Seamless transition from ocean to coastal retracking algorithms

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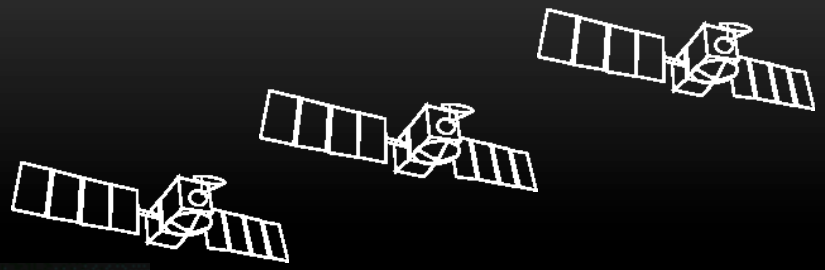
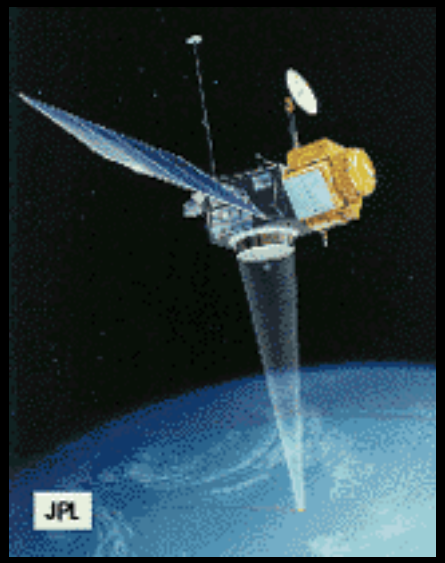
& Pierre Thibaut (CLS)

Homogeneity





Matching TOPEX and Poseidon data

Continuity of T/P, Jason-1, Jason-2 etc

New instrumental techniques
(delay-Doppler, AltiKa, WSOA,)

So what's so difficult about linking COASTAL and OPEN OCEAN?

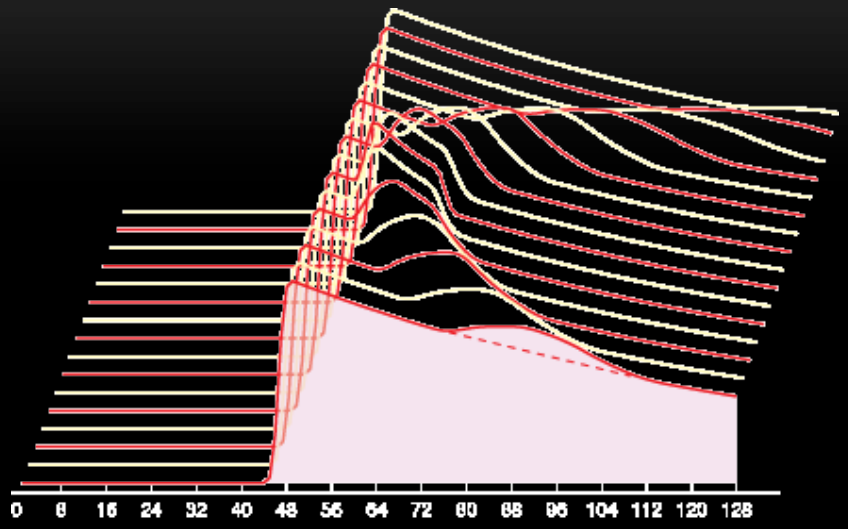
“Brown Model” PLUS

Tackling individual waveforms

Reduced
(Thibaut, Deng/Idris, see past CAWs)

BGP
BAGP
(Thibaut, CAW-4,5; Halimi et al, TGARS, 2012)

Processing multiple waveforms



Hyperbolic pre-tracker (Quartly CAW-5)

