SDT SWOT
TOULOUSE JUN 2017

SWOT ALIASING IN ESTUARINE AND COASTAL ZONES

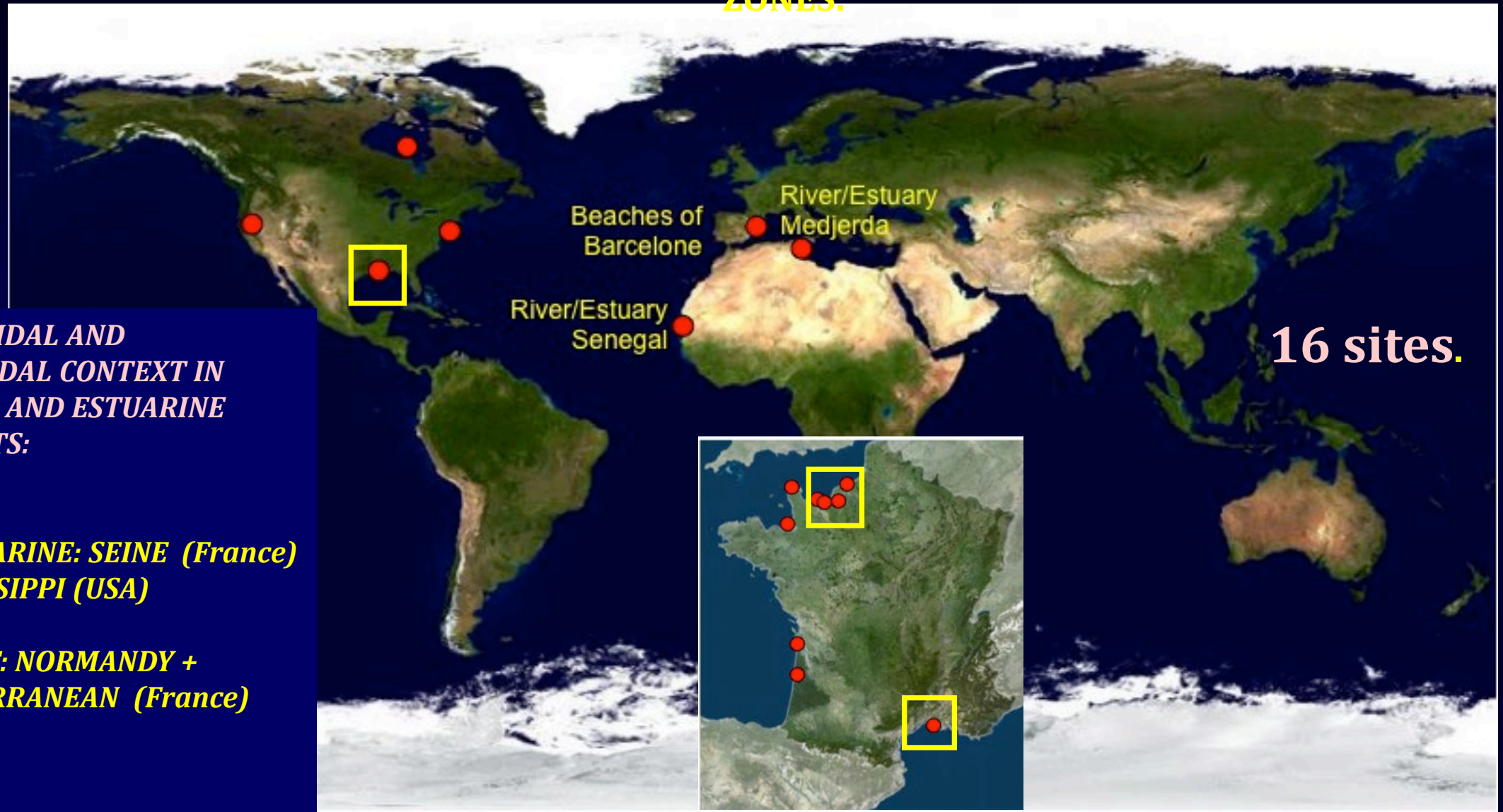
INSIGHTS INTO SOME TIDAL AND NON TIDAL ALIASING OF SWOT MEASUREMENTS IN COASTAL AND ESTUARINE ZONES: APPLICATION FOR MICROTIDAL AND MACROTIDAL CONTEXTS

Imen TURKI

Benoit LAIGNEL, Laetitia CHEVALIER, Marc SIMARD, Antoine SOLOY

CONTEXT

OUR PROJECT: SWOT MEASUREMENTS OF PHYSICAL PROCESSES IN ESTUARINE AND COASTAL ZONES.



MACROTIDAL AND MICROTIDAL CONTEXT IN COASTAL AND ESTUARINE CONTEXTS:

1- ESTUARINE: SEINE (France) + MISSISSIPPI (USA)

2- COAST: NORMANDY + MEDITERRANEAN (France)

CONTEXT

Discrepancies increase from hydrological to coastal systems !!!!

