

THE USE OF SATELLITE FOR ESTIMATING

CRITICAL WIND STRESS** IN FLORIDA BAY

**** Critical wind stress is the wind stress required for resuspension to occur.**

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NOAA Center for Monitoring and Assessment
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Partners:

- **NASA,**
- **West Florida ECOHAB,**
- **FMRI,**
- **NOAA Coastal Research Service Center,**
- **NOS Coast Survey,**
- **NOAA Coastwatch,**
- **Tracy Villareal (University of Texas),**
- **Pat Tester, Sabrina Varnam (NOAA),**
- **Olympic Regional Harmful Algal Bloom Research Program,**
- **Naval Research Laboratory.**

This study:

**Jeff List, Rich Signell, Megan Frayer, Ellen Prager,
NOAA Coastal Ocean Program &
USGS South Florida Ecosystem Program.**



...And More Trailers Before the Thriller

What:

Chl = f (blue, green, sediments)



Why: TX HABS Monitoring

What:

Chl = f (precip)

Why: better understanding of the sys → forecasting.

What:

Z = f(red, green, blue)

Why:

Z → bottom type classification

What: correct for absorbing aerosols.

Why: improve data quality.

Hey Griffin,

11/13/03

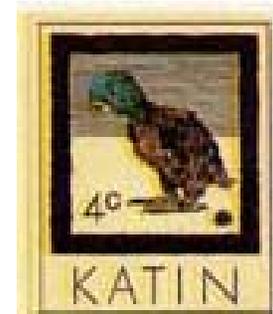
How are things? Would you attend this talk and tell me about it:

“the Use of Satellite Data for Estimating Critical Wind Stress in Florida Bay” by Varis Ransibrahmanakul, Ph.D.

Sigh.

Thanks and High 5,

Sabine



NATURALIGHT
PRODUCTIONS
PO. BOX 14
DANGRIGA
BELIZE

AIR MAIL

Relevance

Bay is no longer clear

Bay is hypersaline, overfertilized, O₂ starved

Lobster & shrimp populations on the decline.

Reef is dying.

100 K acres of seagrass have died. (decline gradually 81-86, rapidly 87-now).

Okay, the Bay may be important but how does it link to this study?

Chain:

wind – resuspension – limit light – seagrass dieoff – nutrients -- HABS -- you

One of the problems:

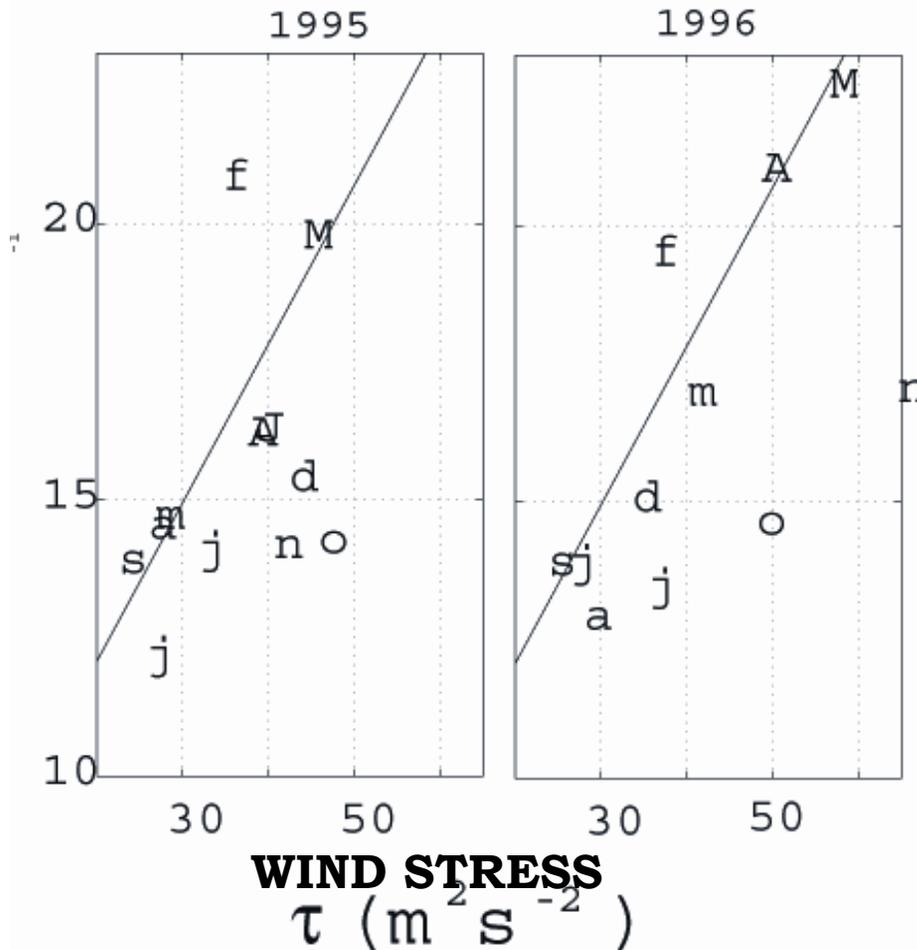
- **Lack of wind response data (i.e., time series of sediment concentration) makes our understanding of wind resuspension process fuzzy.**

Contribution:

- **parameters that describe the resuspension process**
- **method of deriving these parameters**

Wind is the transport agent in Florida Bay

Monthly Mean Conc (mg/L)



What Others Have Done?

Place	Critical wind speed (m/s)	# of folds Sed. Conc. Increased	freq/dur (days)	authors
• Chesapeake	7	10	1 / 10	Ward, 85
• Prairie Lake	5	10	3.5 / 41	Carper & Bachmann, 84
• Tamaren Lake	5	4	< 60	Bengtsson & Hellstrom, 92
• F1 Bay	$f(x,y)$	$f(x,y)$	1-3 / 720	Ransi, Stumpf, 02.

About AVHRR

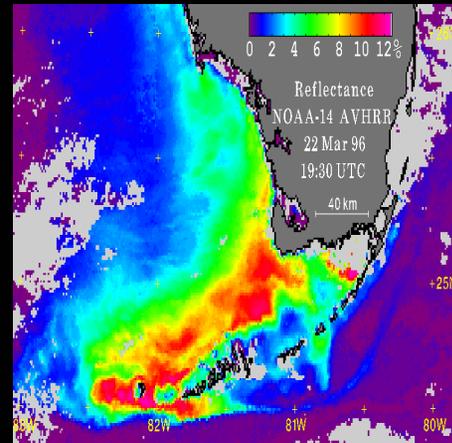
- **Advanced Very High Resolution Radiometer**
- **satellite is our NOAA satellite**
- **get it daily at 1 km**
- **data is good when sky is clear**
- **swath - 2700 km (from CA to the NY Island)**
- **these bands are made for SST and turbidity**

