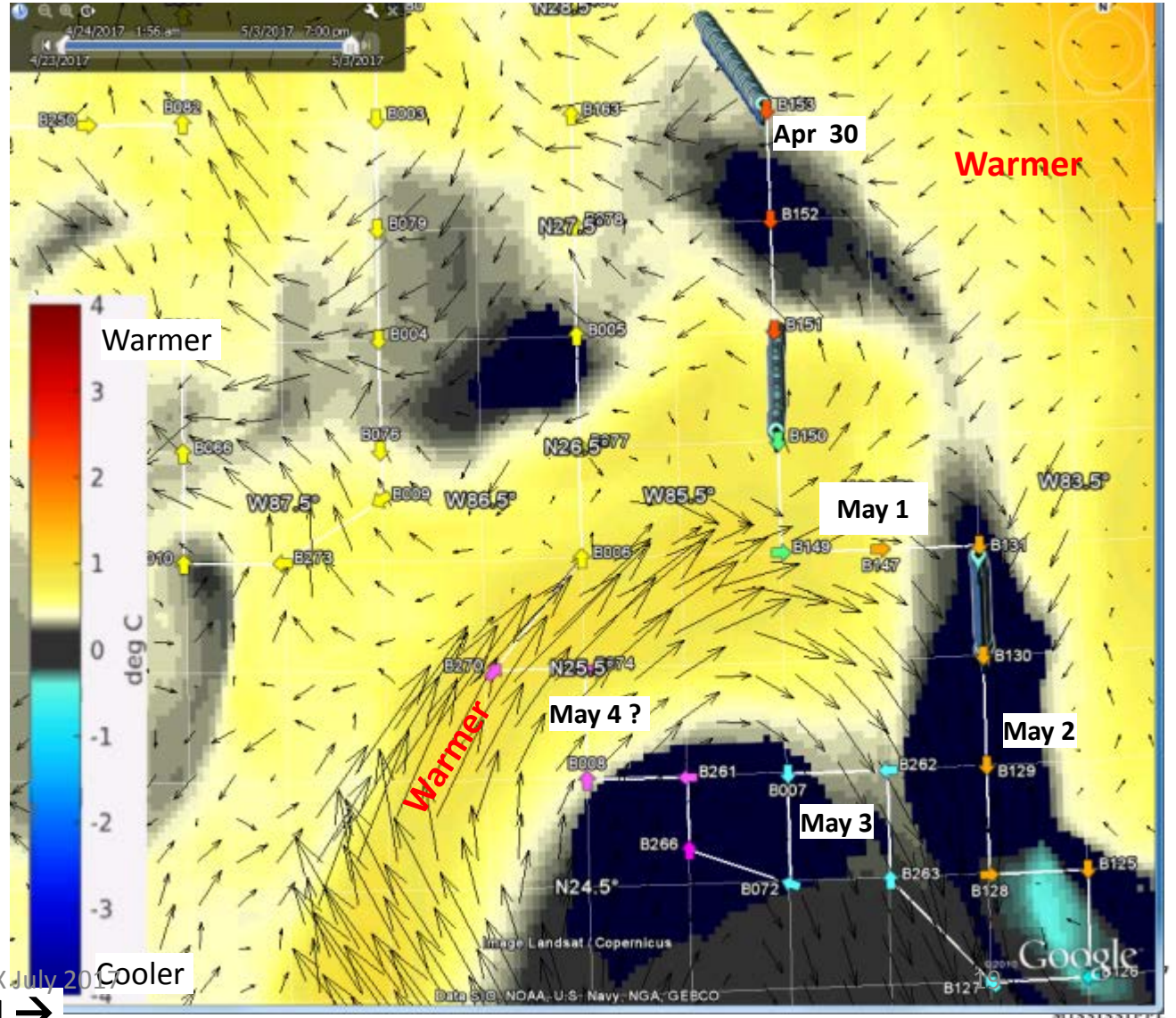
Nowcast Conditions
Seamap Stations 126 127 , 263, 262, 007, 072

May 3, 2017

Sea Surface Temperature



Anomaly SST - April 23



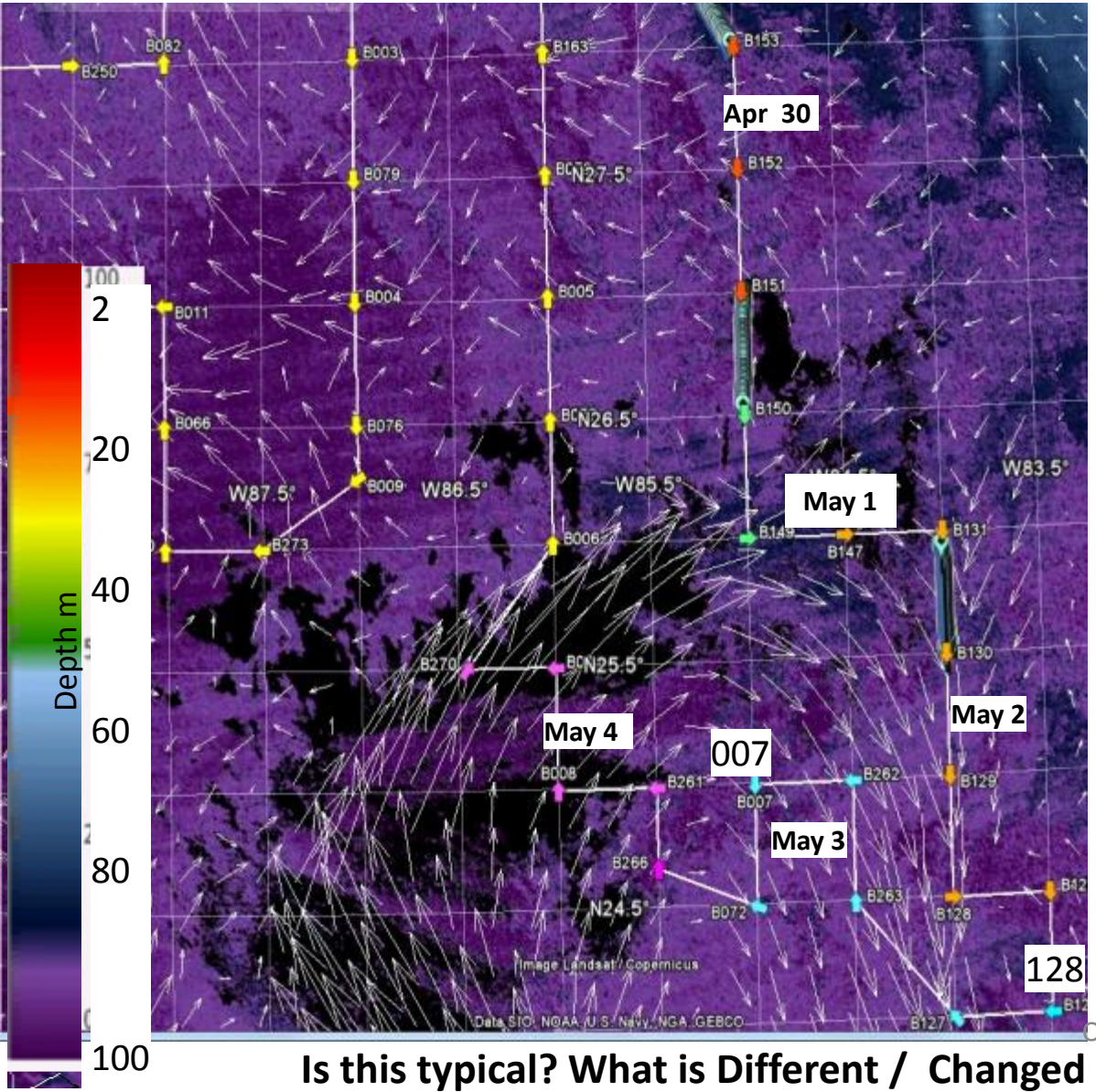
Is this typical? What is Different / Changed →

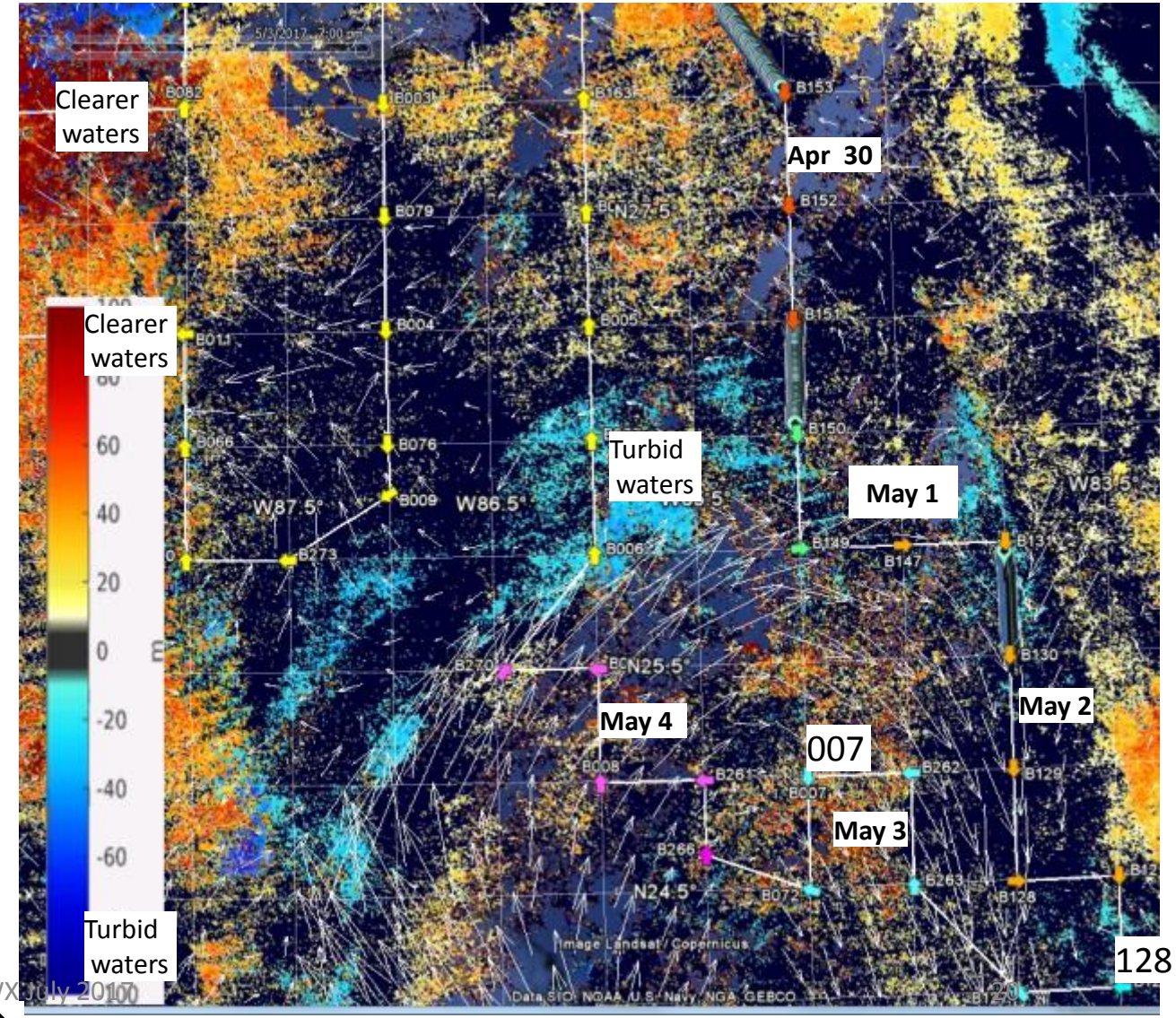
Nowcast Conditions
Seamap Stations 126 127 , 263, 262, 007, 072

May3, 2017
Water Clarity (Euphotic depth)