1. Measurements are not enough in time to reproduce the evolution.

2. Aliased shifted variations with sampling and in neighboring groud tracks.

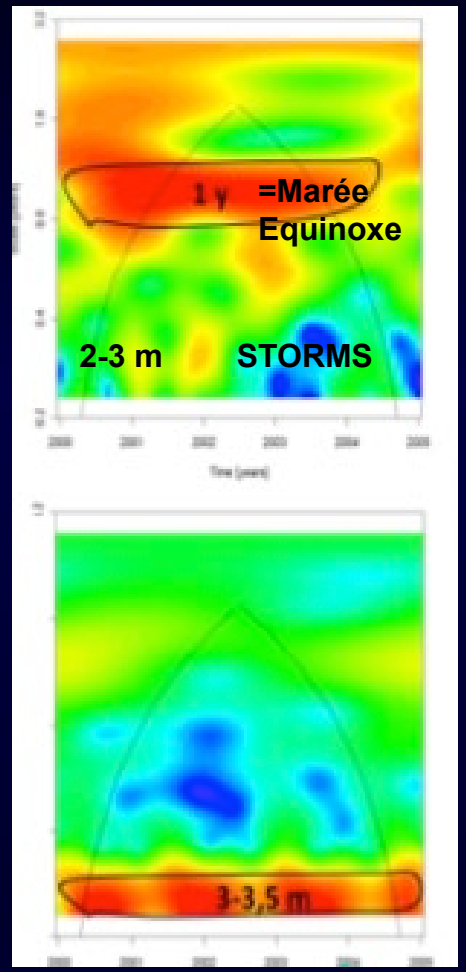
The Channel
Macrotidal

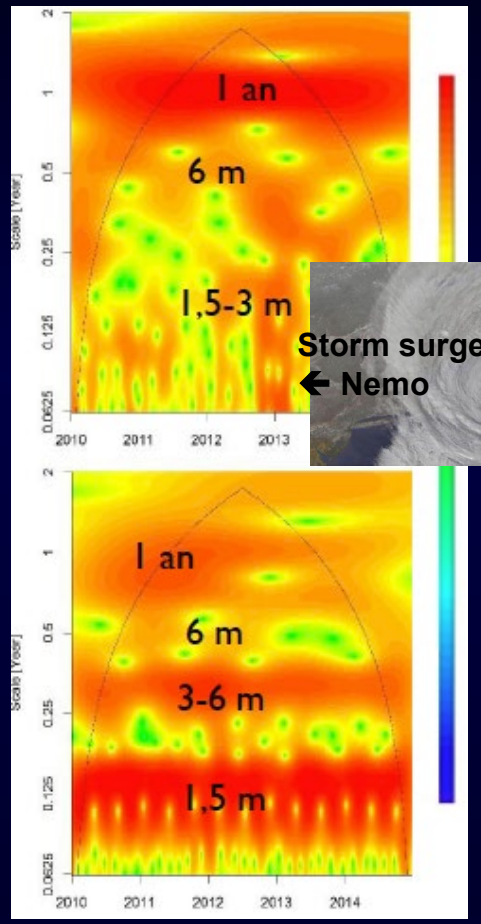
Atlantic-Connecticut bay
Microtidal

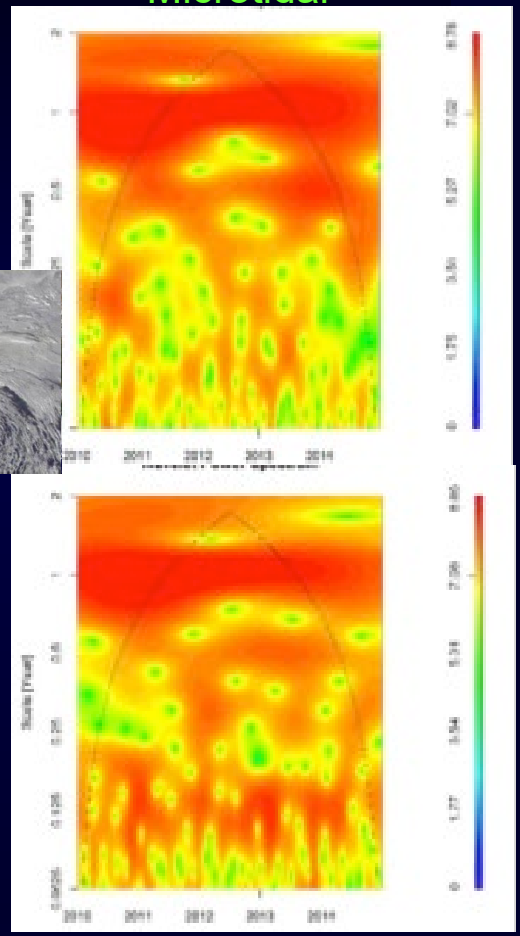
Gulf of Mexico-Mississippi
Microtidal

In situ

SWOT







53 à 65%

73%

82%

CONTEXT

DESIGN OF SWOT ORBIT

78 degrees and 20.8646 day repeat period was chosen for gapless coverage and good tidal aliasing properties.