Method of estimating critical wind stress

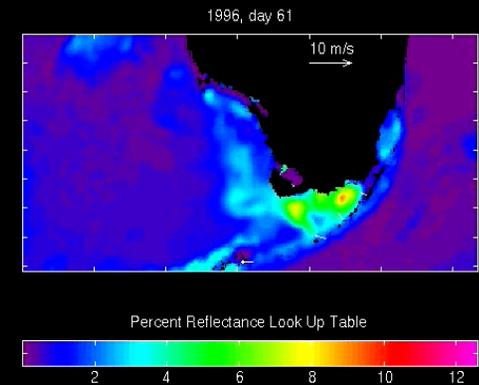
1. Raw count

~!@#\$%
^&*()-012
345678
9ABCDEFGHI
HIJKLMNO
PQRSTUVWXYZ

2. Just **HIJKLNO**



3. Remove clouds

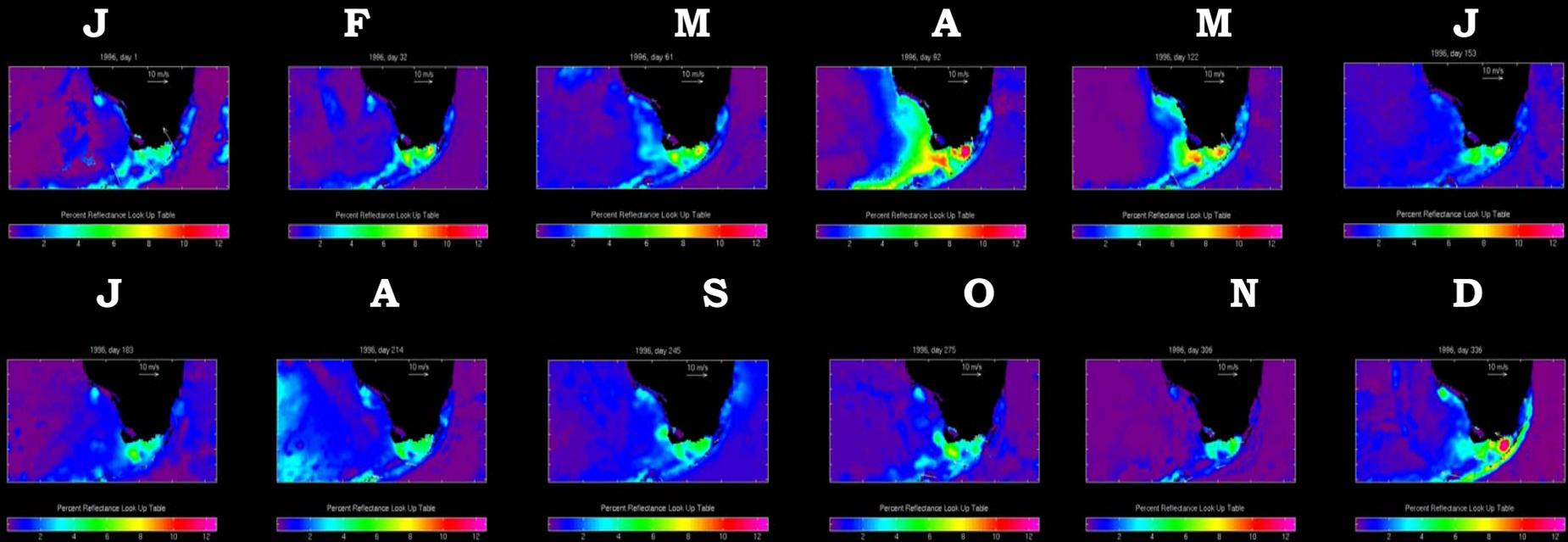


4. What parameters describe resuspension process?

5. Hypothesize a resuspension model using the pars defined in 4.

6. Use the mod. to solve for pars in 4.
Test the mod. If it's reliable, then so are the pars.

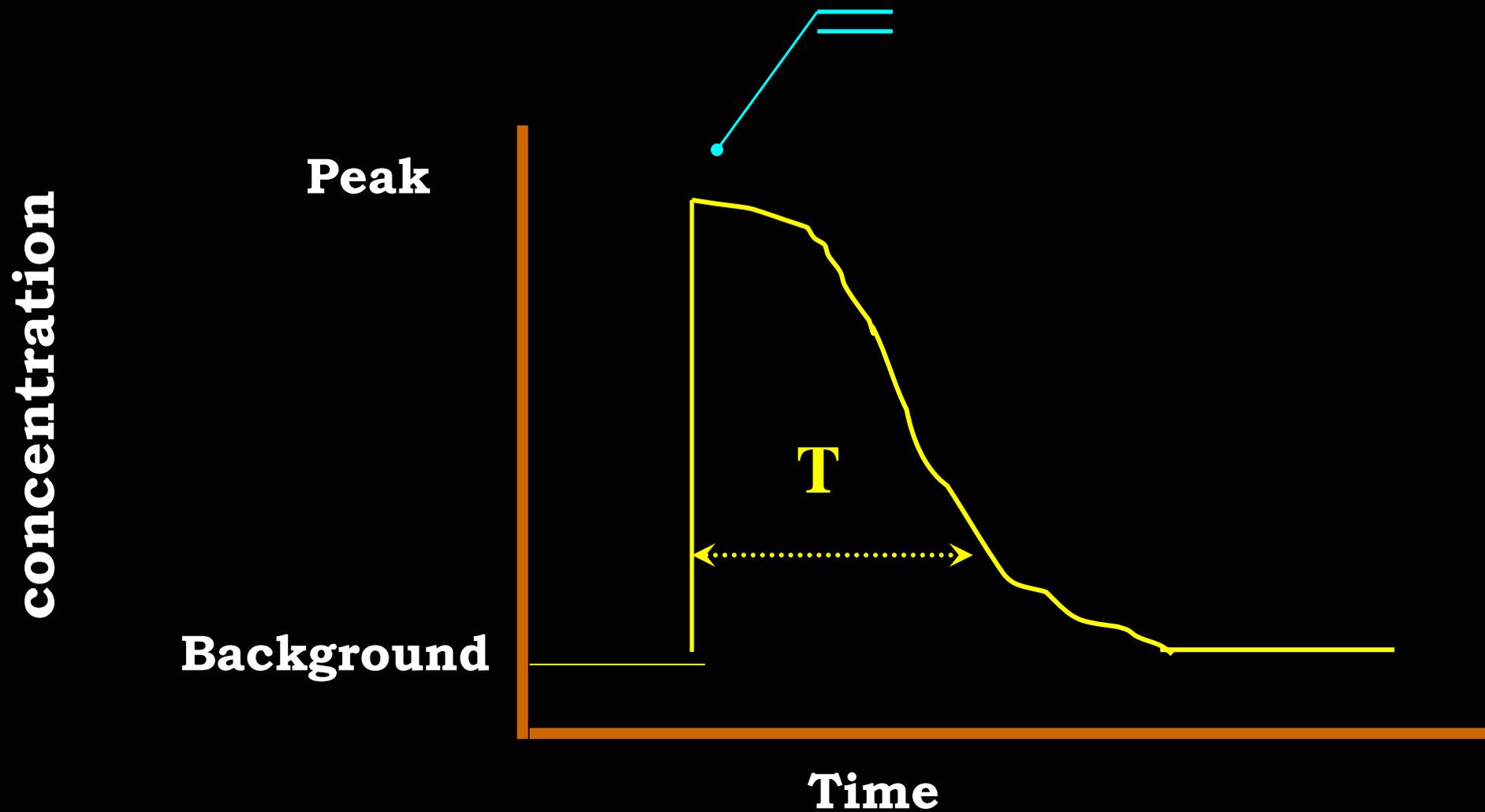
7. Reality check



What describes a resuspension process?

1. Background concentration
2. Peak concentration
3. Wind speed needed to resuspend
4. Time req. to return to normal.

Movie for Show, Model for Dough



Step#6. SOLVE THE FOUR RESUSPENSION PARAMETERS AND TEST THE MODEL

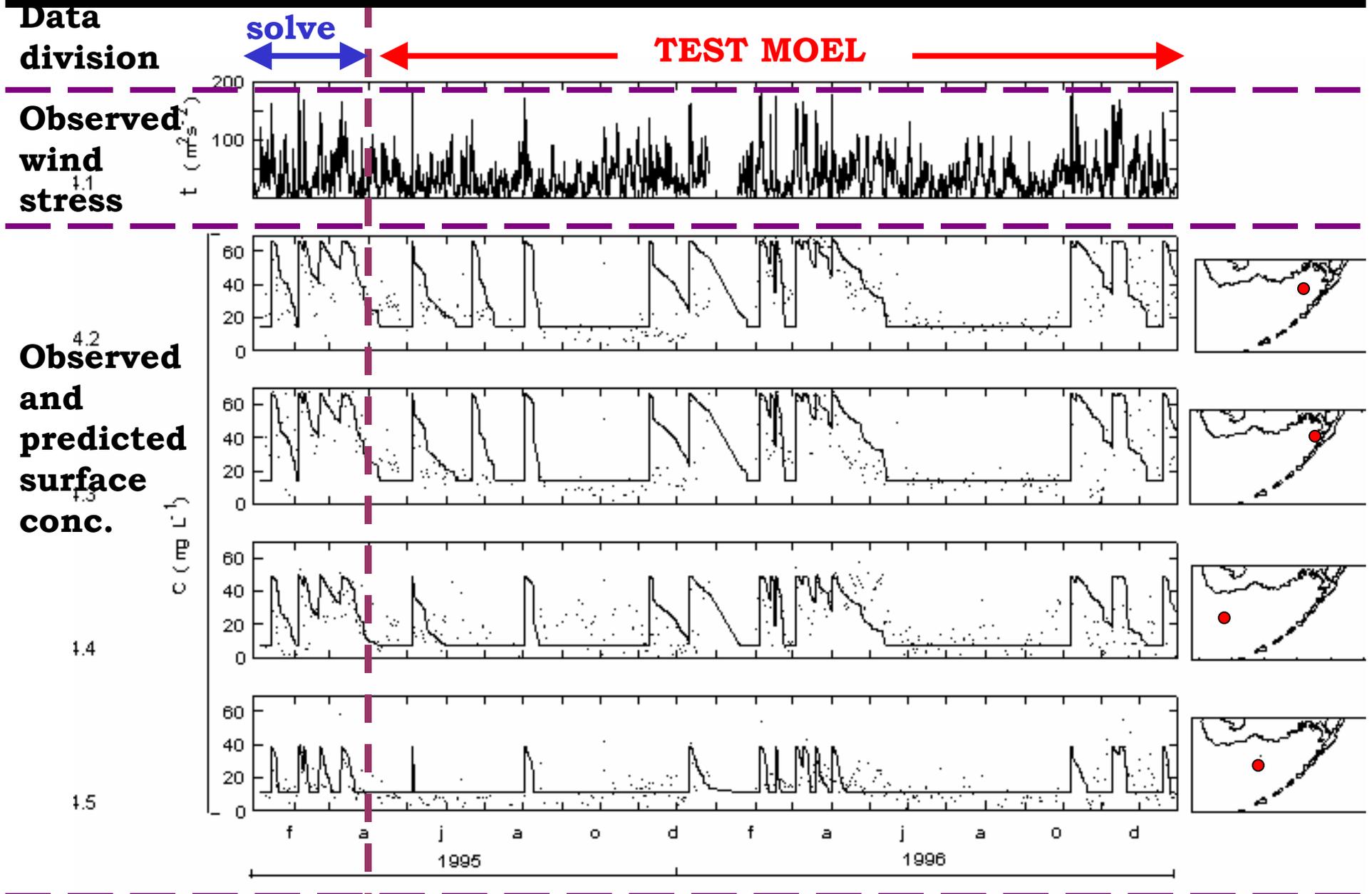


Figure 4.4. The wind stress from the Long Key Florida OMAN station.