Nowcast - All clear at clear

Anomaly April 23





Is this typical? What is Different / Changed →

May 19 TRACK

Westerly Coastal Plume

May 19, 2017
- Oregon 2 SEAMAP – Leg 2 Cruise track

R. Arnone
B. Jones , I. Soto
Ocean Weather
Real-time monitoring
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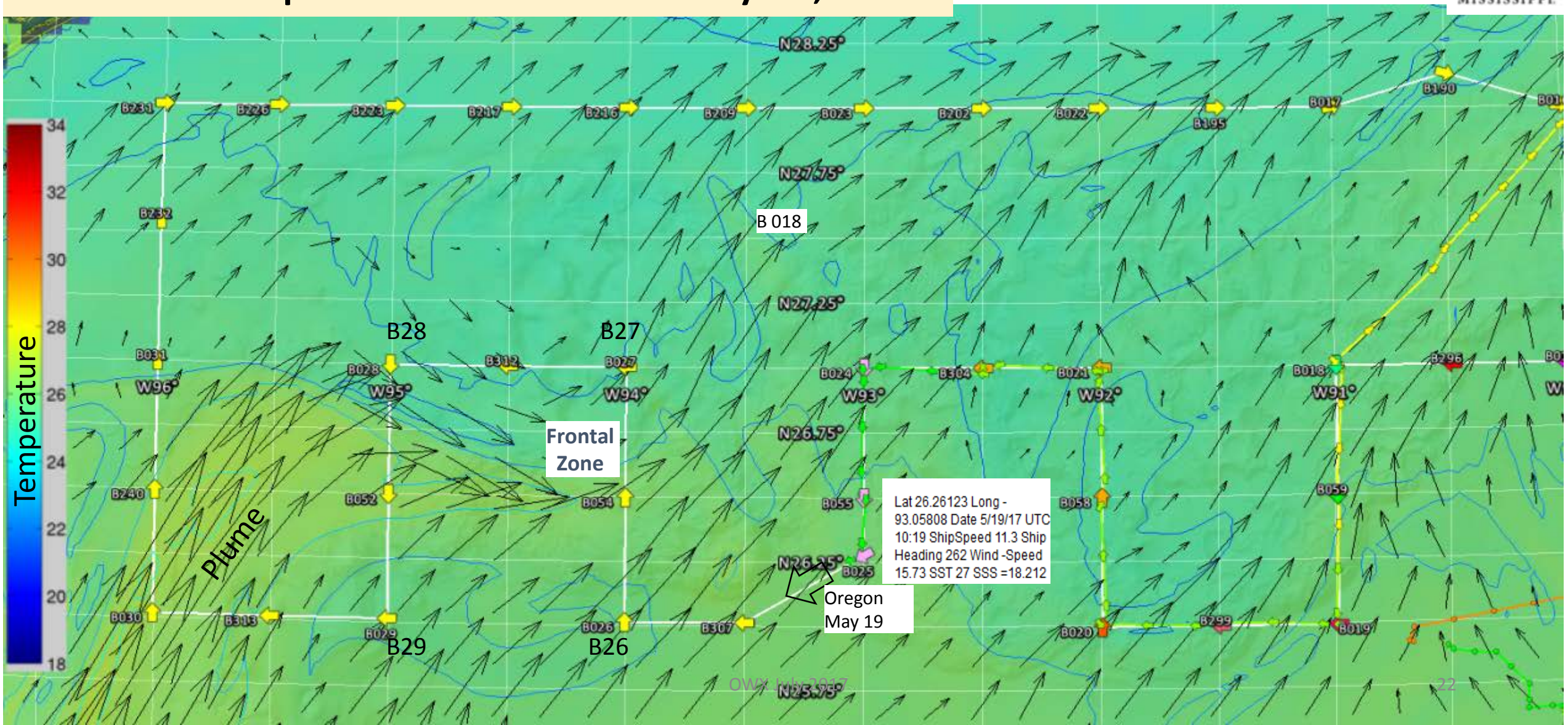
NOWCAST

Sea Surface Temperature – Currents for May 18, 2017

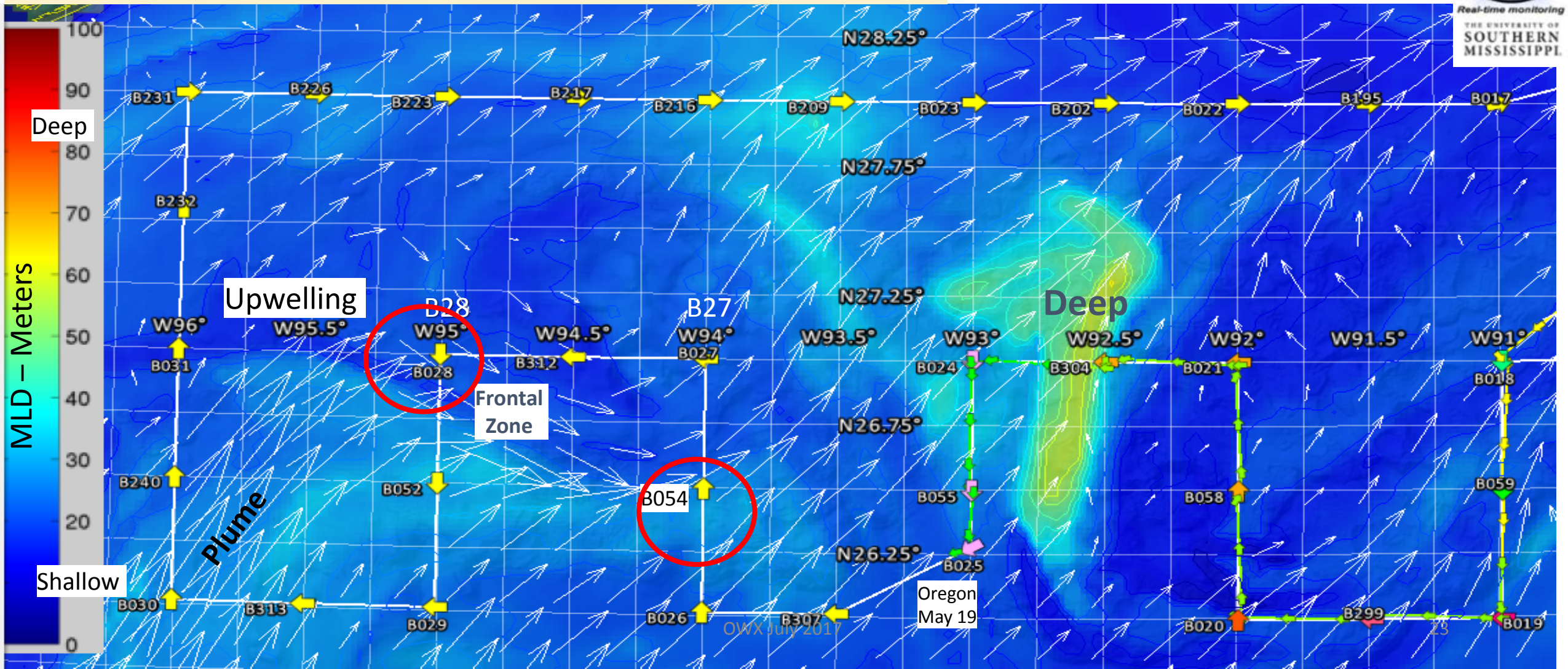


Oregon 2 Cruise track May 19, 2017

Plume Moving across the Cruise Track
B054 and B028 – At upwelling / frontal region