Questions:

What types of aliasing should be considered for SWOT sea level measurements?

How much does aliasing phenomena affect SWOT sea level measurements ?

OBJECTIVES

ALIASED SIGNAL UNDER ALTIMETRY SAMPLING

1- TIDAL ALIASING: *combine effect of spatial and temporal aliasing results in a systematic propagation of the tidal variability.*

Focus on cross-track aliasing closely related to temporal aliasing

What's happen with the more energetic diurnal components: M2 S2 K1 O1 and the ter-diurnal component M3 ?

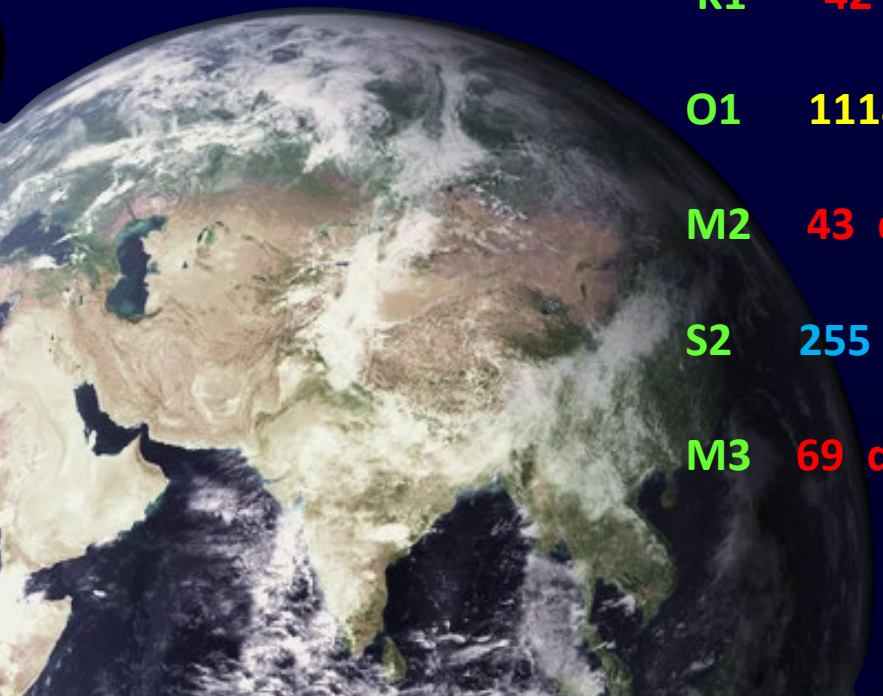
2- NON TIDAL ALIASING: temporal sea level variability.

TIDAL ALIASING

TIDAL ALIASING: *temporal aliasing produced by semi-diurnal stationary components:*

Aliased Period: Ta

Ta=f(period of tidal contituant T0, orbital repeat period Ts)



K1	42 days	*SEMI-DIURNAL COMPONENTS*
O1	1118 days	
M2	43 days	
S2	255 days	
M3	69 days	*TER-DIURNAL COMPONENT*