**QUIZ: If there are
3 bottom types –**

hard (sandy), ■

**Low-medium
(muddy)** ■

densely vegetated. ■

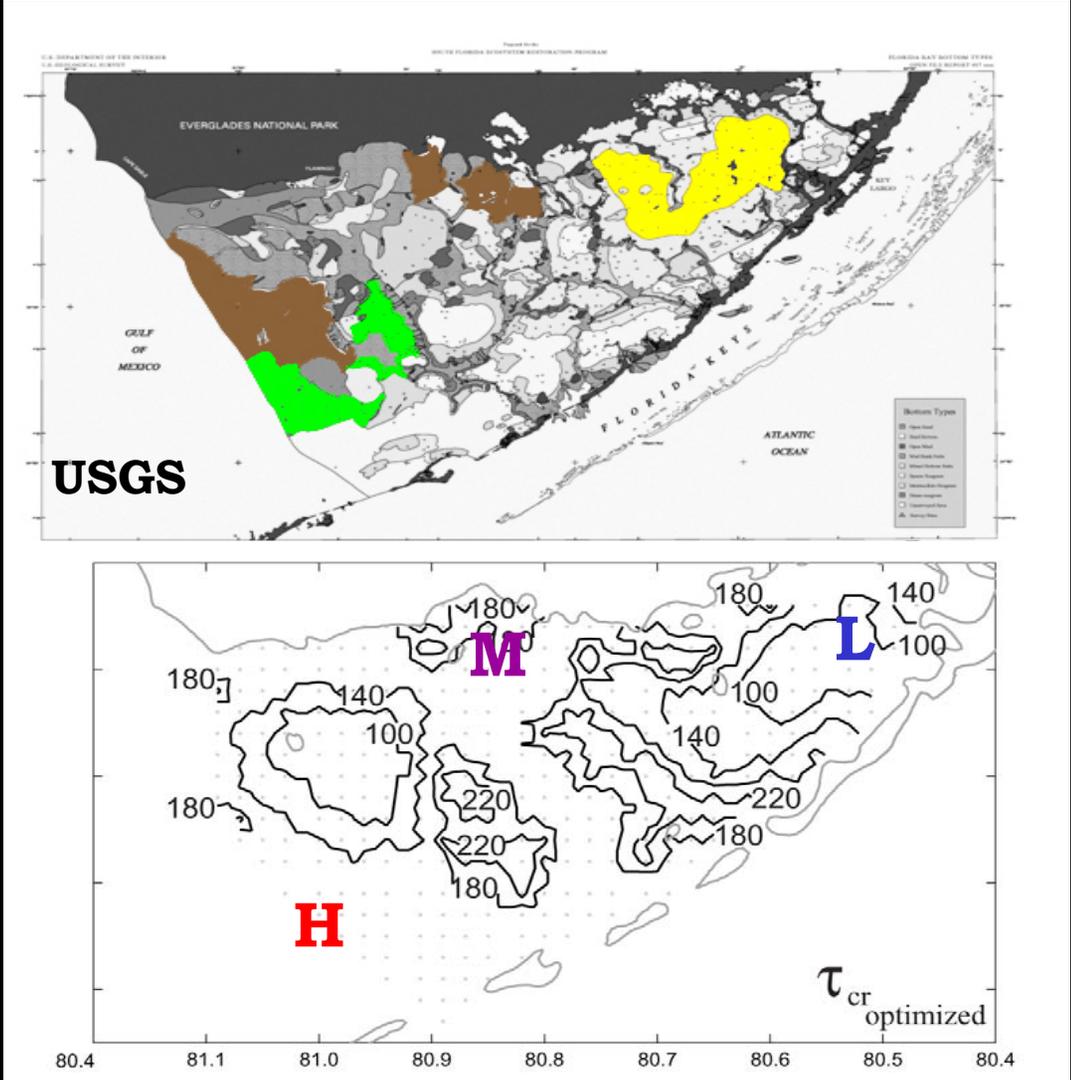
**a. which would
require the most
energy to
cause resuspension?**

b. And the least?

**a. Vegetated
b. hard**

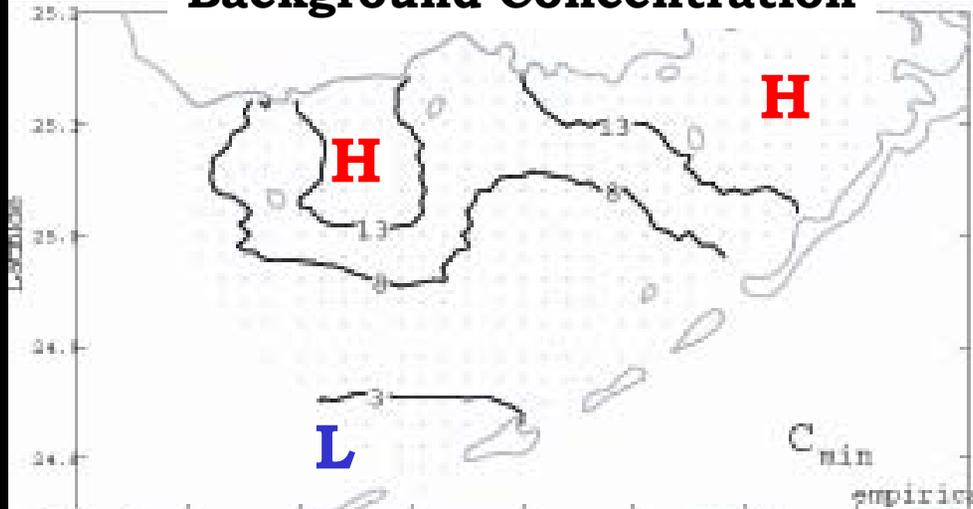
Step#7. Reality Check:

**USGS bottom type survey (1996)
VS
Estimated critical wind stress**

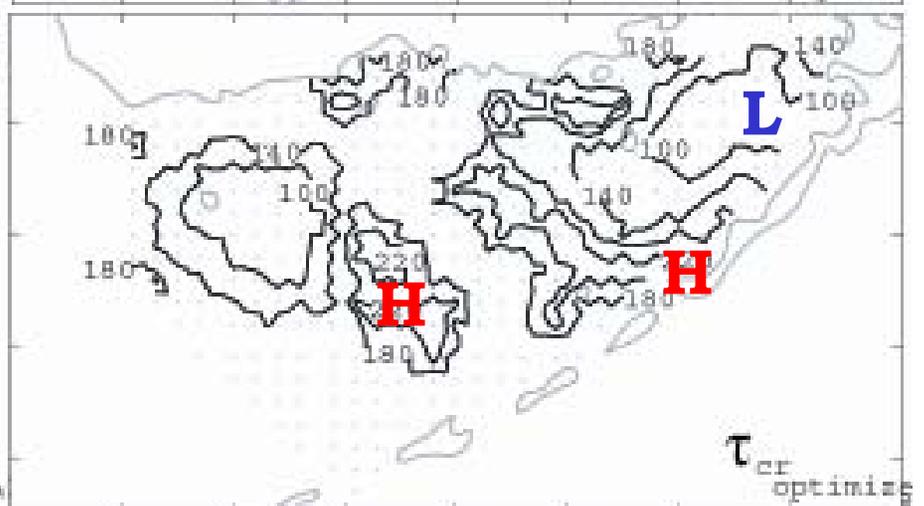
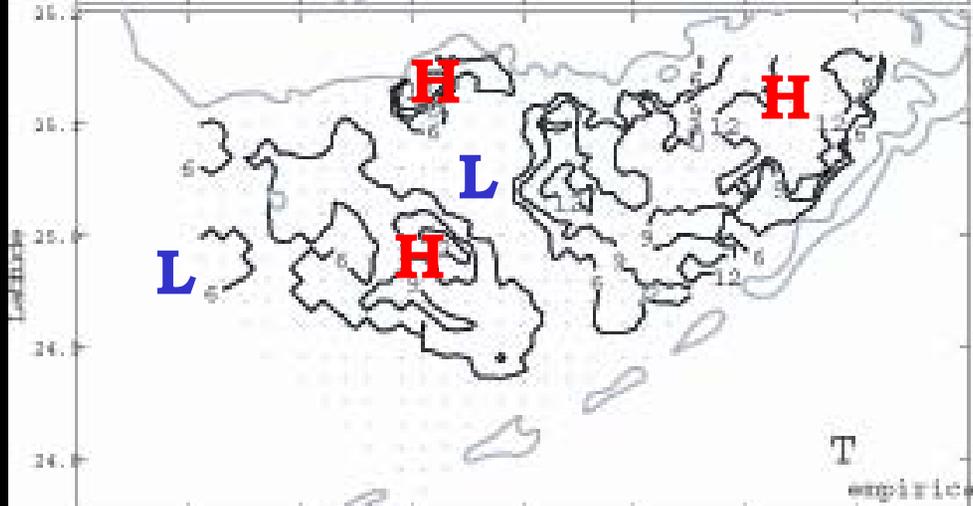
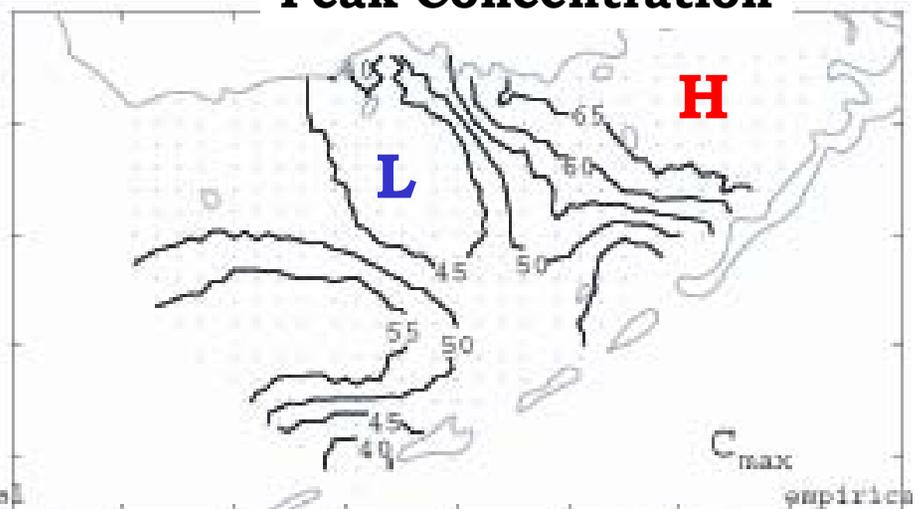


THE REST OF THE RESUSPENSION DESCRIPTIONS.