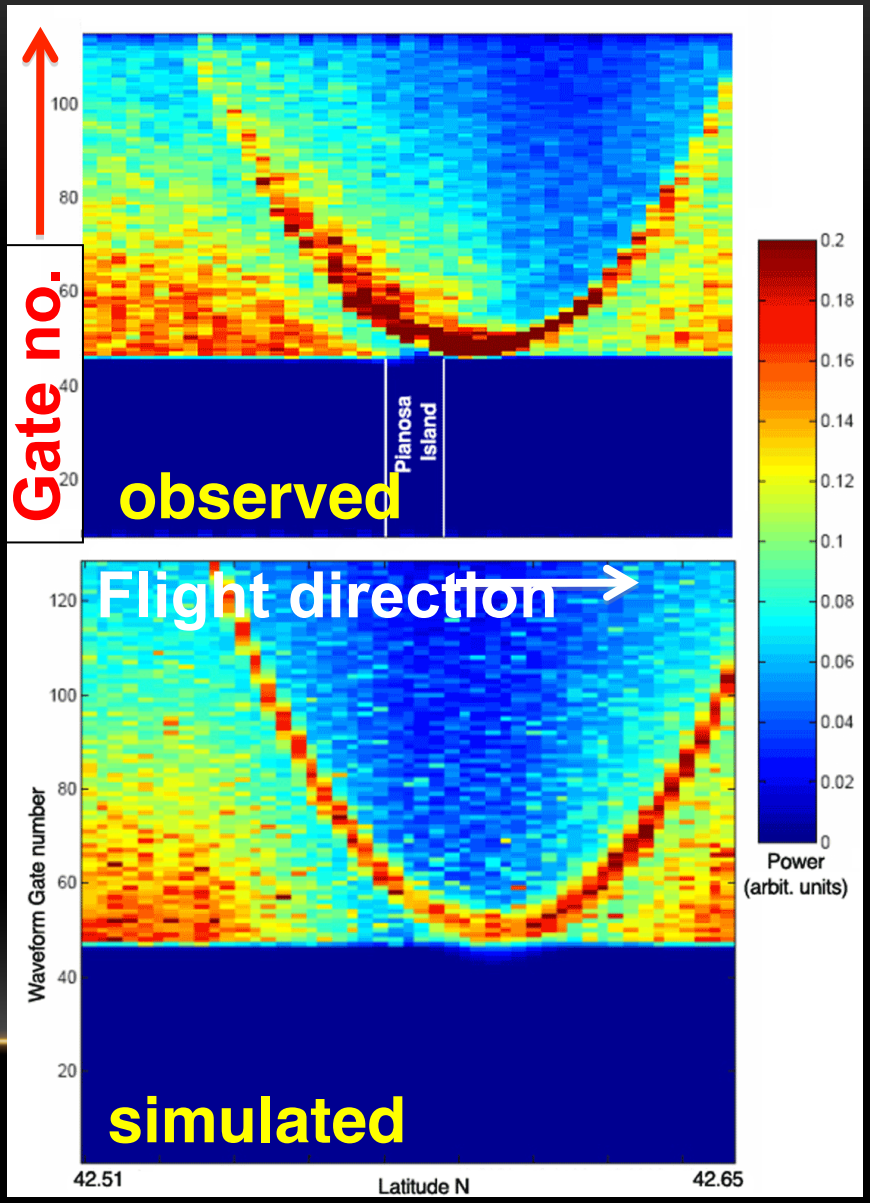
Singular Value Decomposition (Thibaut CAW-5)

Bayesian Retracking / Linear Bayes techniques (tentative)

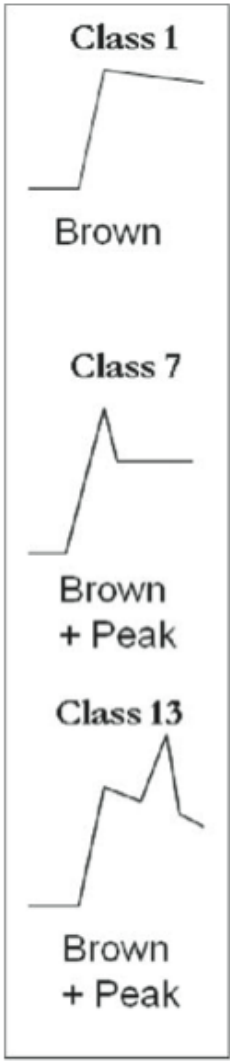
Hyperbolic features are relatively common