High frequency
< 45 days
< 3 months . M3

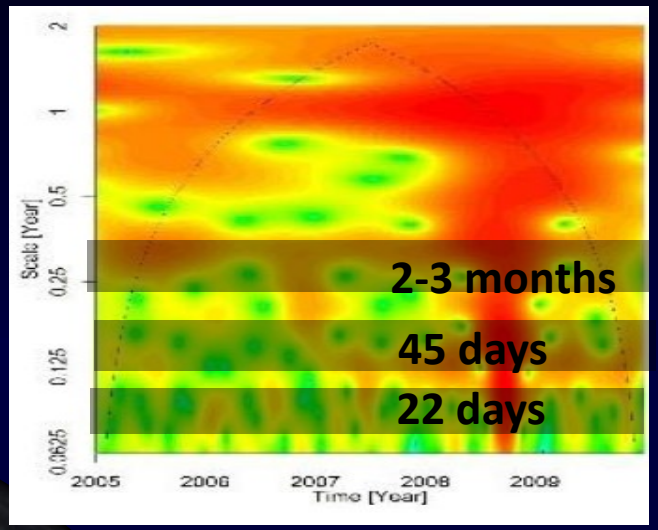
Low frequency
> 1 year

Mean Frequency
3 months - 1year

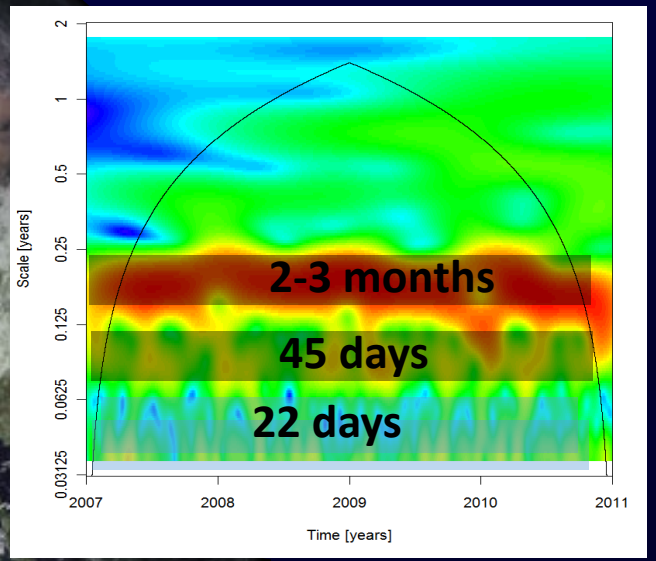
TIDAL ALIASING

FREQUENCY ANALYSIS: CONTNUOUS WAVELET TRANSFORM OF SWOT MEASUREMENTS

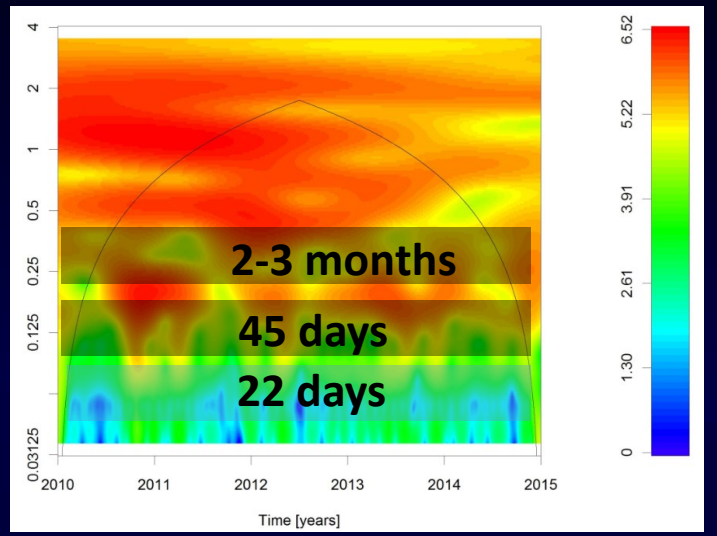
MISSISSIPI: BAY



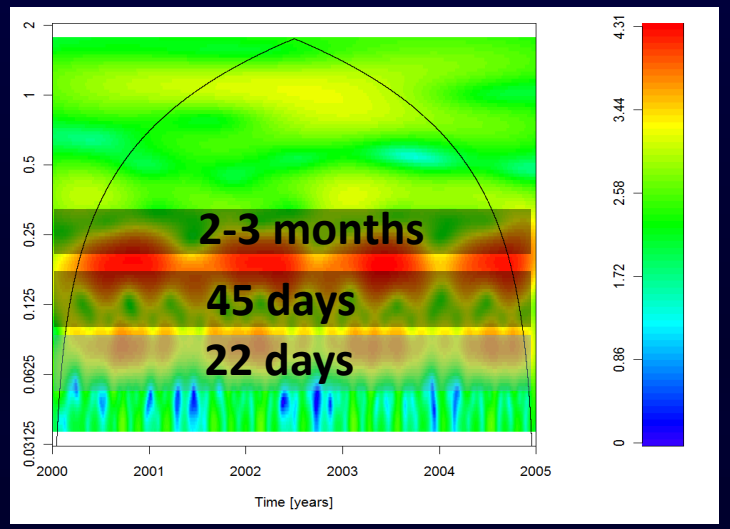
SEINE: BAY



MEDITERRANEAN: MARSEILLE



NORMANDY: COAST

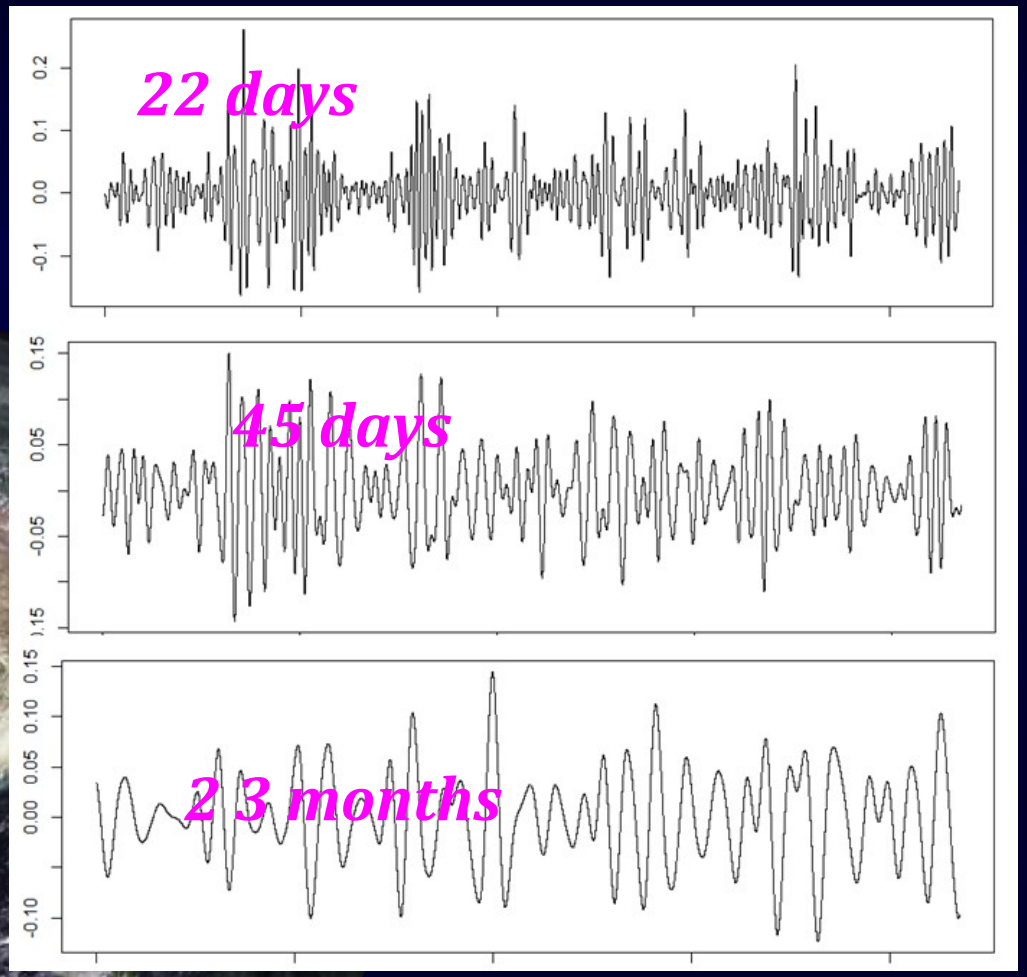