NOWCAST

Mixed Layer depth -Currents for May 18, 2017

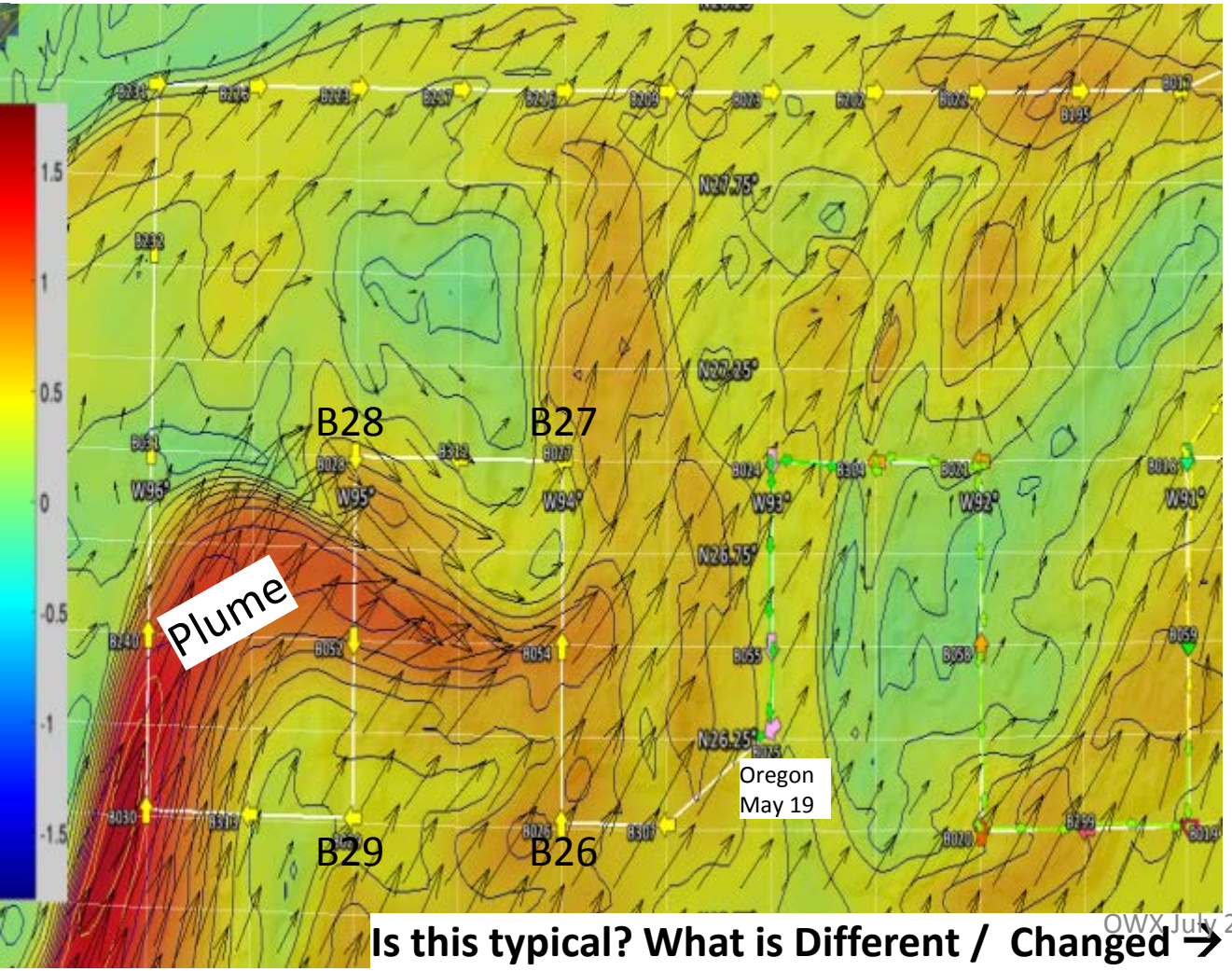


Oregon Cruise May 19 , 2017
Currents

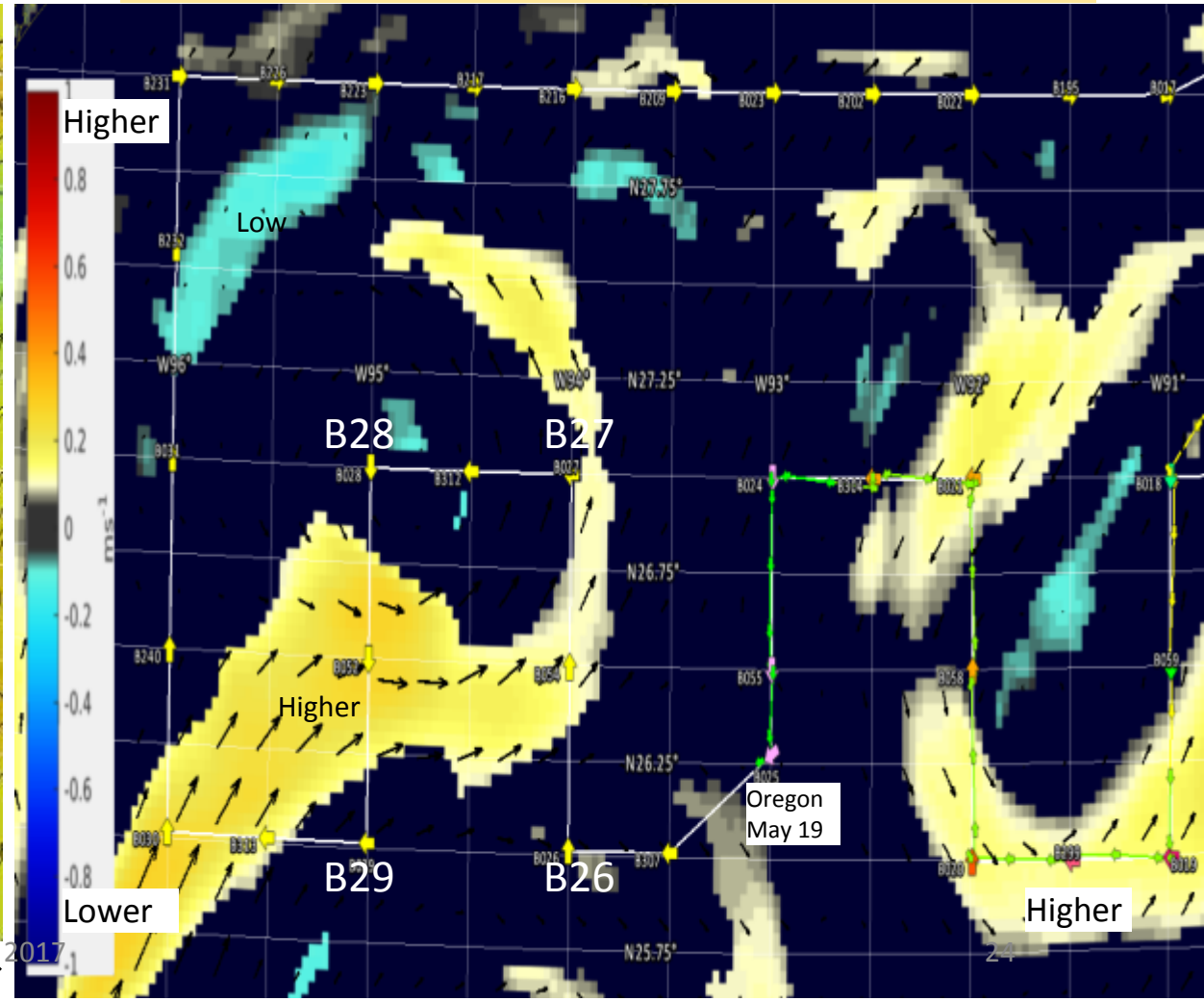
Leg 2 = Some stations have Higher currents B52, B54
Plume to West
Plume conditions - high salinity ,high currents, clear waters.

NOWCAST

Surface Current Magnitude May 18



Current Anomaly May 9-16 SD MSK1



Is this typical? What is Different / Changed →

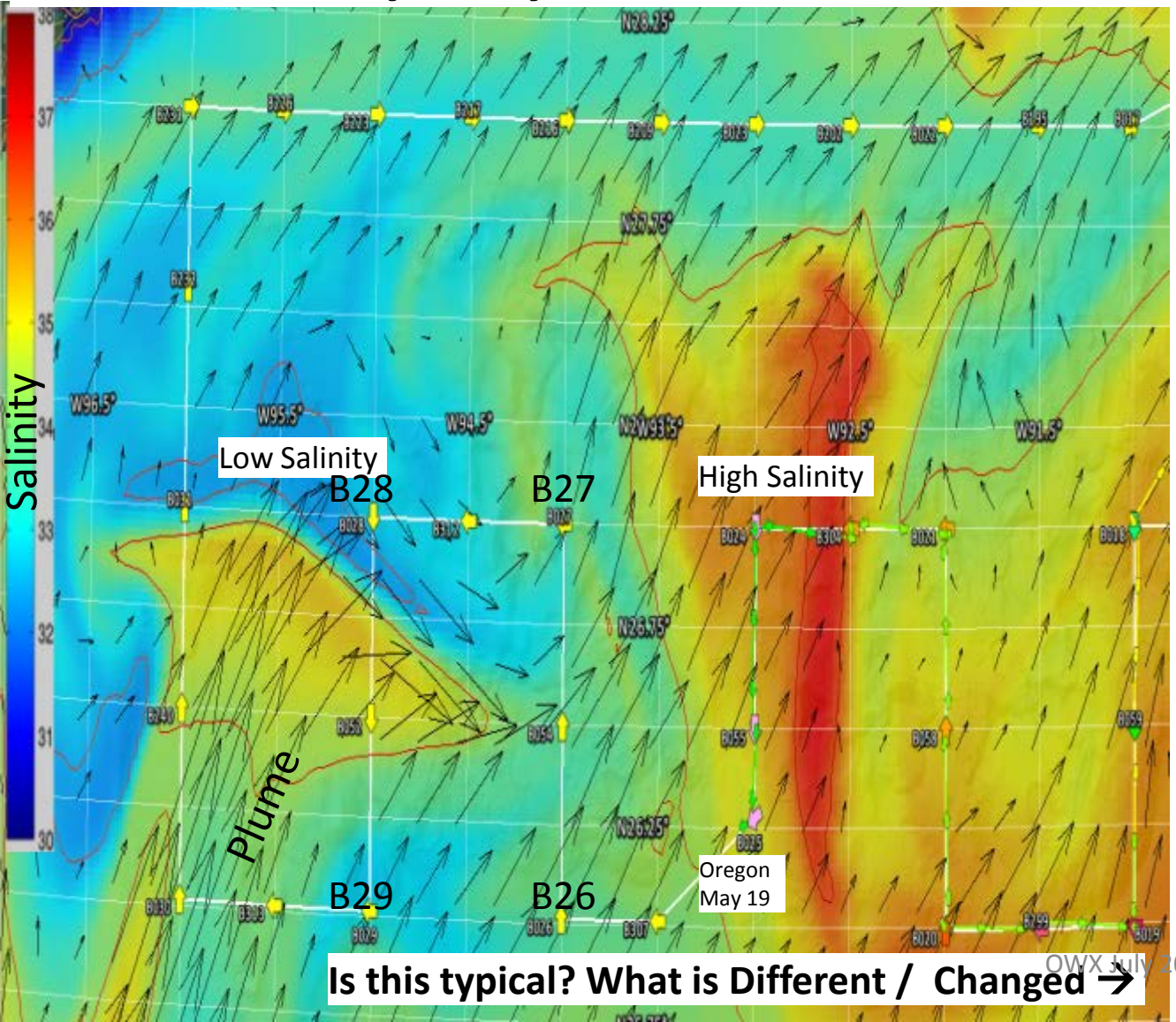
Oregon Cruise May 19 , 2017

Salinity

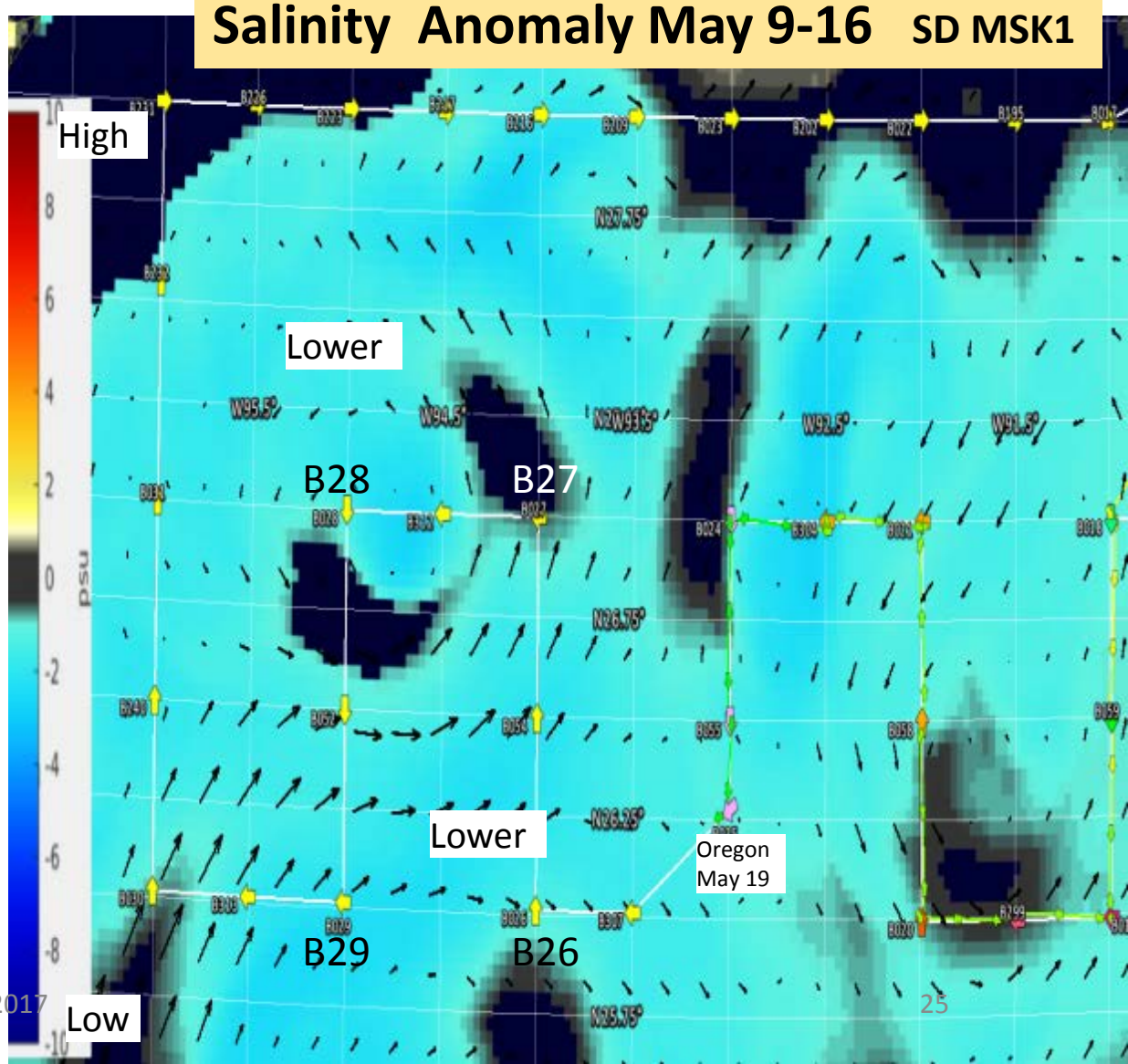
NOWCAST

Leg 2 - CHANGING SALINITY B26,27,28,52 , 29
Lower Salinity Water Most western SeaMap Stations
Plume salinity variable …