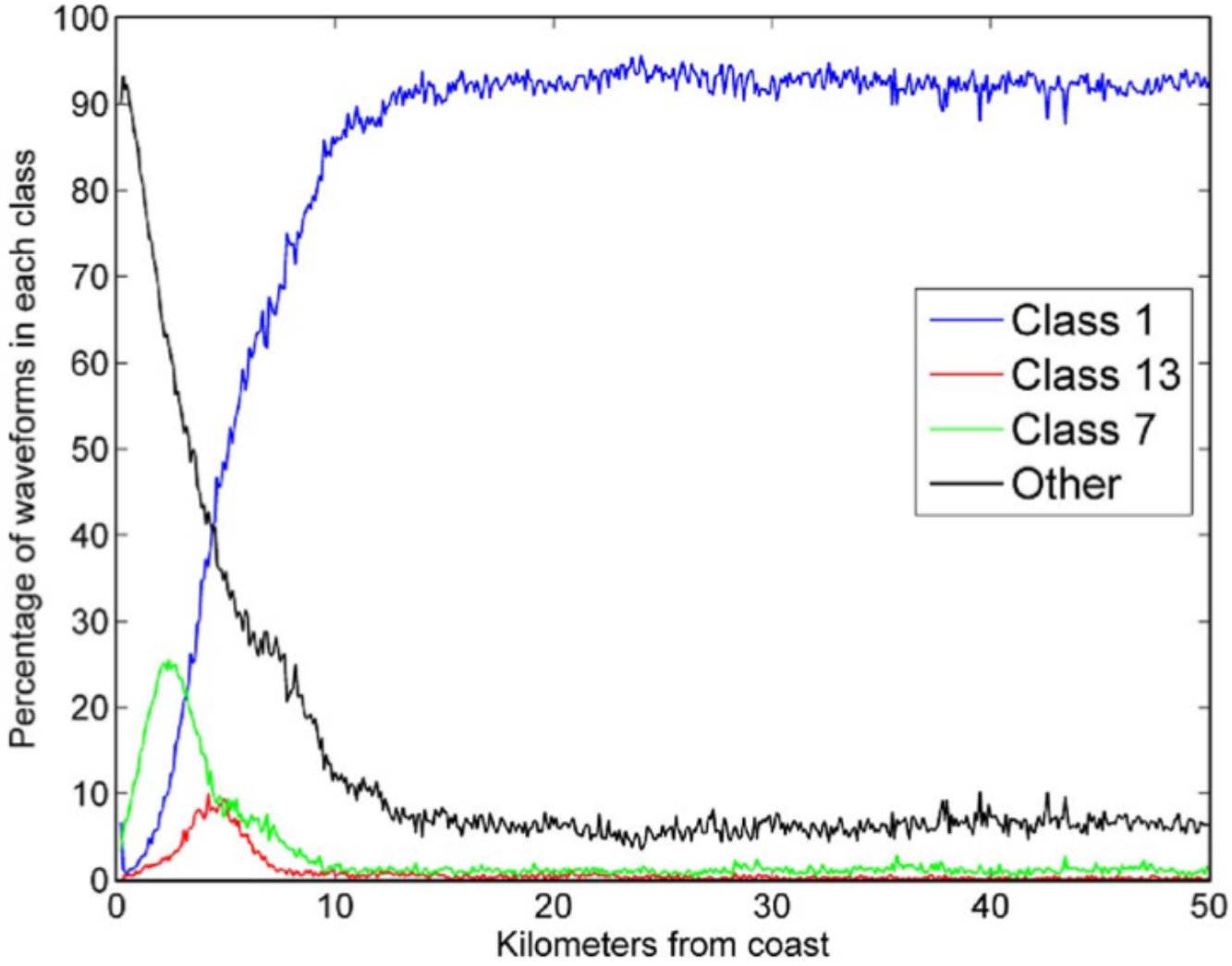
In cycle 49, bright target due to wave sheltering in NW bay (Golfo della Botte)