TIDAL ALIASING

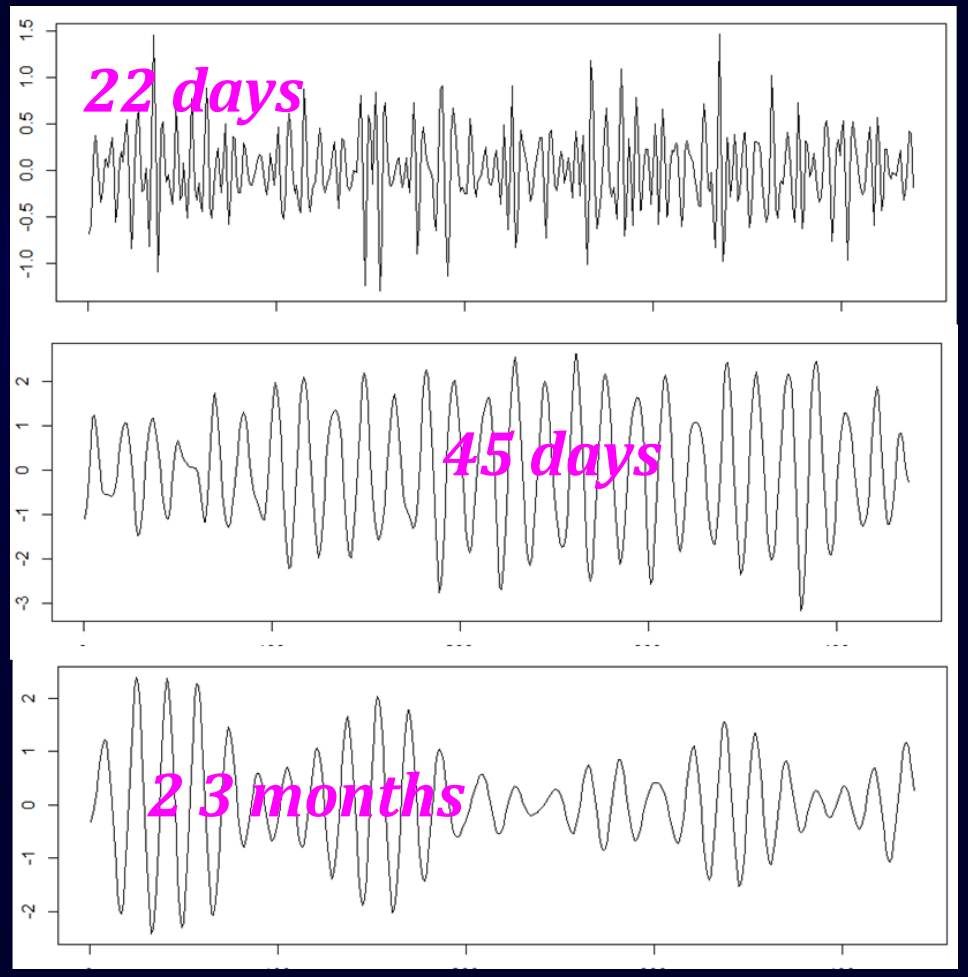
FREQUENCY ANALYSIS: RECONSTRUCTION OF HEIGH FREQUENCIES

MICROTIDAL CONTEXT

Mediterranean Coast



Mississippi Bay

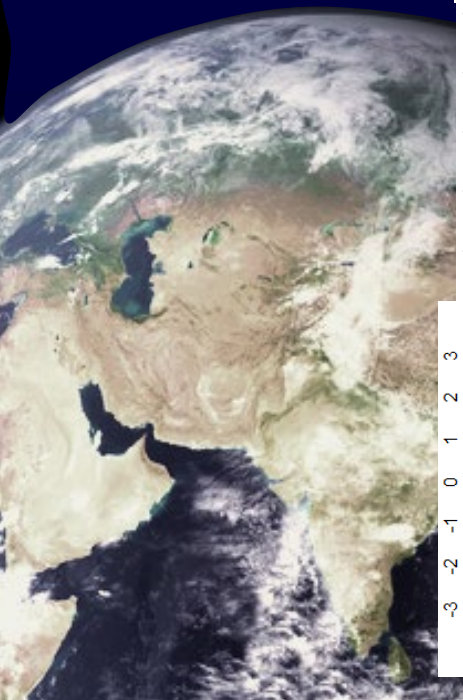


TIDAL ALIASING

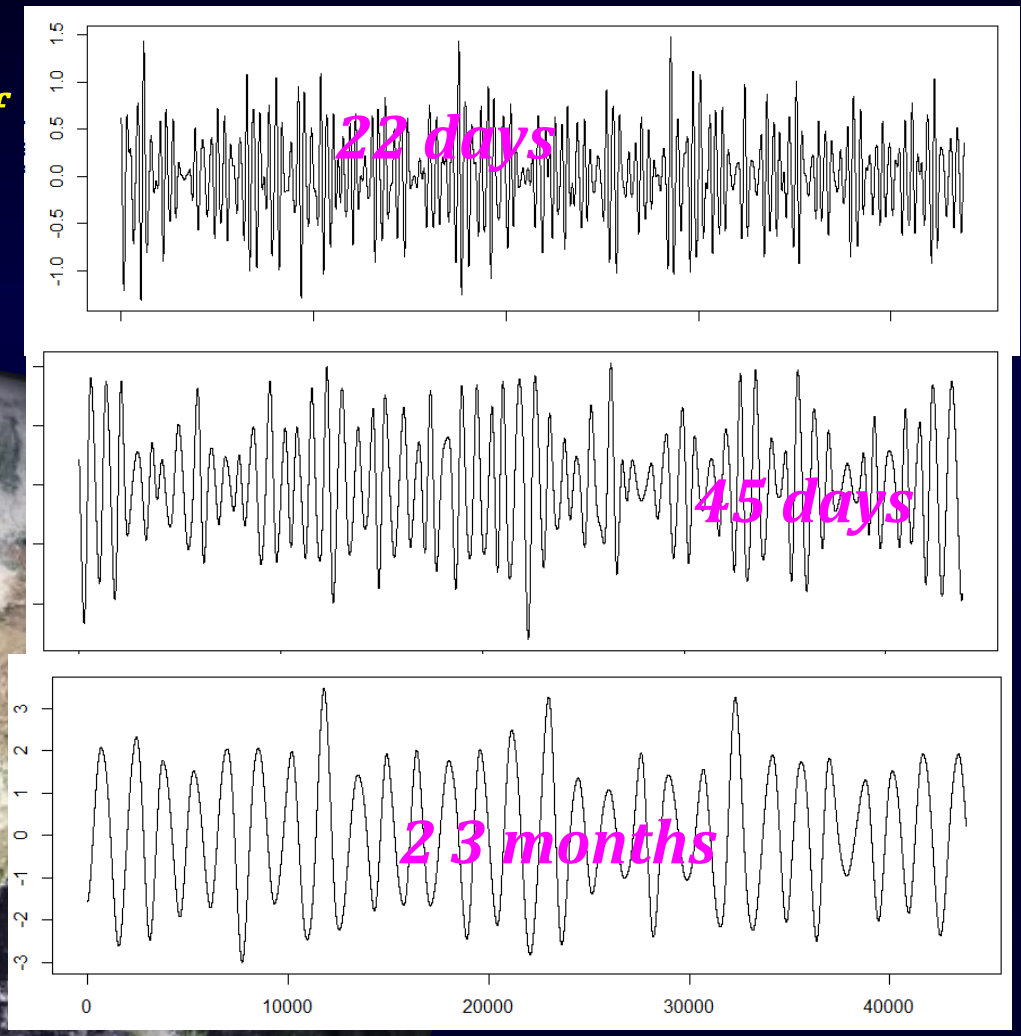
FREQUENCY ANALYSIS: RECONSTRUCTION OF FREQUENCIES

MACROTIDAL CONTEXT

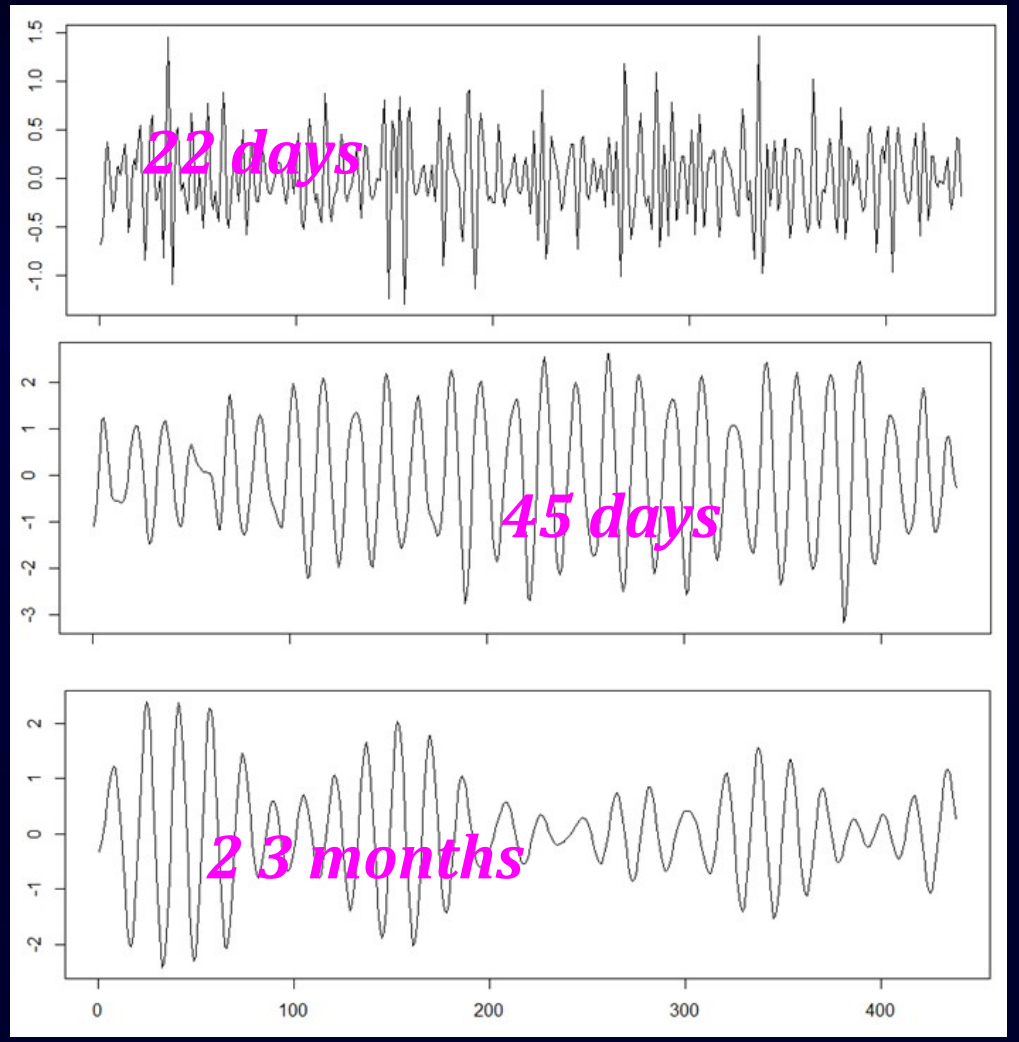
Importance of harmonic frequencies



Normandy Coast