Surface Salinity May 18



Salinity Anomaly May 9-16 SD MSK1



Is this typical? What is Different / Changed →

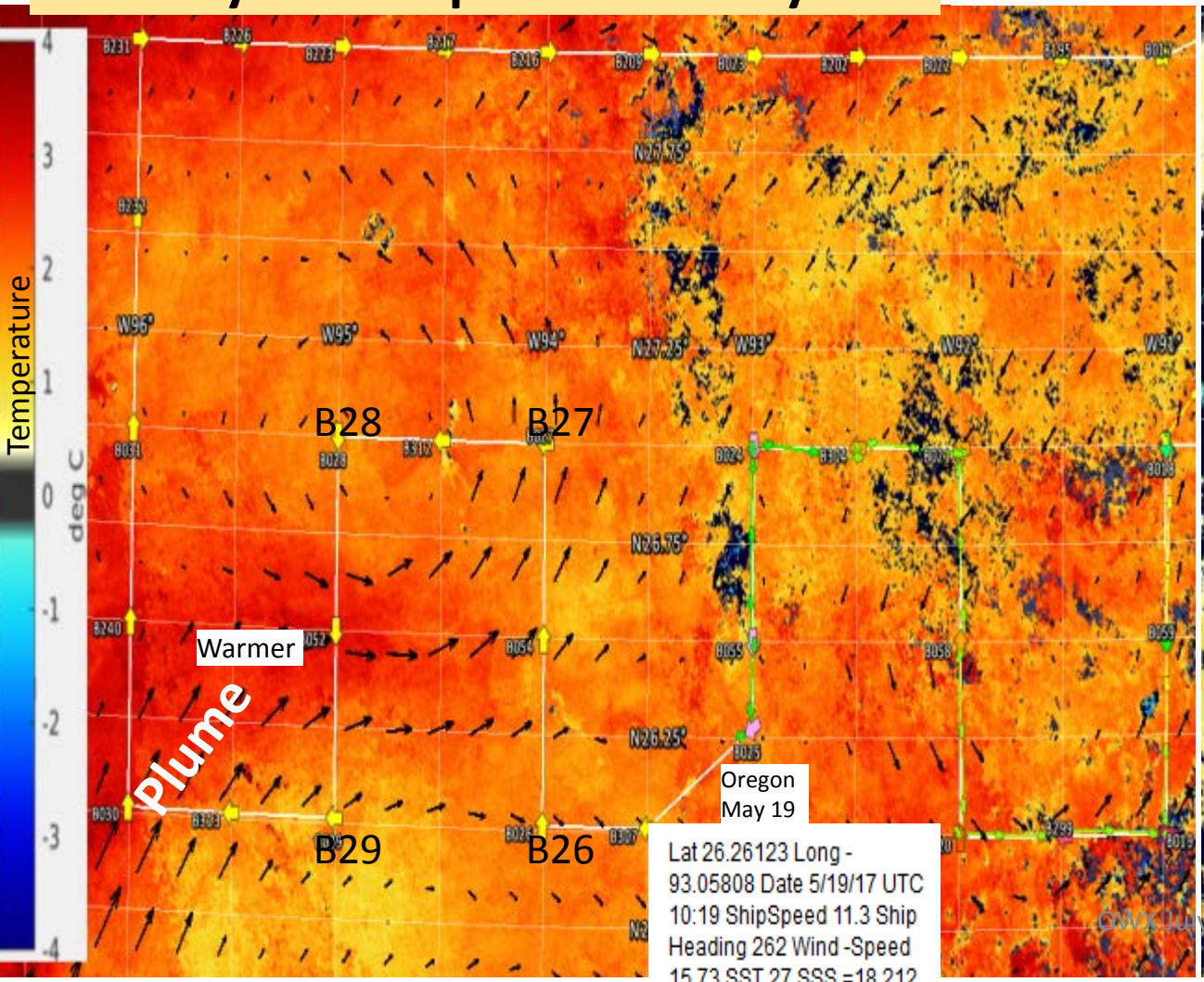
May 19, 2017 Oregon 2 Cruise

1) Overall Warmer waters than last 2 month
2) Clearer Station B312 -304

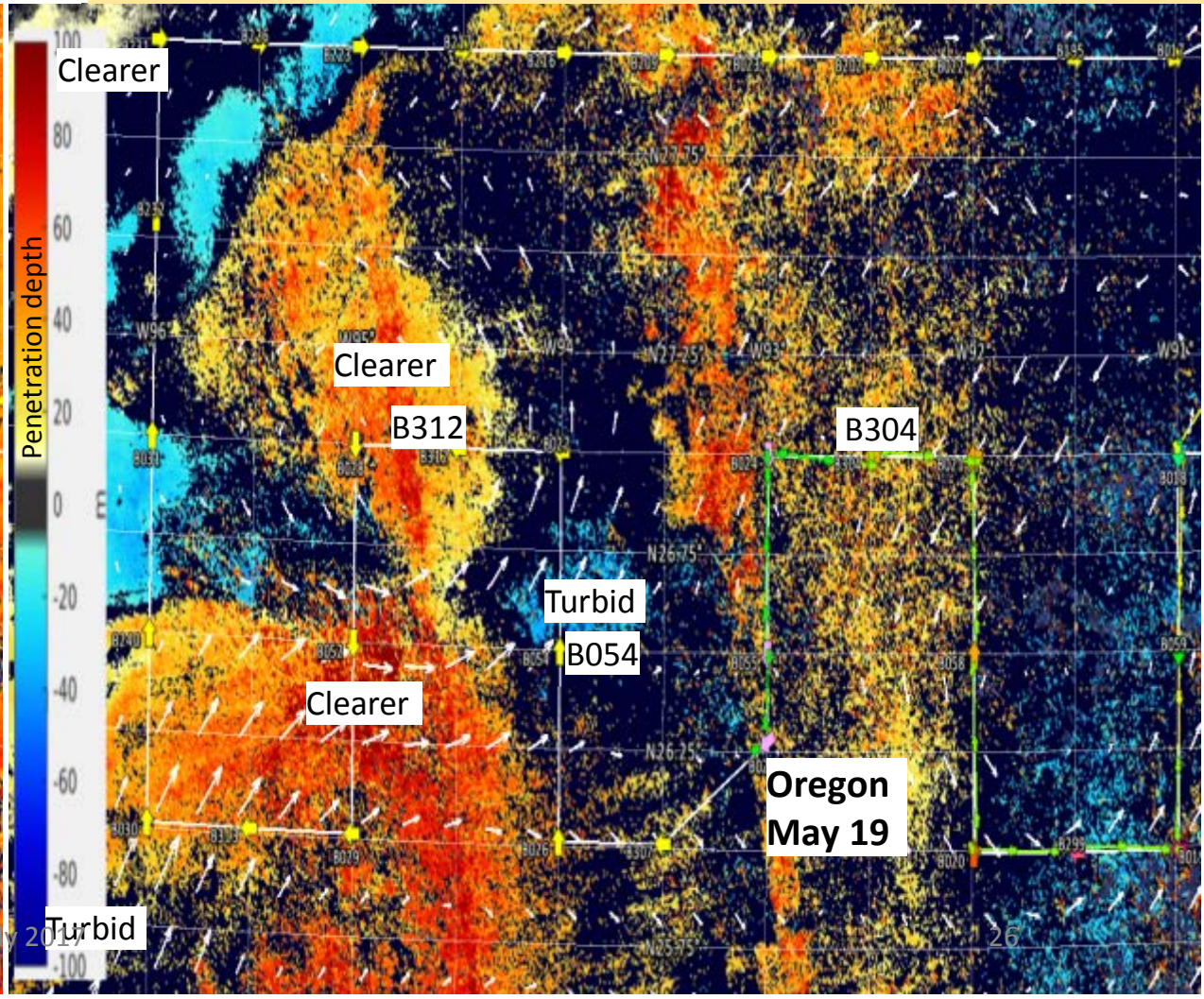
Anomaly Conditions

Have Conditions Changed - YES !

Anomaly SS Temperature May 9-16 Currents Weekly



Anomaly Water Clarity Currents Weekly



May 29 – Return to Leg 2 B-017, B190, B016 Mississippi River

Strong East Ward Flow

Changes in Salinity

May 29, 2017
- Oregon 2 SEAMAP – Leg 2 Cruise track

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Real-time monitoring
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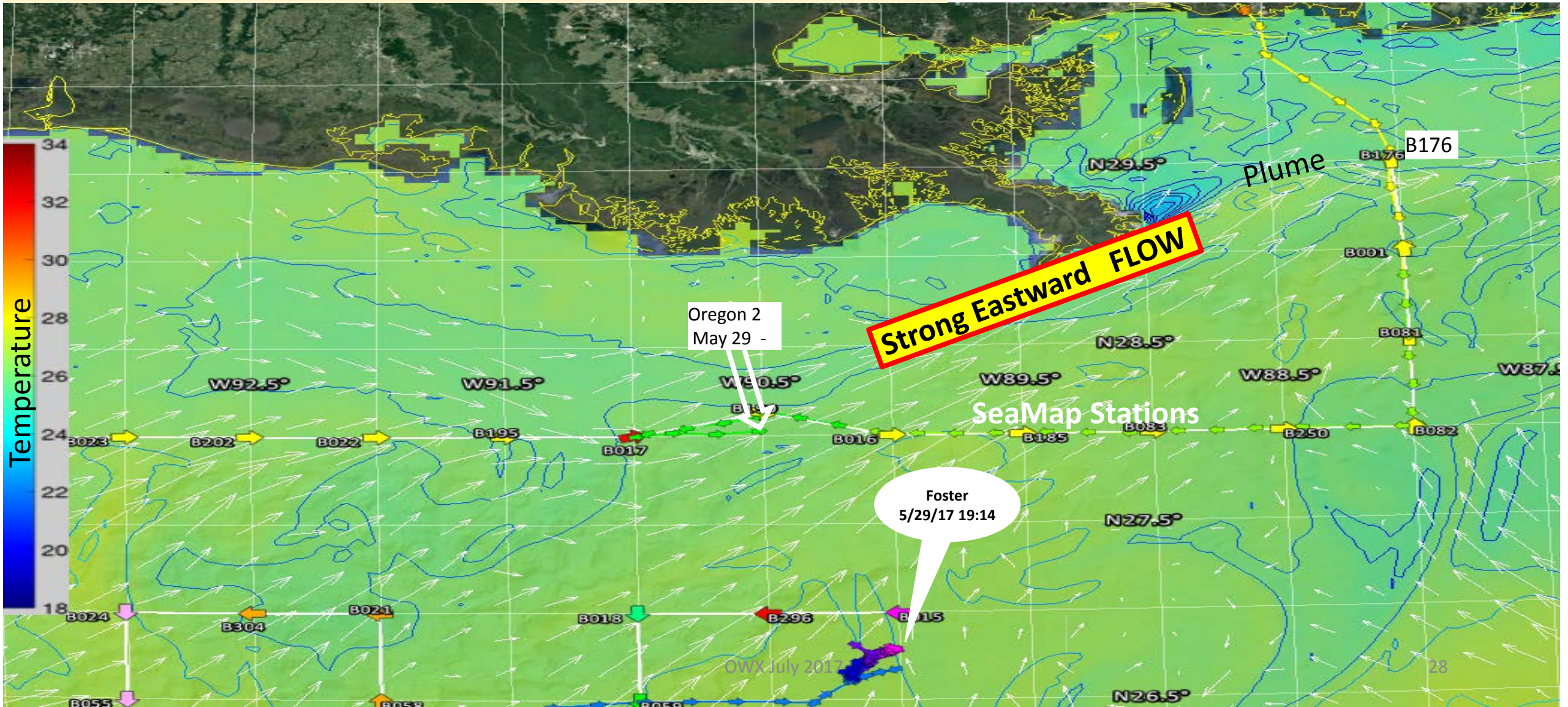
NOWCAST