Background Concentration



Peak Concentration



Settling Period

Critical Wind Stress

Something to Write Home About

~~Redskins make the playoffs.~~

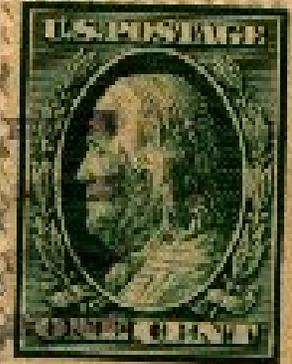
Hey Sabine!

I learnt wind-resuspension-limit light-seagrass dieoff-nutrient HABs-Floridians may be linked.

However, we lack the wind response data to better understand the resuspension response. NOAA/USGS used satellite data to estimate critical wind stress and settling period for Fl Bay. This approach is also applicable elsewhere.

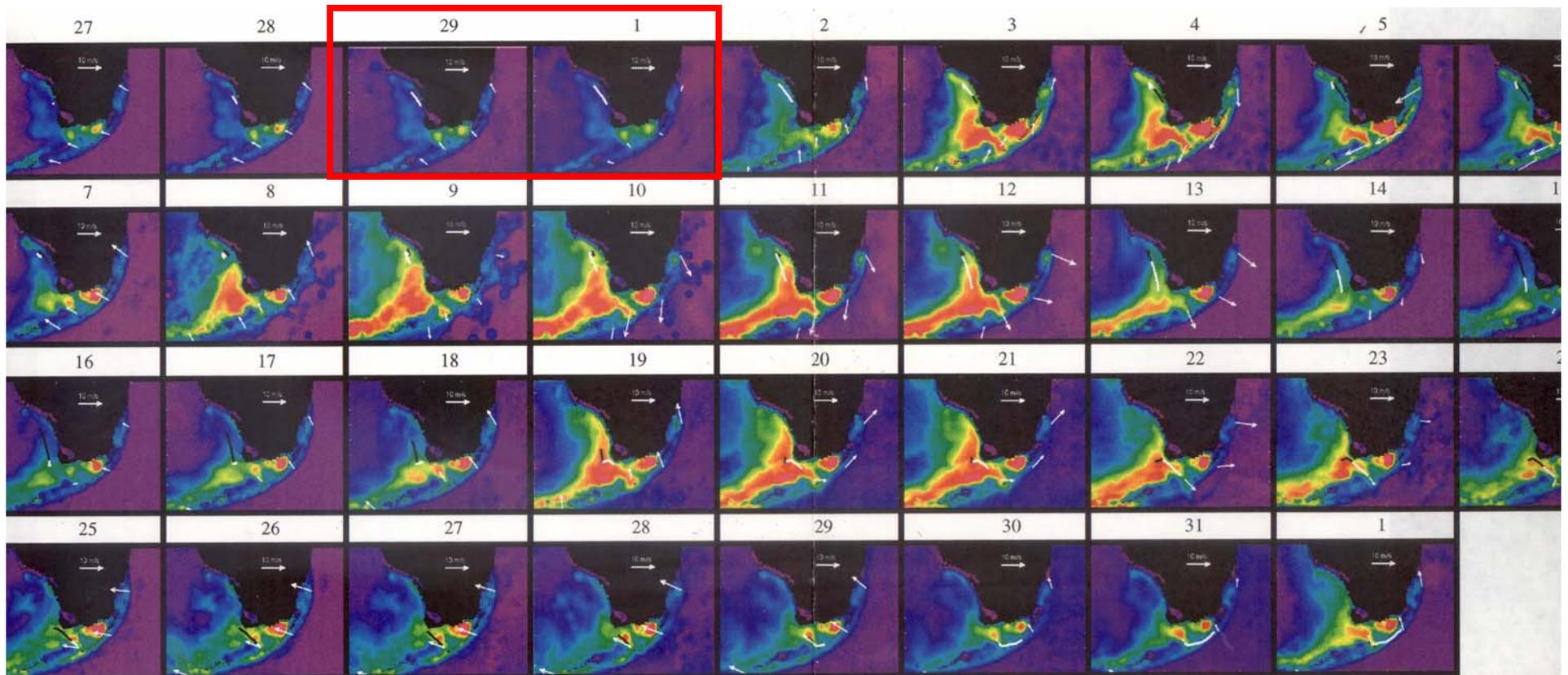
Love, Griffin

P.S. Their URL is WWW.CCMA.NOS.NOAA.GOV/RSD

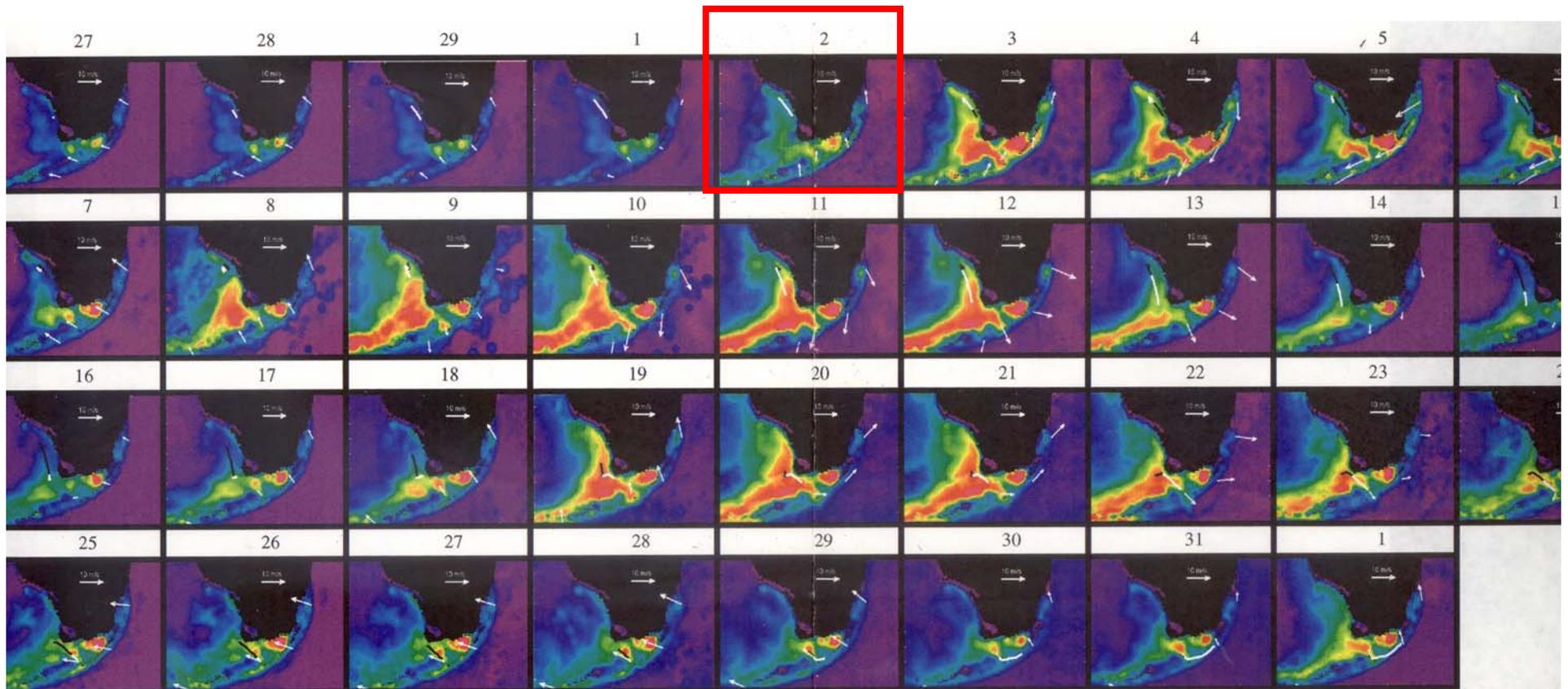


Webb
Lamar
Wta