J. Gómez-Enri et al., IEEE GRSL 2010



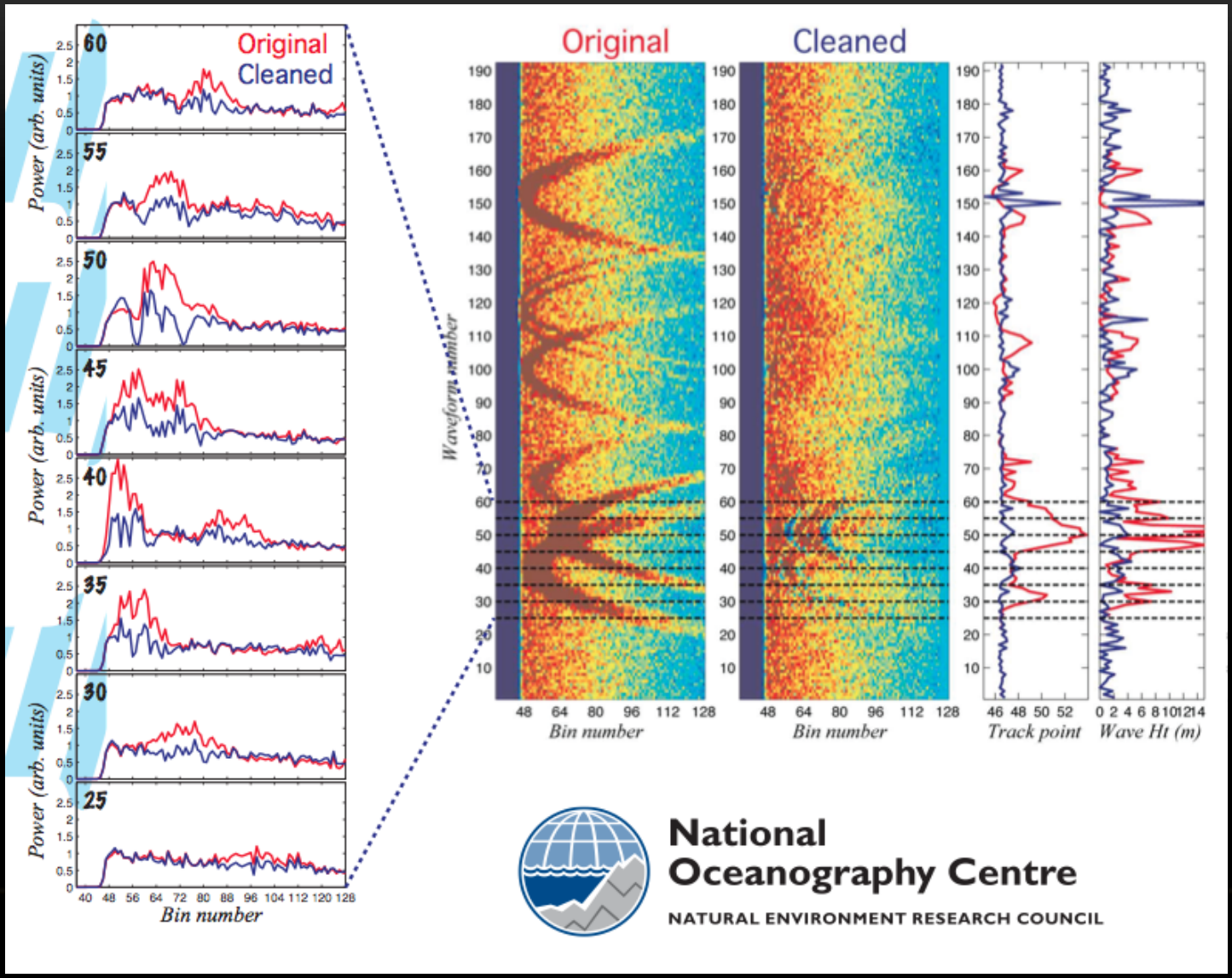
Hyperbolic features are relatively common





Halimi et al, TGARS, 2012

Hyperbolic *pre-tracker*, then Brown fitting



Brown with Asymmetric Gauss. Peak (BAGP)

$$\tilde{s}_k = s_k + p_k$$

with

$$p_k = A \exp\left[\frac{-1}{2\sigma^2}\left(kT_s - T\right)^2\right]\left\{1 + \operatorname{erf}\left[\gamma\frac{\left(kT_s - T\right)}{\sqrt{2}}\right]\right\}$$