Sea Surface Temperature – Currents for May 27, 2017



Oregon Cruise May 29 , 2017
Salinity

MS plume to EAST

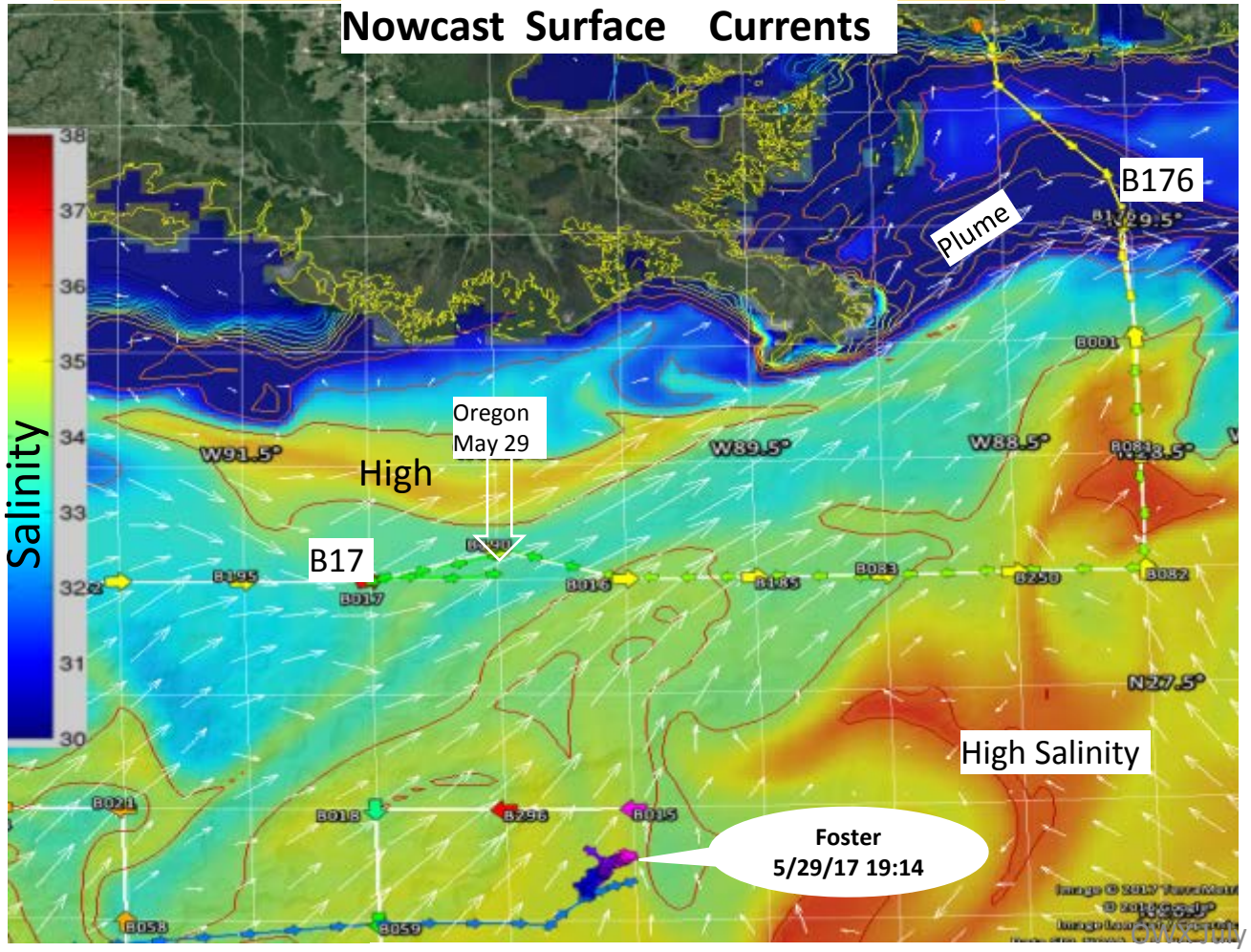
MS- Plume at B176

LA- Coast has high Salinity region

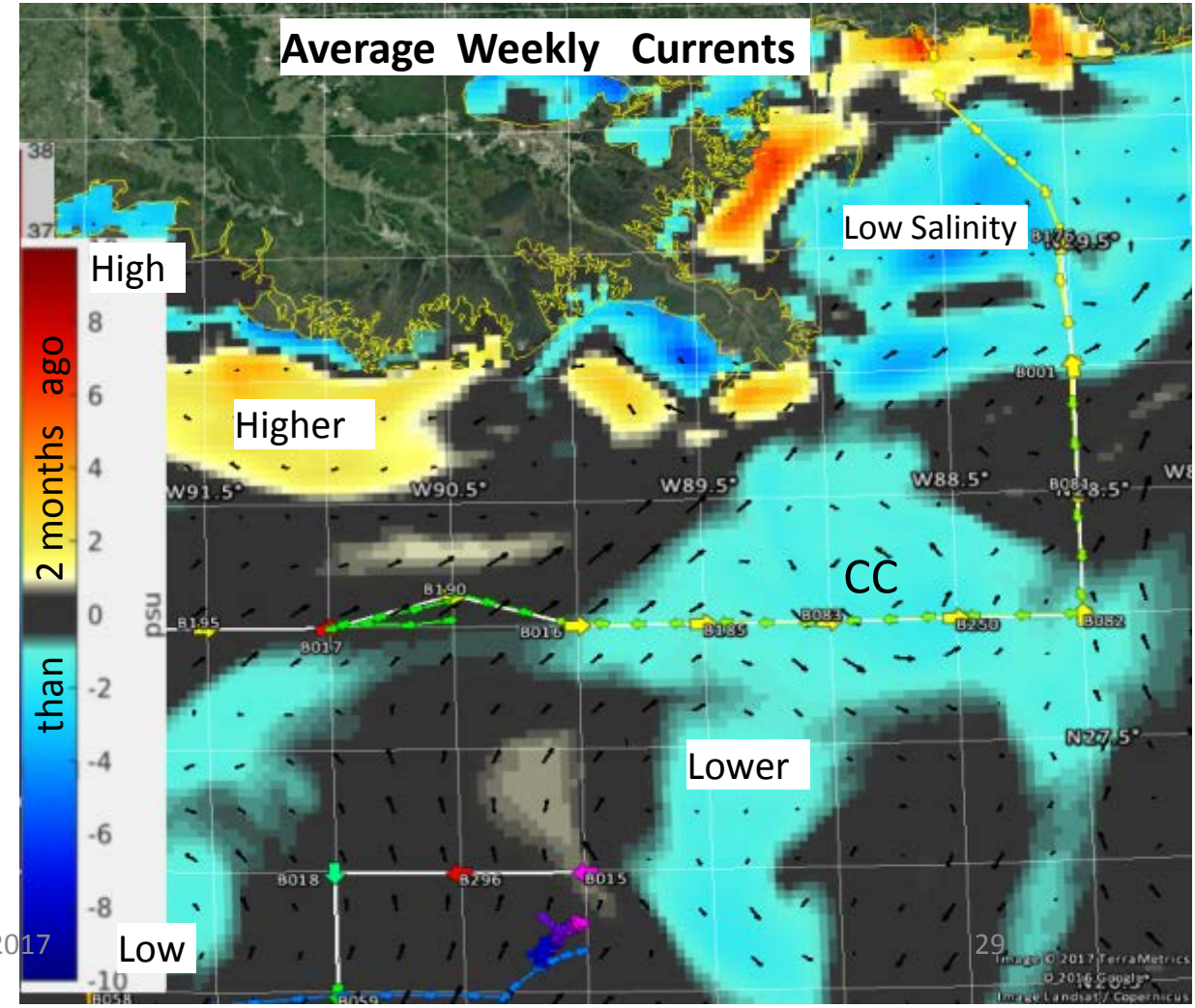
Lower Anomaly salinity regions - B176, B185-B082

NOWCAST

Surface Salinity May 27



Salinity Anomaly May 17-24 SD MSK1



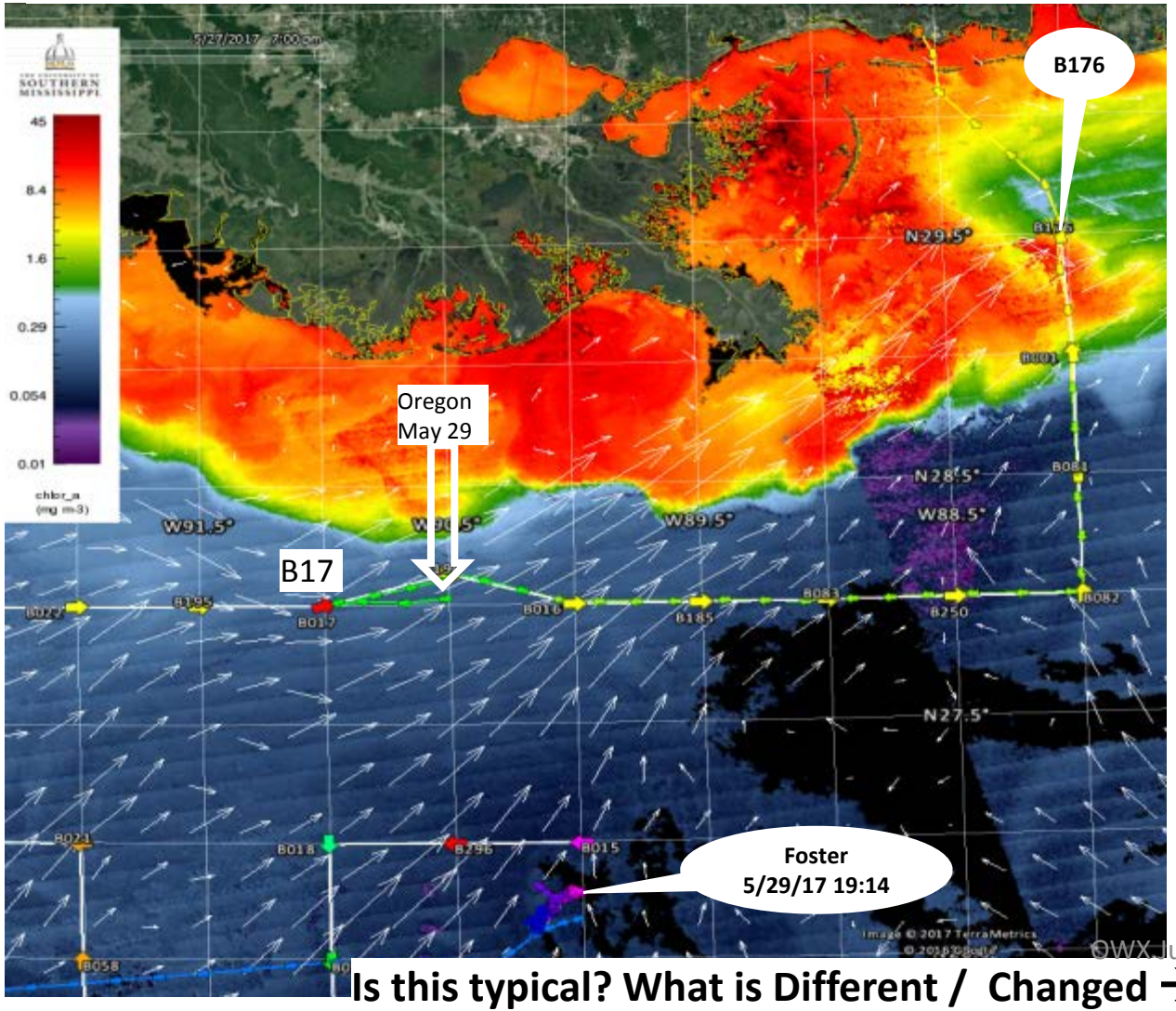
Is this typical? What is Different / Changed →