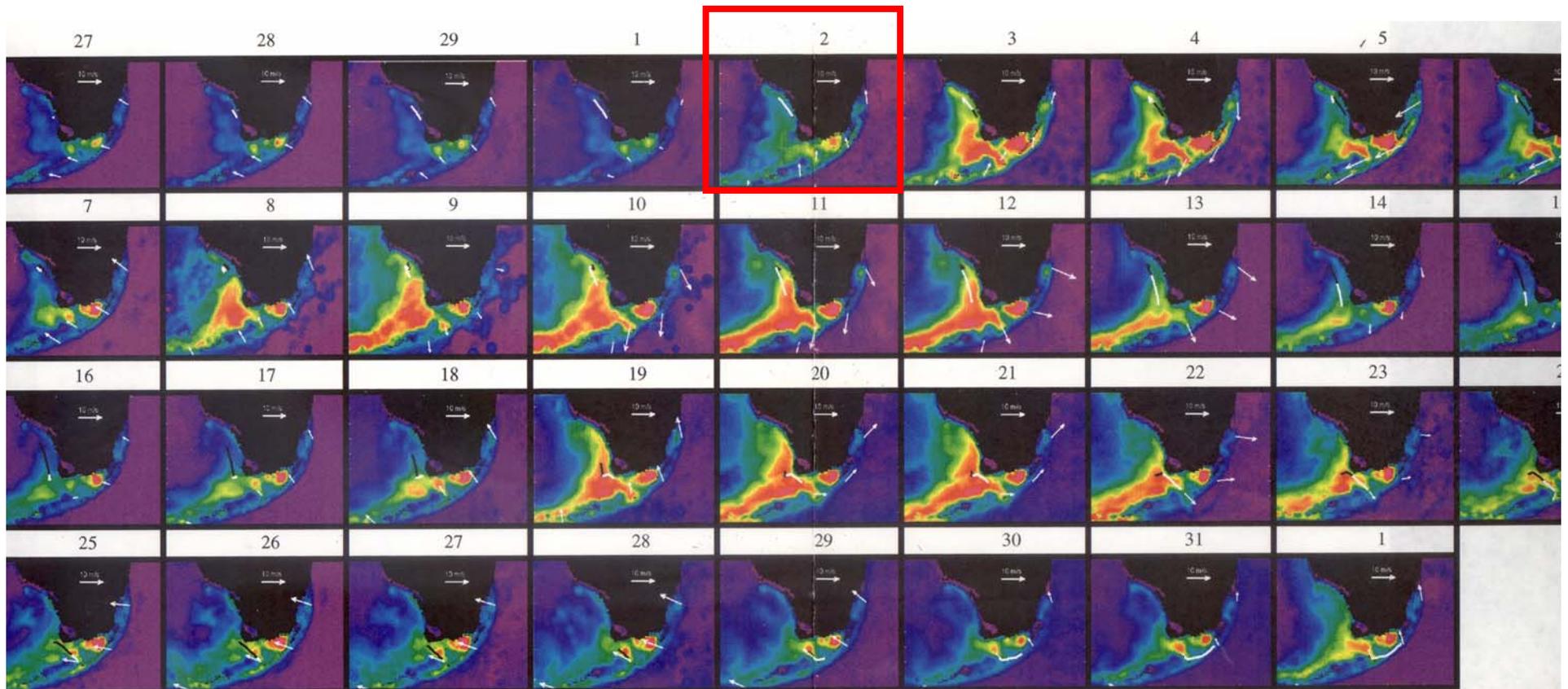
Date	Wind	Observations	Lessons Learned
2/29-3/1		<p>Wind remains easterly but speed decreased from 10 to 5 knots.</p> <p>Sediments in NE and SE Bay begin to settle.</p>	<p>1. NE & SW Bay are slightly turbid during light wind.</p> <p><i>none</i></p>



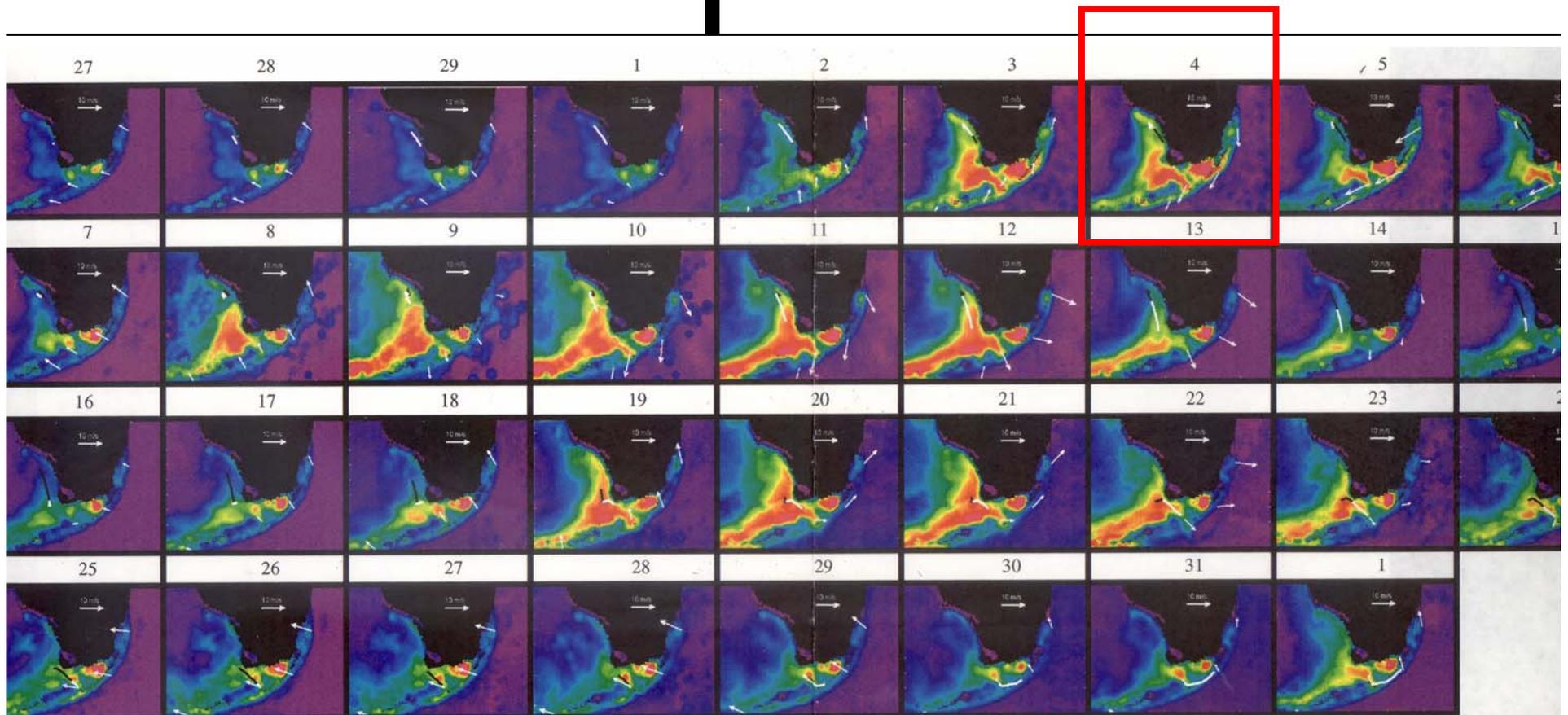
Date	Wind	Observations	Lessons Learned
2		<p>5 knot southerly turns 15 knot southerly. The initial 15 knot can resuspend bottom sediments in NE Bay.</p>	<p>1. NE & SW Bay are turbid during light wind <i>2. NE Bay can be easily resuspended.</i></p>



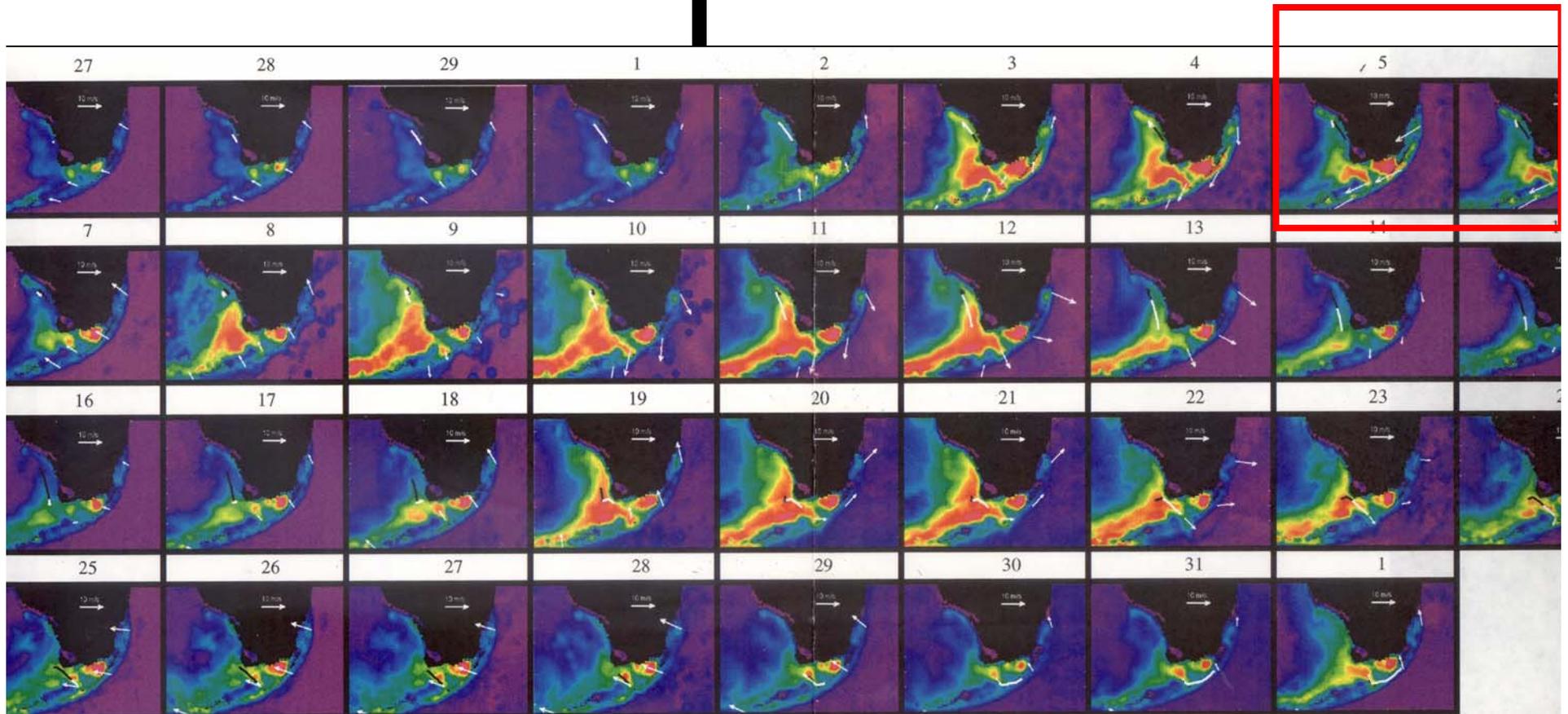
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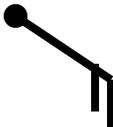