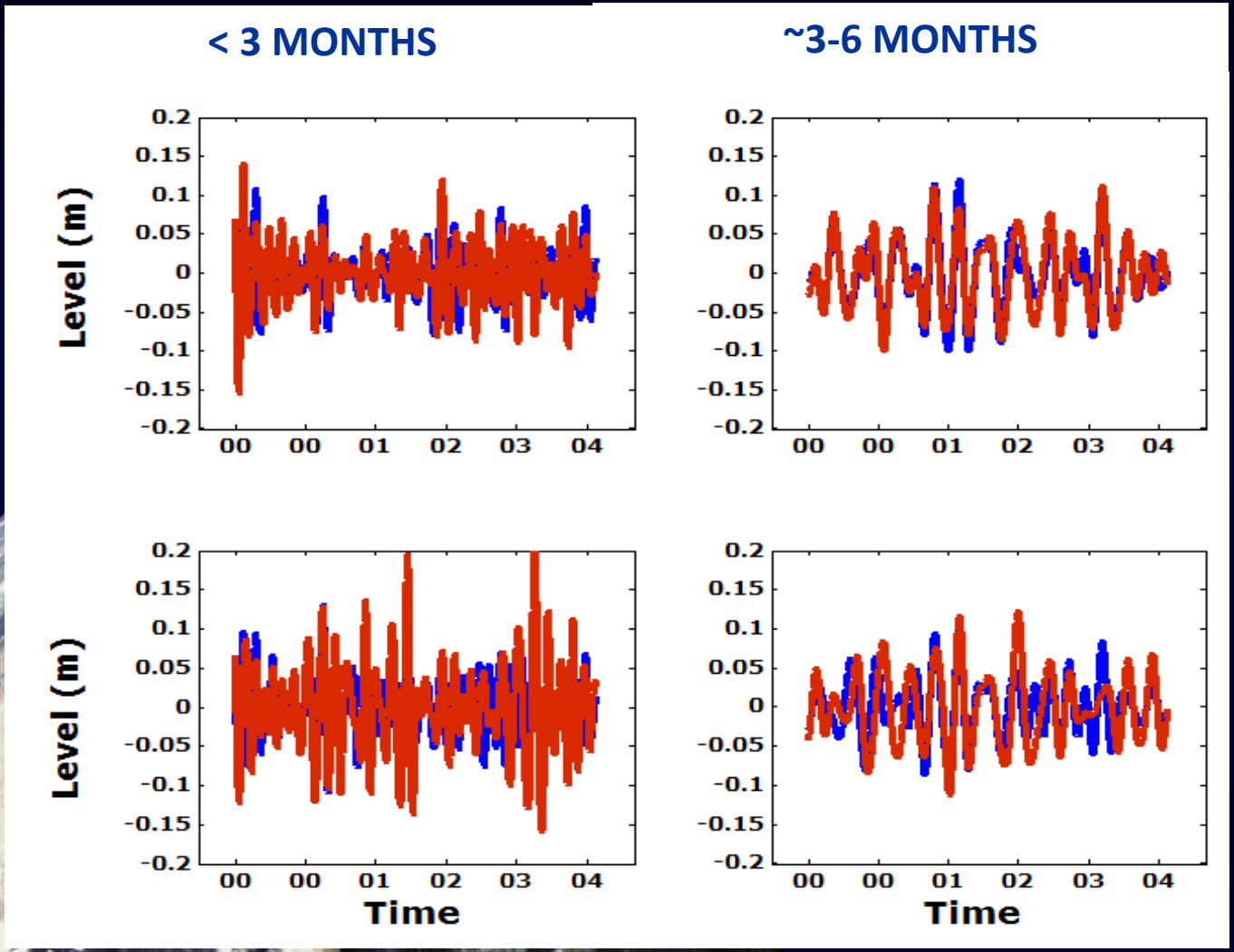


Seine Bay



NON TIDAL ALIASING

USE OF SWOT RESIDUAL NON TIDAL SEA LEVEL:



USE OF SWOT RESIDUAL NON TIDAL SEA LEVEL:

~3-6 MONTHS: SEASONAL VARIABILITY

< 3 MONTHS: SHORT TERM VARIABILITY STORMY EVENT

Comparison between real and sampled residual measurements:
Mean Amplification of the signal :
between 15 an 18% : **~3-6 MONTHS**
Between 25 and 45% : **< 3 MONTHS**

NON TIDAL ALIASING

How much variance is explained by the frequency of seasonal and stormy events in the different contexts

Seasonal Variability

Stormy Events

NORMANDY: COAST

35%

36%

*NORMANDY SEINE **BAY***

27%

34%

MEDITERRANEAN COAST

42%

45%

MISSISSIPI BAY

45%

42%

Importance of Storm surges and seasonal variability in Microtidal systems

FURTHER WORKS

The importance of aliasing contamination caused by SWOT sampling is strongly related to the physical processes of the hydrodynamic context in estuarine and coastal zones:

- *SWOT-Aliased frequencies and hydrology-Aliased cover each other and this covering is strongly related to the hydrodynamic context.*

- *Different sceanrios of estuarine and coatal systems which should be resolved.*

- *Development of hybrid models (combining between statistical and physical concepts) for estimating the errors. Calibration of the models function of the particularities of the system.*