Oregon Cruise May 29 , 2017
Chlorophyll

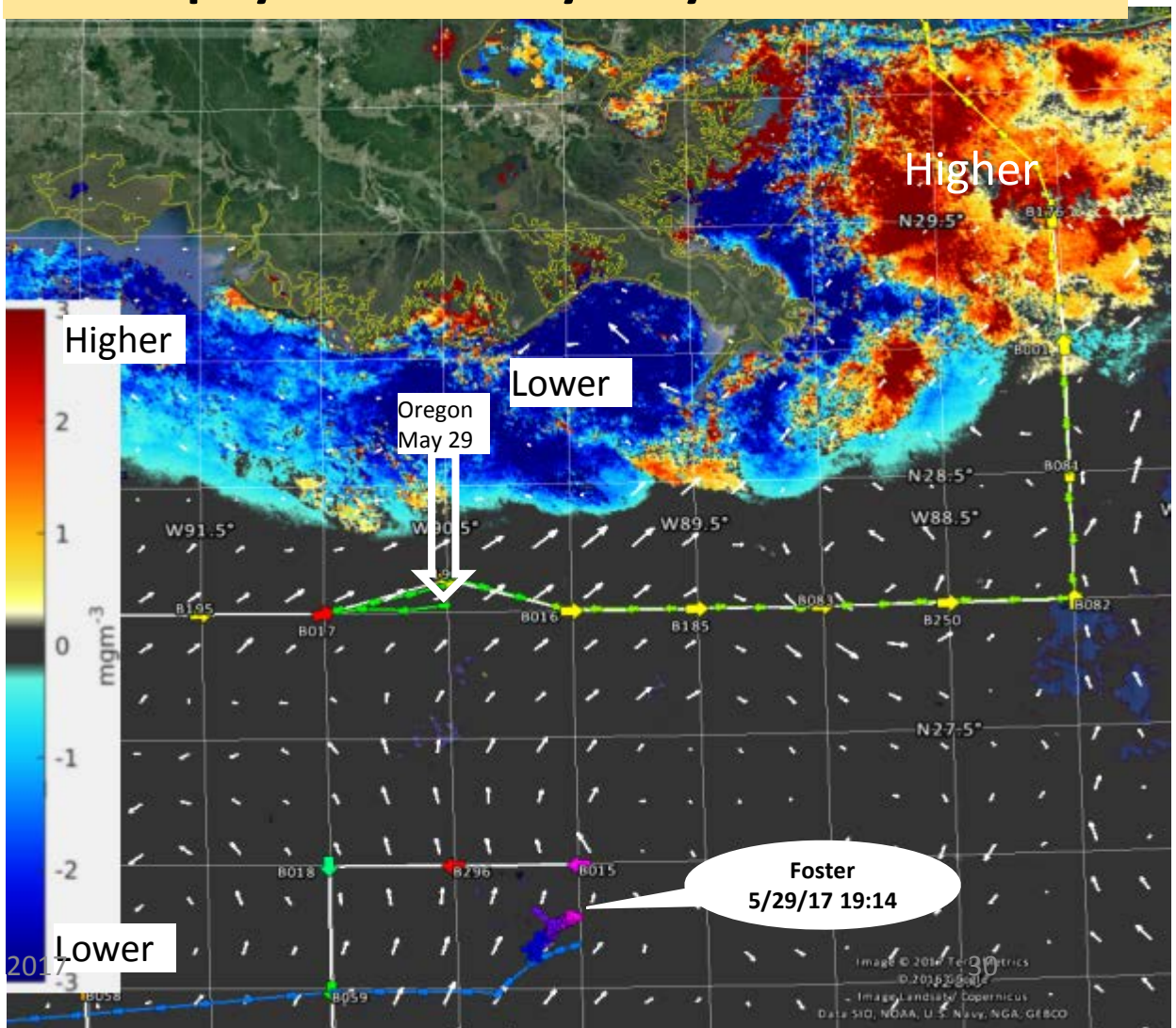
Chl- Extending Offshore !
Anomaly Chlorophyll -
Lower along LA coast - North of B17
Higher along MS coast - B176

NOWCAST

Chlorophyll May 27



Chlorophyll Anomaly May 24- 17 SD MSK1



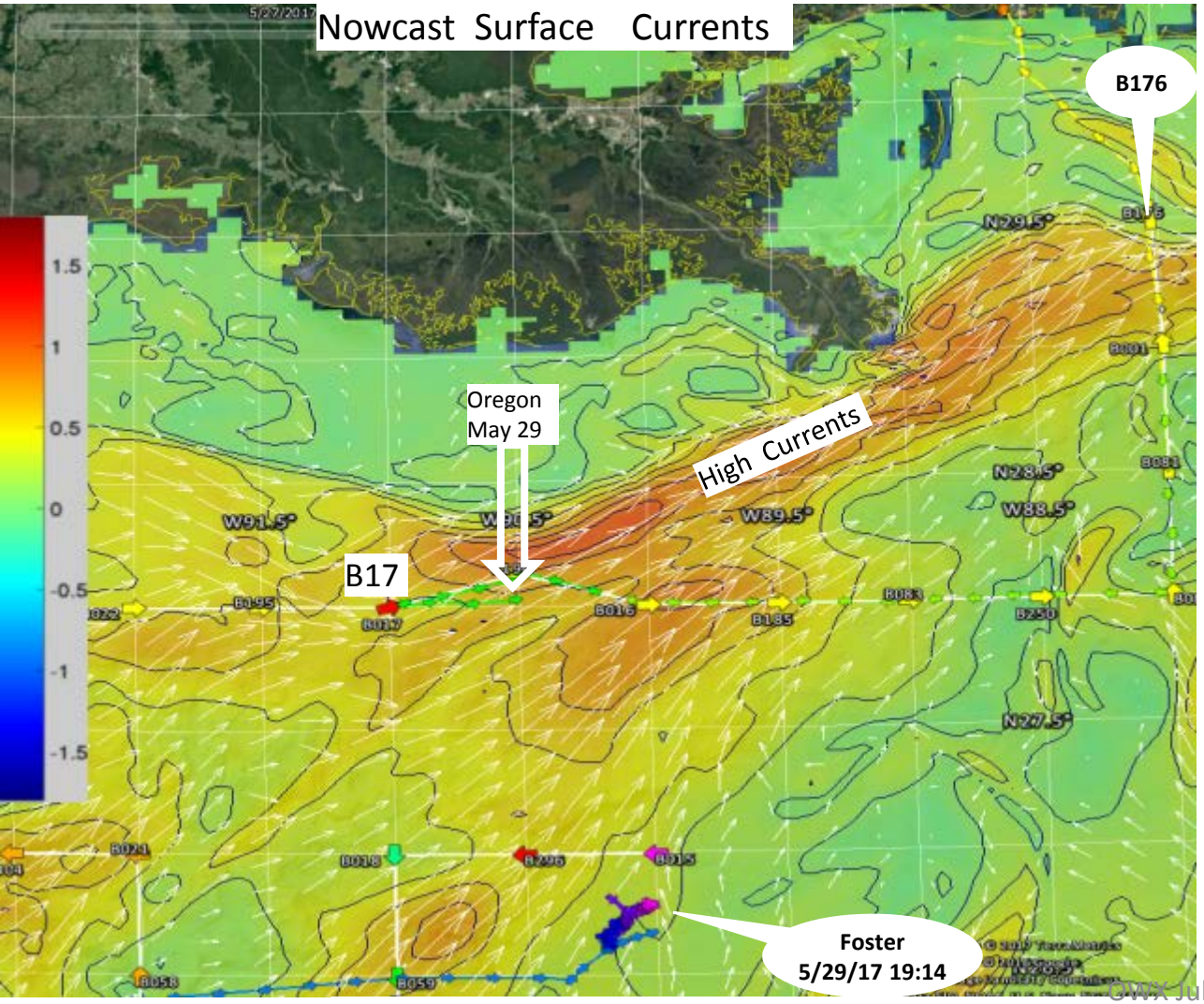
Is this typical? What is Different / Changed →

Oregon Cruise May 29 , 2017
Currents

NOWCAST

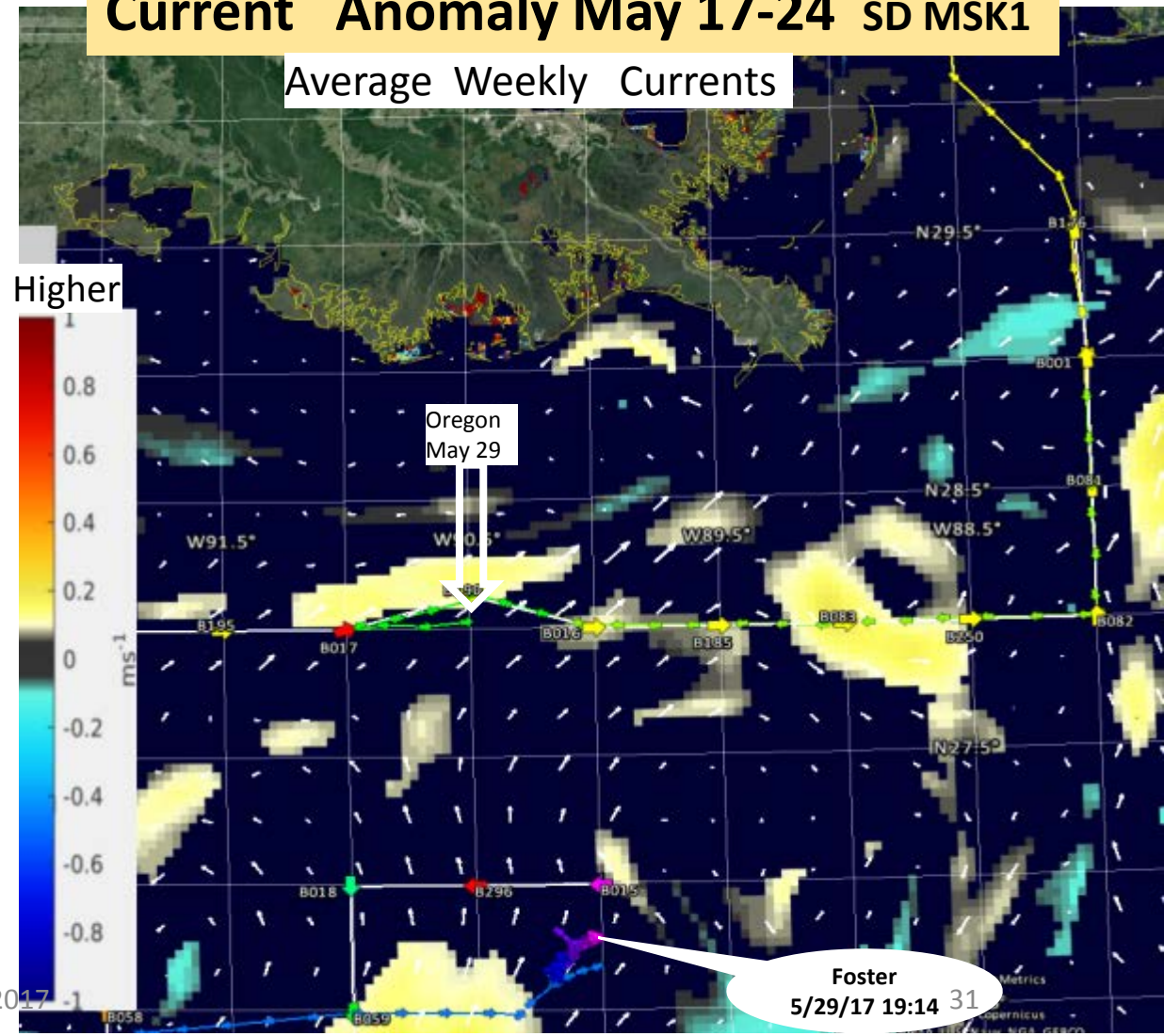
CHANGING currents in last 2 months
Currents – Nowcast and Weekly – Different