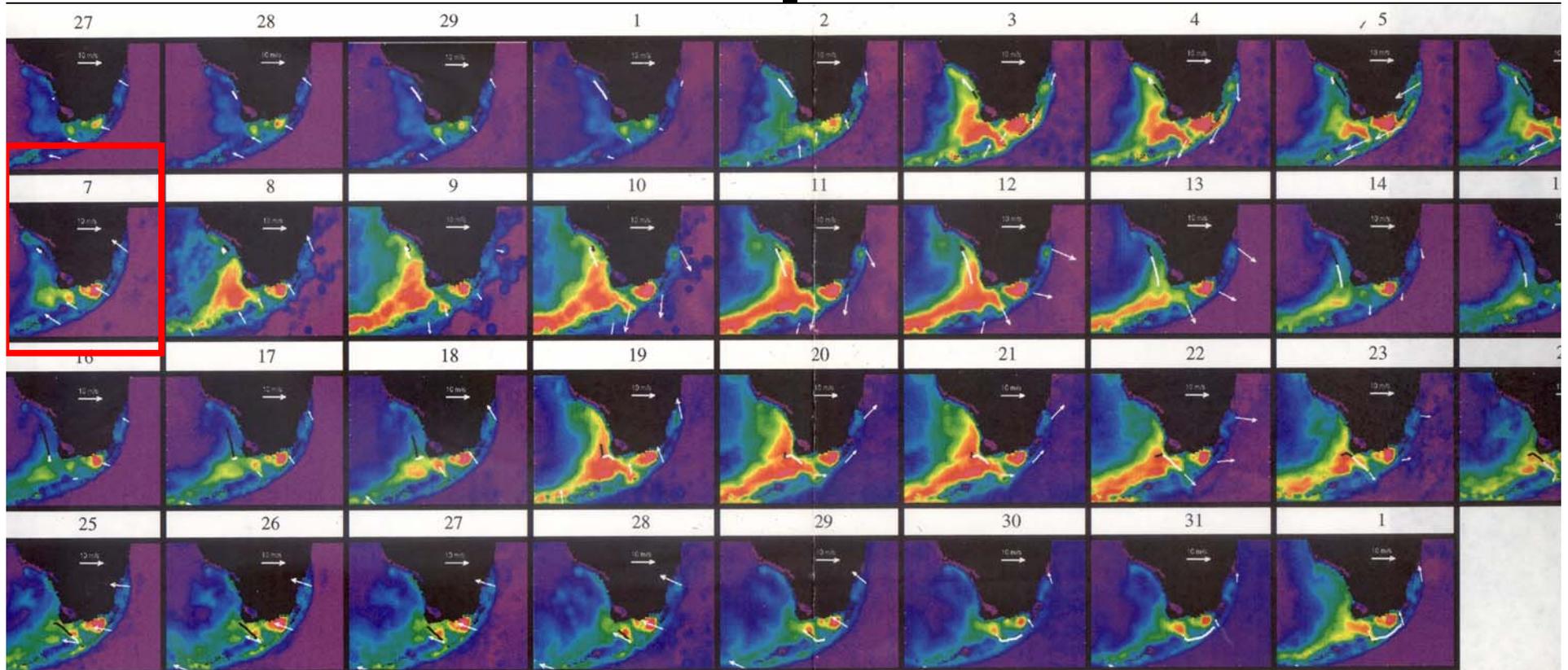
date	wind	observations	Lessons Learned
4		<p>15 knot southerly turns 20 knot northerly. The strong wind keeps sediments in suspension.</p>	<ol style="list-style-type: none"> 1. NE & SW Bay are turbid during light wind. 2. NE Bay can be easily resuspended. 3. The sys. responds immediately to strong wind event. 4. <i>As long as wind > some threshold, sed remain in suspension</i>

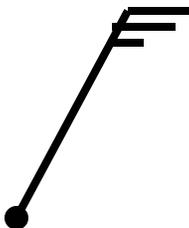


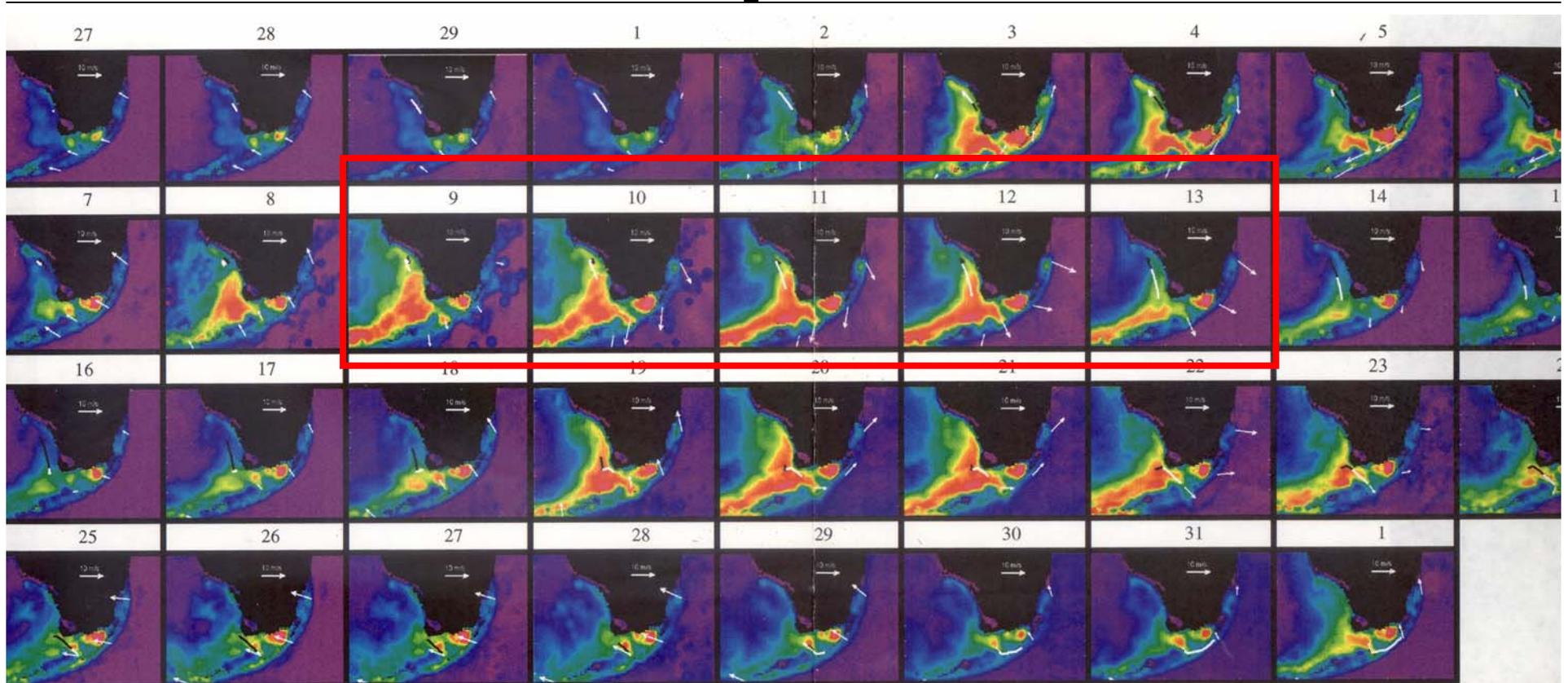
date	wind	observations	Lessons Learned
5,6		<p>20 knot northerly turns 30 knot easterly. The strong wind is not letting the sediments settle!!</p>	<ol style="list-style-type: none"> 1. NE & SW Bay are turbid during light wind. 2. NE Bay can be easily resuspended. 3. The system responds immediately to strong wind event 4. As long as wind > some threshold, seds remain suspension ←