Current Magnitude May 27



B17 – In higher currents

Current Anomaly May 17-24 SD MSK1



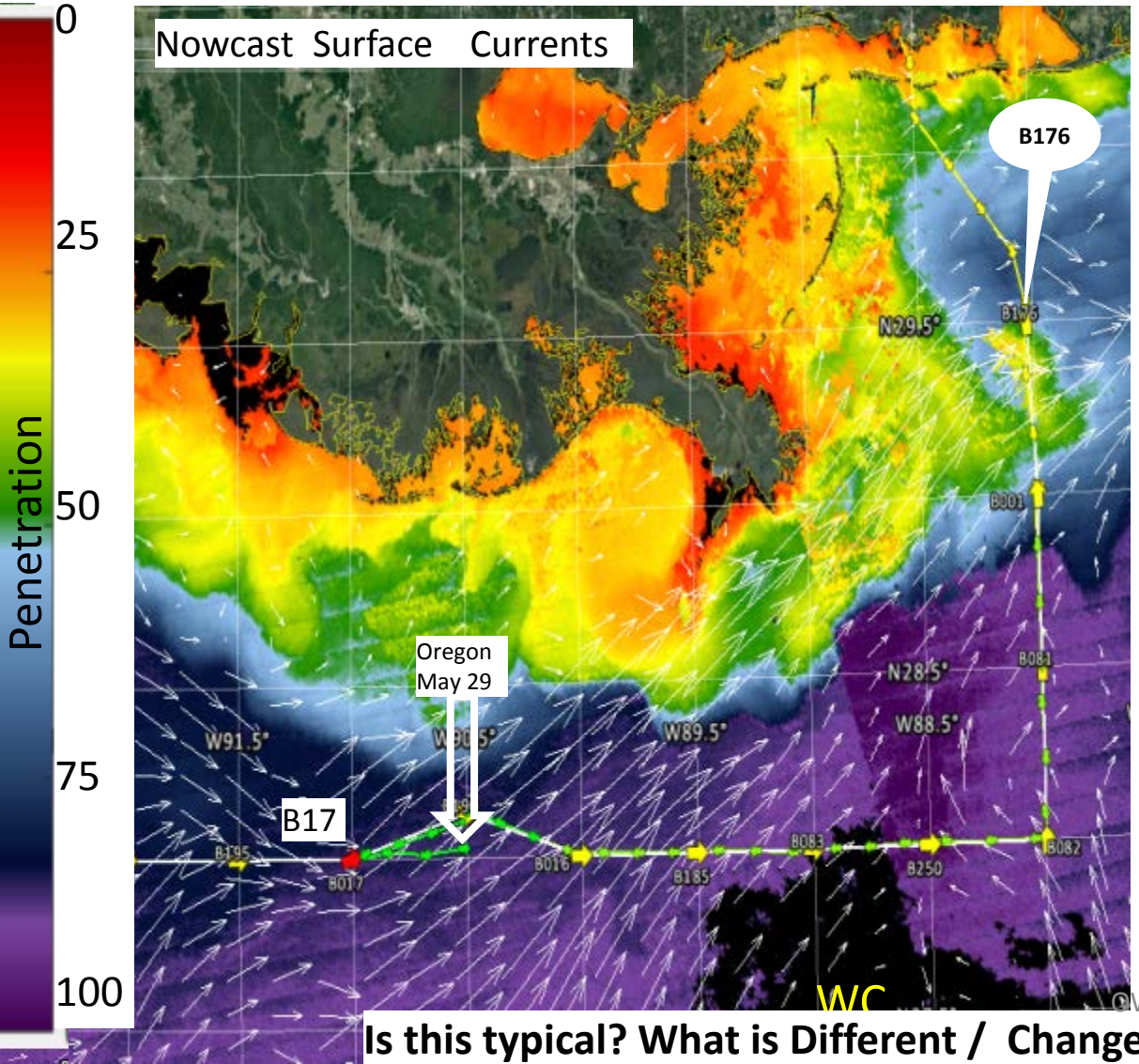
Is this typical? What is Different / Changed →

Oregon Cruise May 29 , 2017
Water Clarity

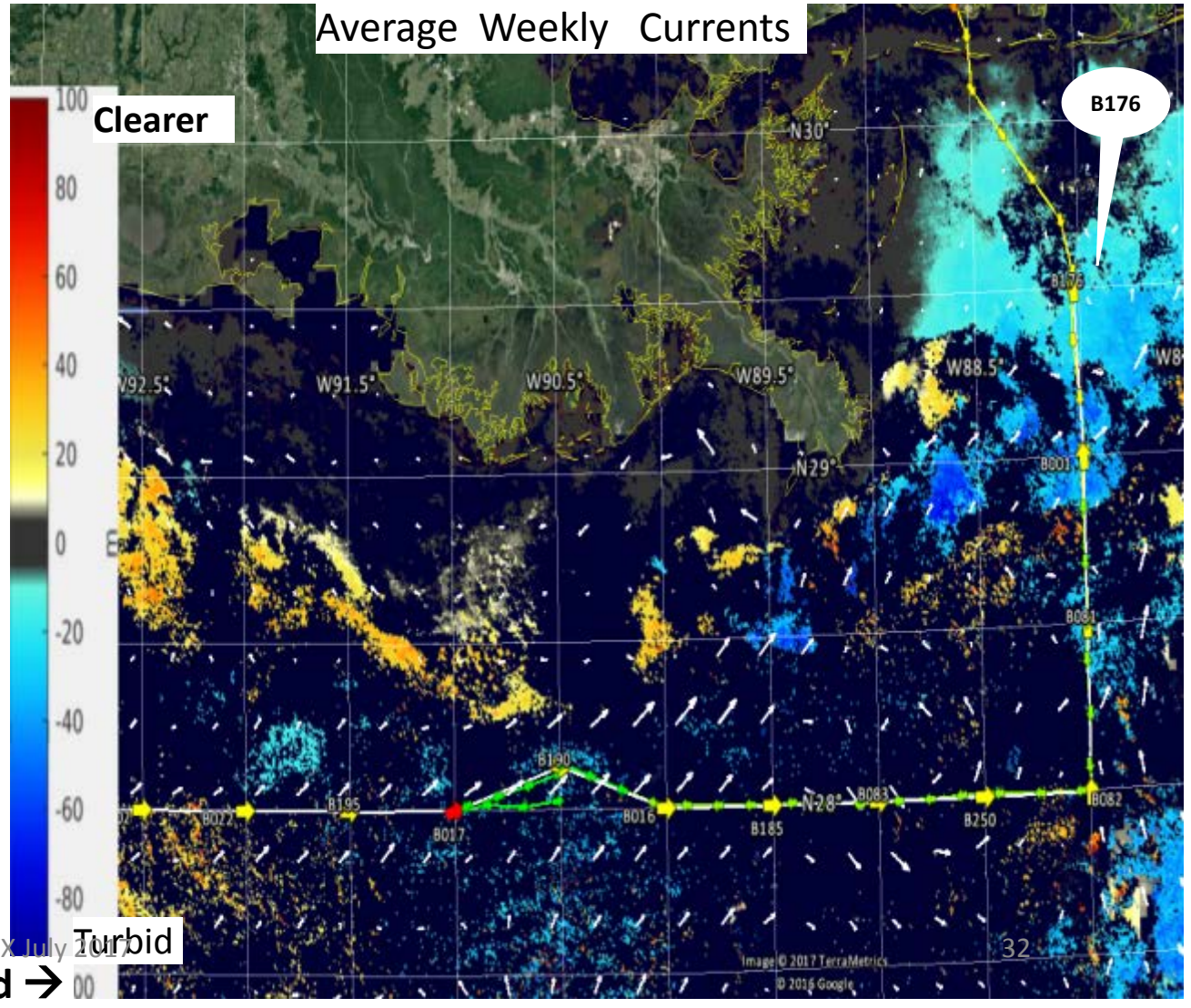
NOWCAST

Station B176 – turbid - other stations clear – and turbid to their north
Abnormal Patches of more clearer and turbid waters.

Water Clarity May 27



Water Clarity Anomaly May 17-24 SD MSK1



Is this typical? What is Different / Changed →

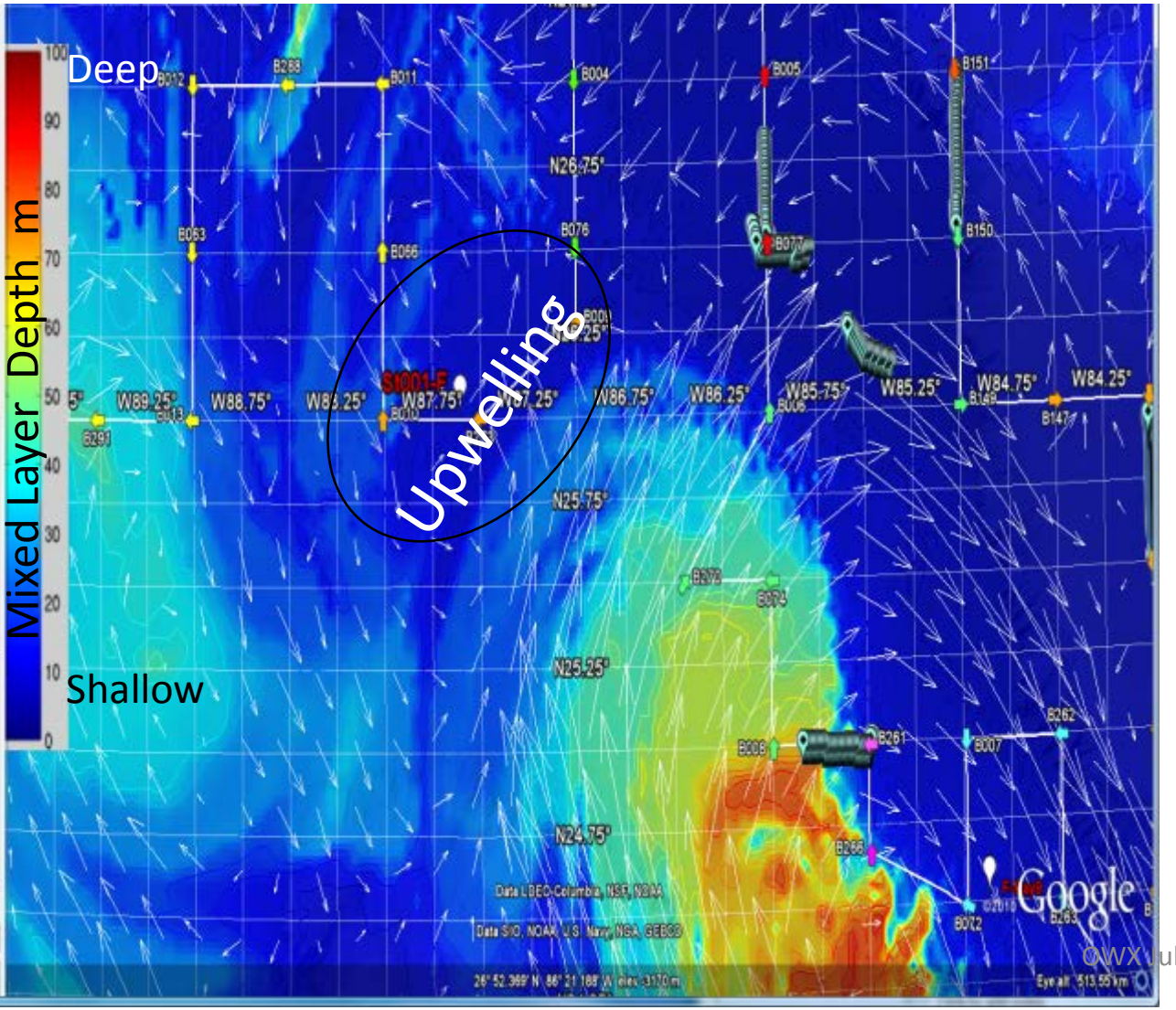
#4

May 9 Oregon
Joint Station with Foster and Oregon
B010, B273
North Loop Current
Upwelling
Foster Foster (May 10)