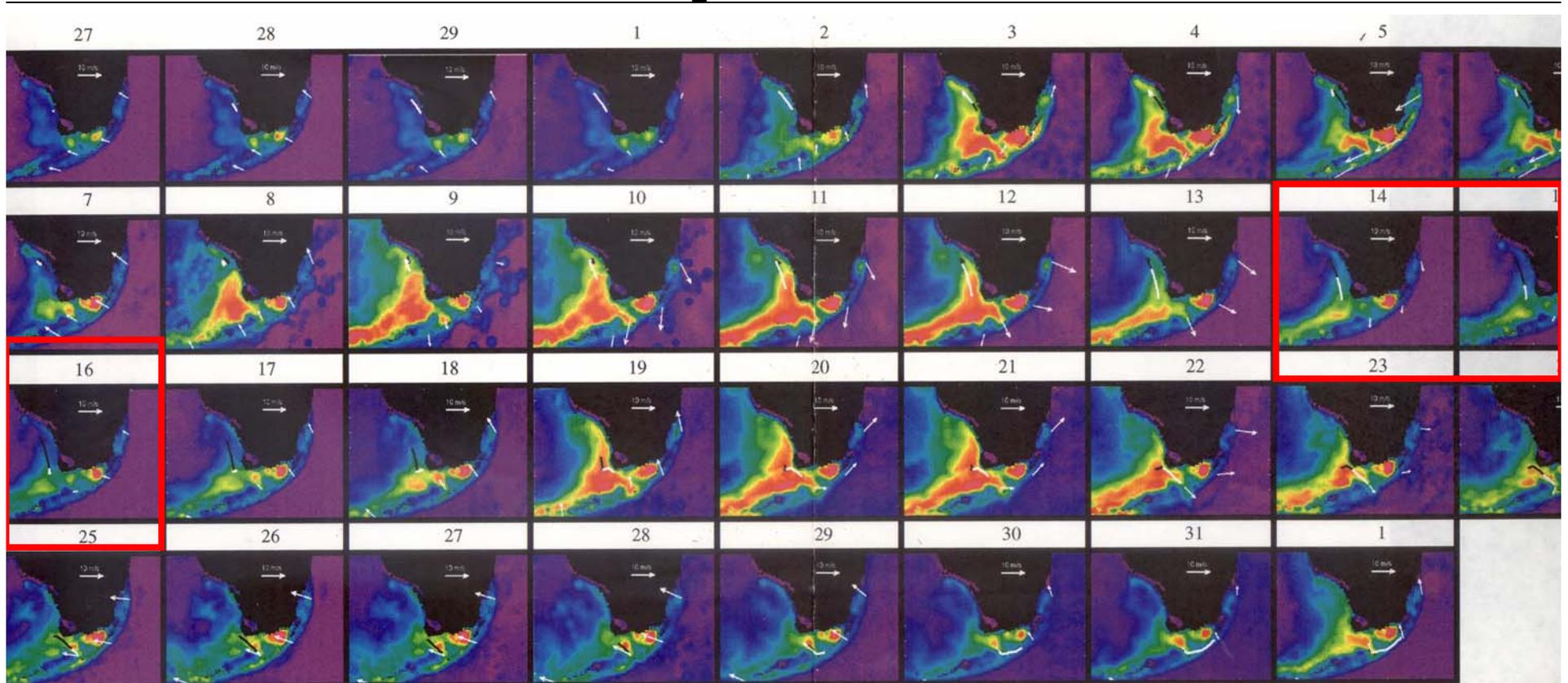
date	wind	observations	Lessons Learned
7		<p>Wind stays easterly but speed decreased from 30 to 20 knots. Although the easterly wind is strong, the Keys may attenuate the stress applied to the Bay. Sediments begin to settle (except on NE and SW Bay). Wind direction, as well as magnitude, determines resuspension.</p>	<ol style="list-style-type: none"> 1. NE & SW Bay are turbid during light wind. 2. NE Bay can be easily resuspended. 3. As long as wind > some threshold, seds remain suspension 4. The system responds immediately to strong wind event. 5. <i>Except for NE, weak easterly will not resuspend seds.</i>

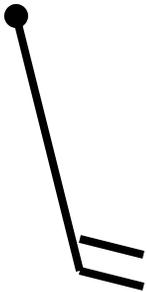


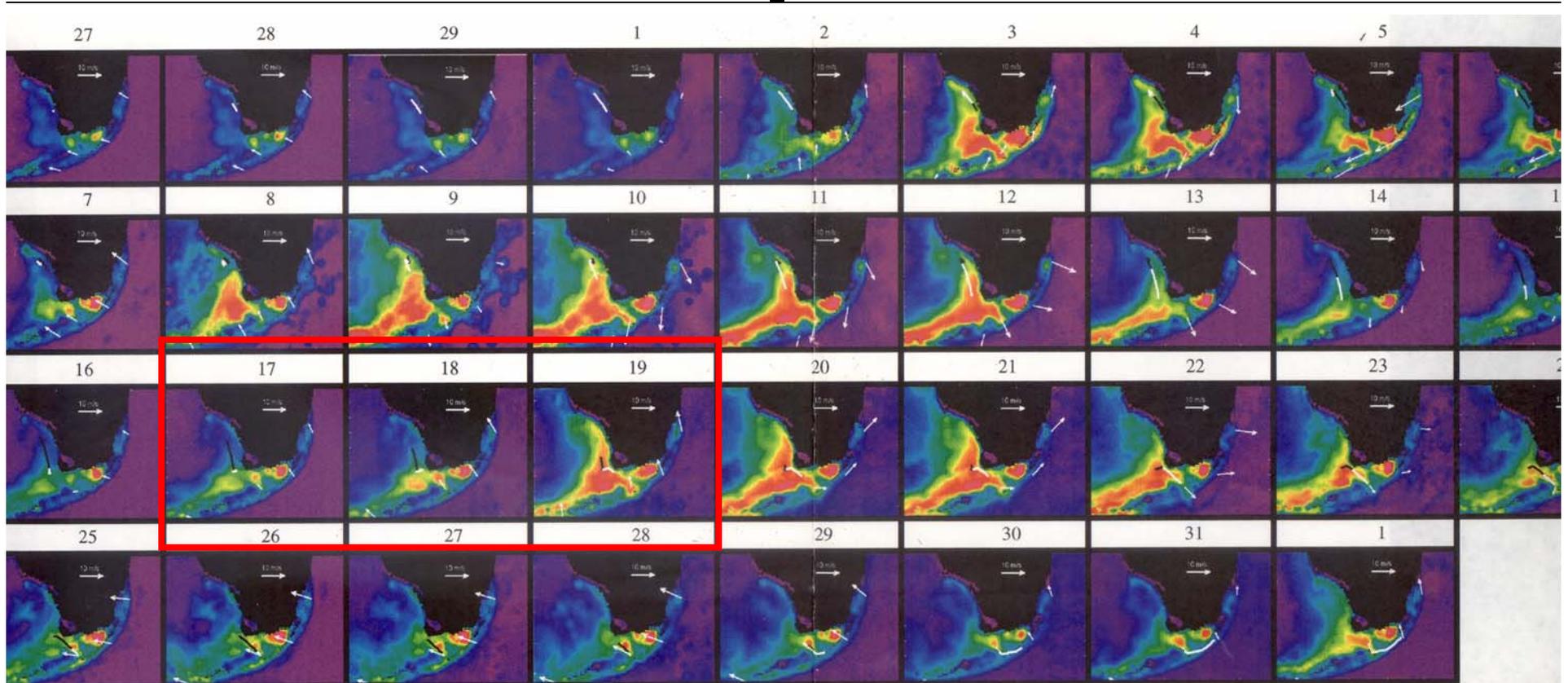
date	wind	observations	Lessons Learned
9-13		<p>20 knot southeasterly turns 25 knot northerly. The whole Bay is turbid. The strong northerly transports turbid plume to the Gulf.</p>	<ol style="list-style-type: none"> 1. NE & SW Bay are turbid during light wind conds. 2. NE Bay can be easily resuspended. 3. The system responds immediately to strong wind event. 4. As long as wind > some threshold, seds remain suspension 5. Except for NE, weak easterly will not resuspend seds. 6. Strong northerly can transport seds into the Gulf.



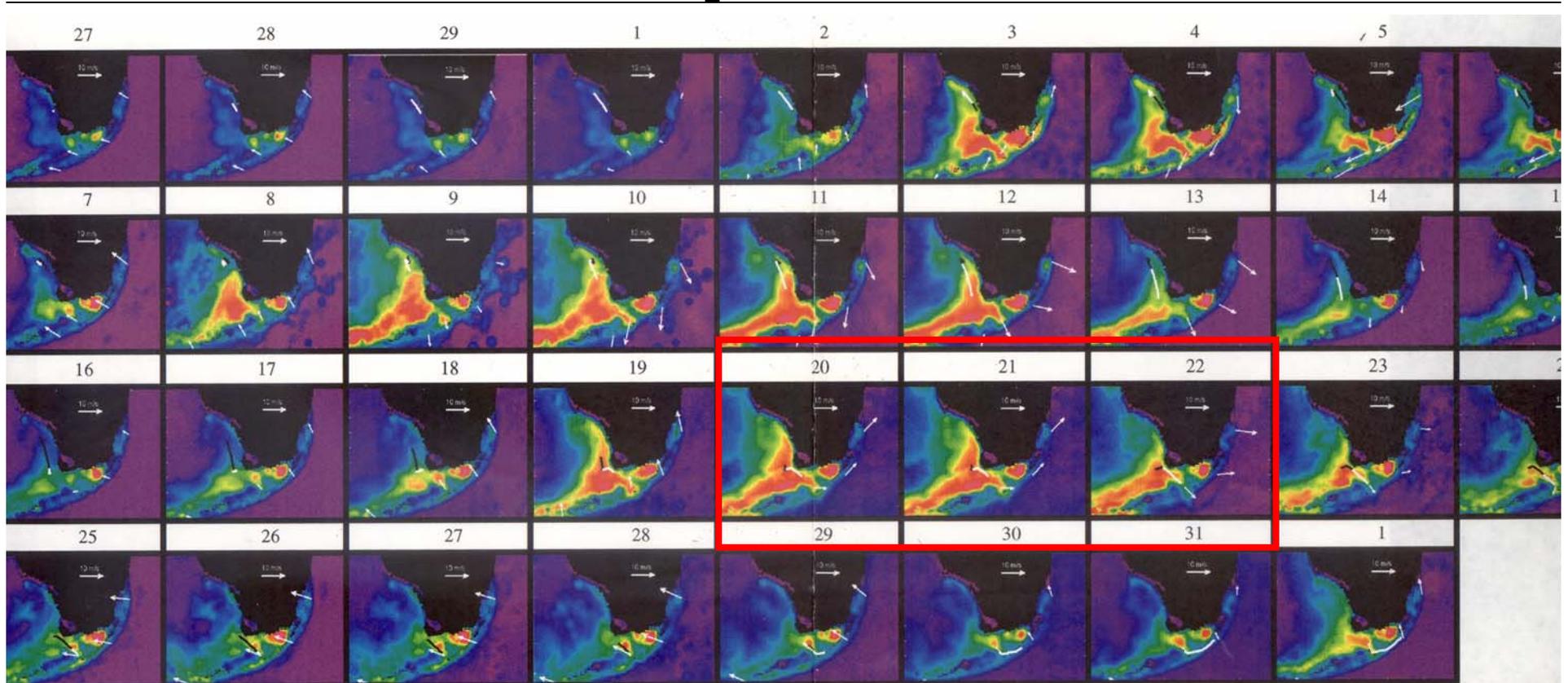
date	wind	observations	Lessons Learned
14-16		<p>25 knot northerly turns 5 knot northerly. Except for NE Bay, sediments begin to settle.</p>	<ol style="list-style-type: none"> 1. NE & SW Bay are turbid during light wind conds. 2. NE Bay can be easily resuspended.  3. The system responds immediately to strong wind event. 4. As long as wind > some threshold, sed remain suspension 5. Except for NE, weak easterly will not resuspend sed. 6. Strong northerly can transport sed into the Gulf.



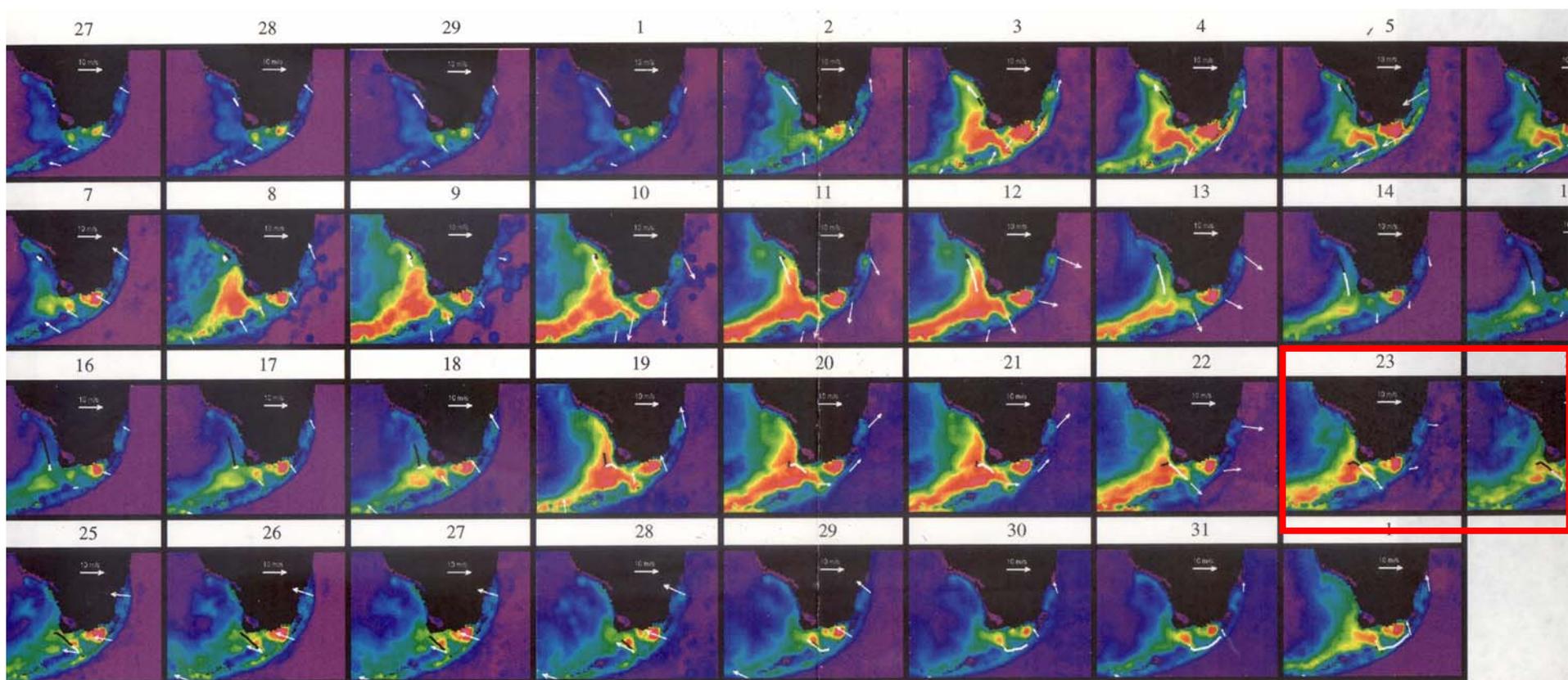
date	wind	observations	Lessons Learned
17-19		<p>5 knot easterly turns 20 knot southerly.</p> <p>Resuspension begins again, first in NE and SW Bay, then the rest.</p>	<ol style="list-style-type: none"> 1. NE & SW Bay are turbid during light wind conds. 2. NE Bay can be easily resuspended. ← 3. The system responds immediately to strong wind event. ← 4. As long as wind > some threshold, seds remain suspension 5. Except for NE, weak easterly will not resuspend seds. 6. Strong northerly can transport seds into the Gulf.



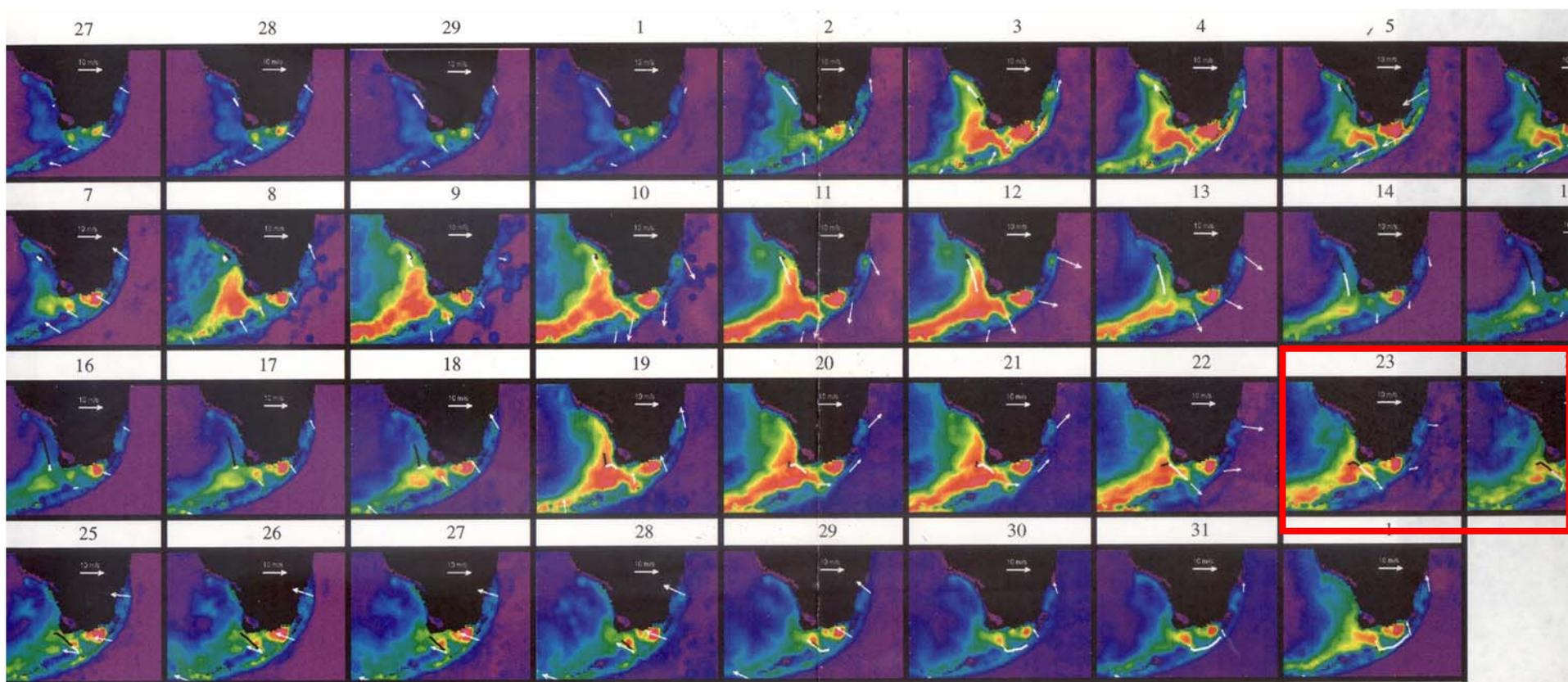
date	wind	observations	Lessons Learned
20-22		<p>20 knot southerly turns to 20 knot westerly.</p> <p>The Bay is completely turbid!</p>	<ol style="list-style-type: none"> 1. NE & SW Bay are turbid during light wind conds. 2. NE Bay can be easily resuspended. 3. The system responds immediately to strong wind event. 4. As long as wind > some threshold, sed remain suspension 5. Except for NE, weak easterly will not resuspend sed. 6. Strong northerly can transport sed into the Gulf.



date	wind	observations	Lessons Learned
23-24		<p>20 knot westerly beomes 5 knot westerly.</p> <p>Settling begins. Settling takes longer than 1 day (not a step function).</p>	<ol style="list-style-type: none"> 1. NE & SW Bay are turbid during light wind conds. 2. NE Bay can be easily resuspended. 3. The system responds immediately to strong wind event. 4. As long as wind > some threshold, seds remain suspension 5. Except for NE, weak easterly will not resuspend seds. 6. Strong northerly can transport seds into the Gulf. 7. Settling time is longer than a day.



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date	wind	observations	Lessons Learned
25-29		<p>5 knot westerly becomes 20 knot easterly.</p> <p>Except for NE & SW Bay, all sediments are settling.</p>	<ol style="list-style-type: none"> 1. NE & SW Bay are turbid during light wind conds. 2. NE Bay can be easily resuspended. 3. The system responds immediately to strong wind event. 4. As long as wind > some threshold, sed remain suspension 5. Except for NE, weak easterly will not resuspend sed. ← 6. Strong northerly can transport sed into the Gulf. 7. Settling time is longer than a day. ←