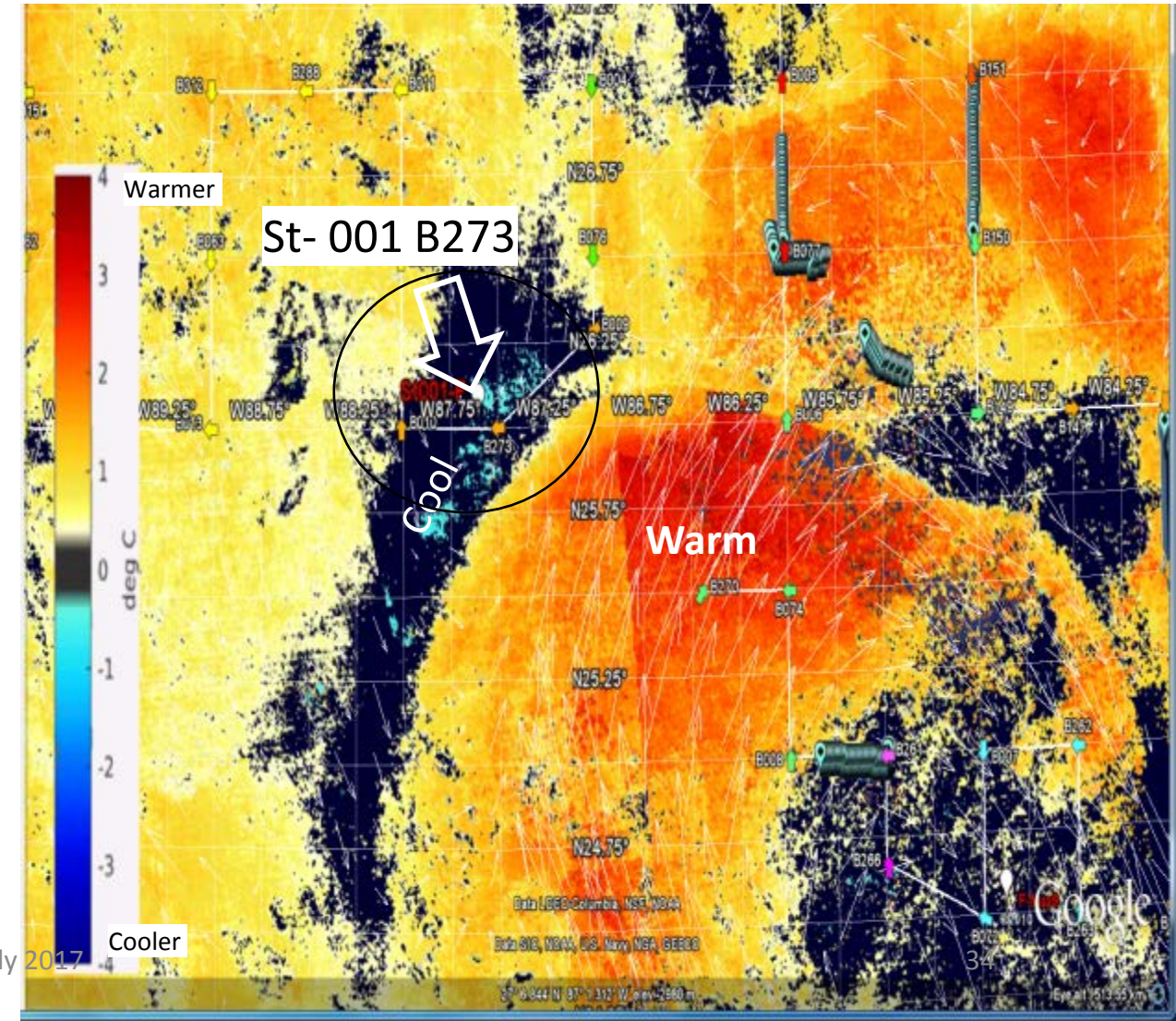
GOOGLE EARTH - SST

The Stations (001, B273) are in an upwelling region , with Cooler Waters

Nowcast May 9
Mixed Layer Depth



MCSST – Anomaly (May)



Water Clarity - Euphotic Depth

Similar Station May 9

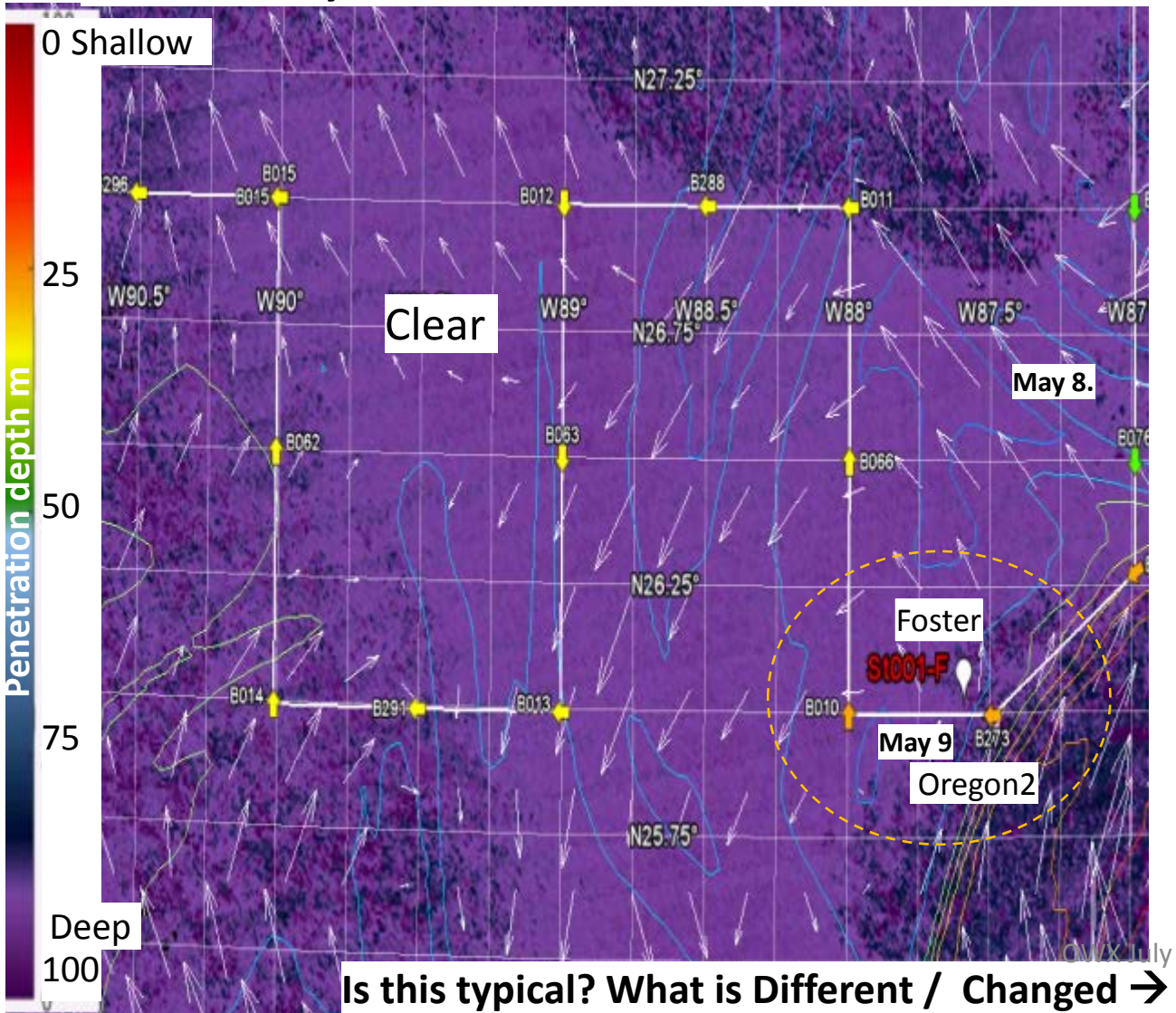
FOSTER ST -001 and Oregon Station B273 at Stable Clear Water

Nowcast Conditions

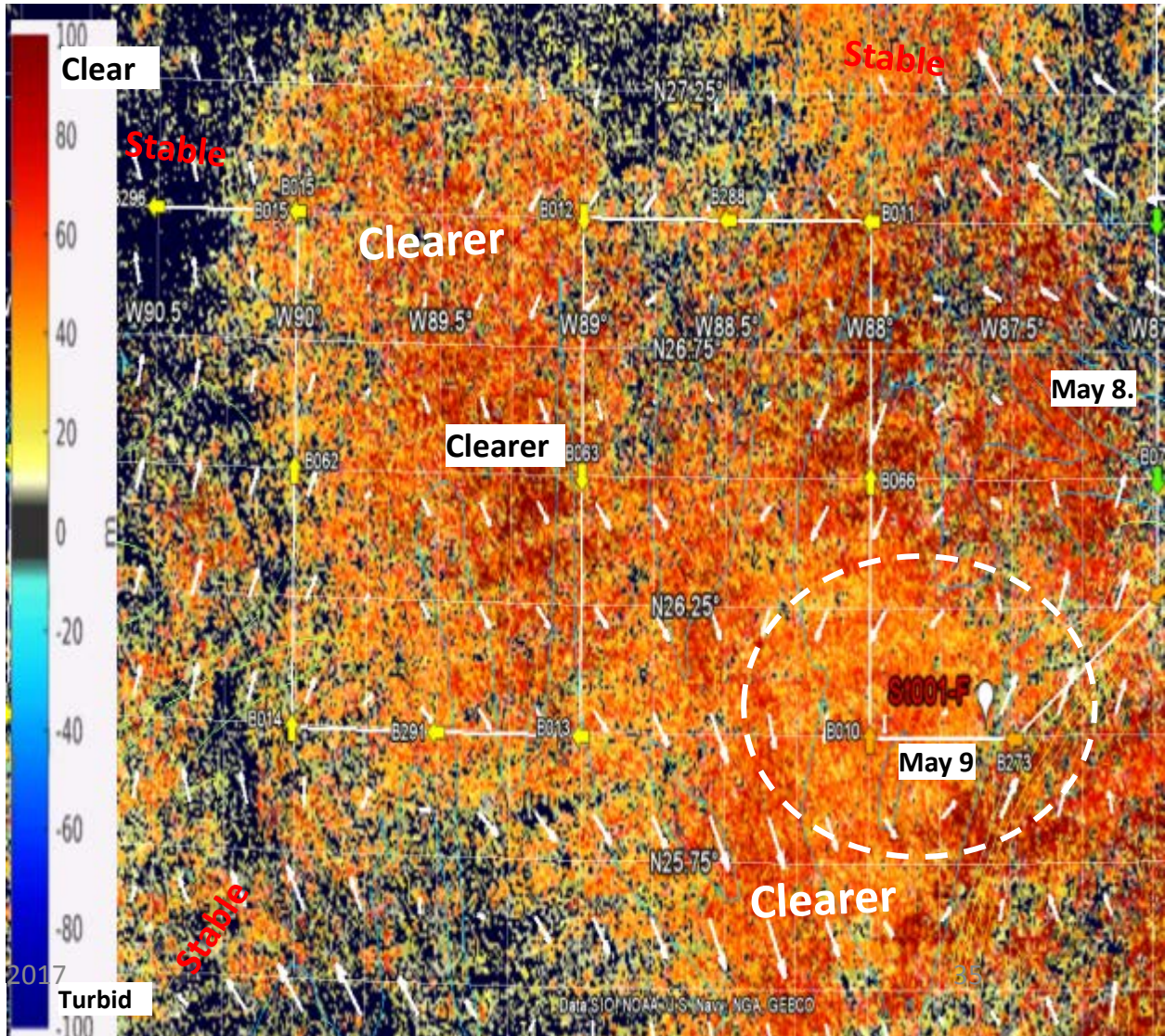
May 9, 2017

Changing Condition in last 2 months

Water Clarity – Nowcast



Anomaly Euphotic Depth - May 1 – Mask 1SD



Is this typical? What is Different / Changed →

R. Arnone
B. Jones , I. Soto

Summary :

1. Dynamic ocean conditions occurred during the Cruise which were identified in the physical and bio-optical processes ?

2. Many eddies and physical events and changing biological events.

3. Learning the how to evaluate todays Nowcast - Has product changed in last 2 months?

4. How does the NOWCAST and ANOMALY products apply to Station's data ?
   Useful Products - combinations →
   SST and Euphotic depth? Vertical layers? Others

5. Station data - Date time of the station and data collected ?
   Can we identify a station activity assessment such as - High, Medium , Low etc ?

6. Other Helpful Products are available that can be applied?

SeaMap -Telecon July 12- 2017

Agenda:

9:00- 9:05 - Introduction and Round table - Objectives:

9:05- 9:15 - Overview of Anomaly and Nowcast products, and how produced. owx

9:15 - 9:25 - Examples from Oregon II Seamap Cruise tracks NOWCAST- ANOMALYS sent. owx

9:25- 9:35 - Discussion of data collected on cruise - round table.

OWX - would like list of stations collected and time , if possible.

9:35 - 9:45 - Discussion on Comments of Data sent out (Examples). How used etc.
Plans for future and new products.

Questions the OWX Lab would like to ask.

Do participants have Google earth ?
Would folks like to be shown how to use the DAP Products in Google?
What anomaly and nowcast Products are most useful?

9:55 - 10: 00 - Data availability, in Google Earth

Ocean Weather Laboratory

Abnormal Environmental Properties

Thanks for Participating