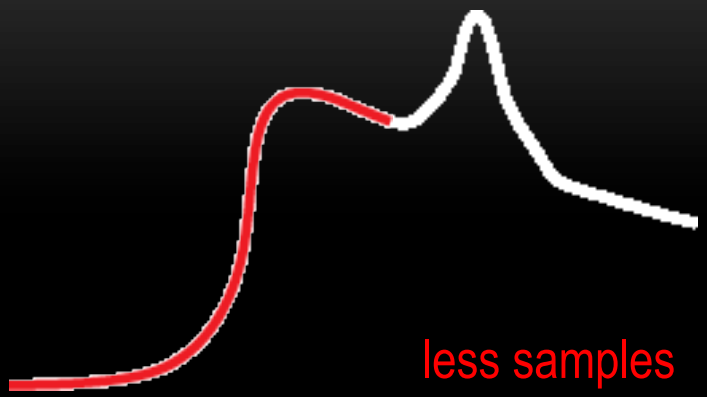
where γ is the asymmetry coefficient of the peak

Generalization of the Brown and BGP models

- BAGP reduces to the Brown model for $A = 0$
- BAGP reduces to the BGP model for $\gamma = 0$

- It should work in many coastal cases, and yield continuous values of parameters
- Should we use it as a reference for other coastal retrackers?!

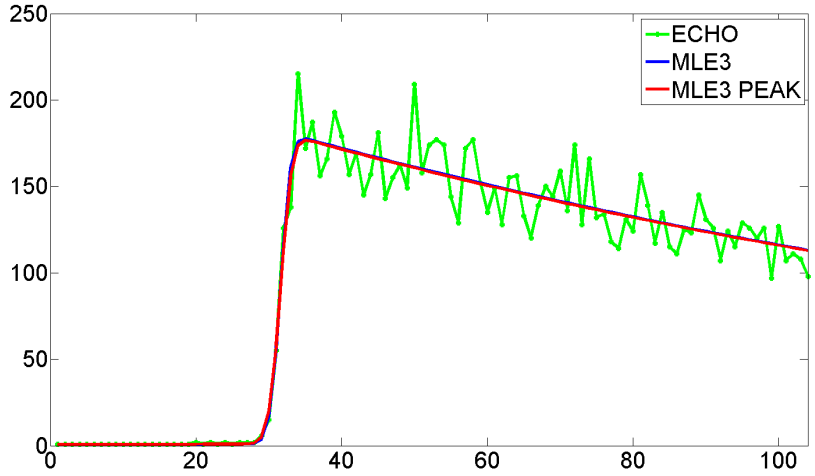
Why not use coastal tracker everywhere?



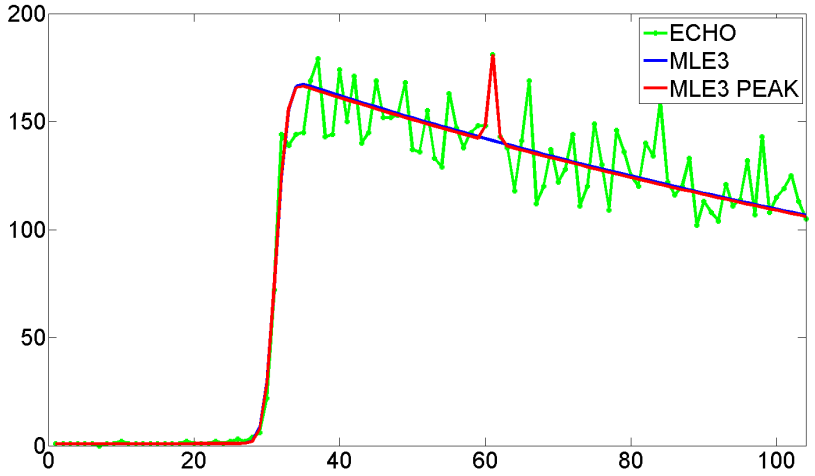
Brown : 3 (or 4) params

Reduced : 3

Regression with MLE3 on normal WFs



Sometimes, no peaks are fitted

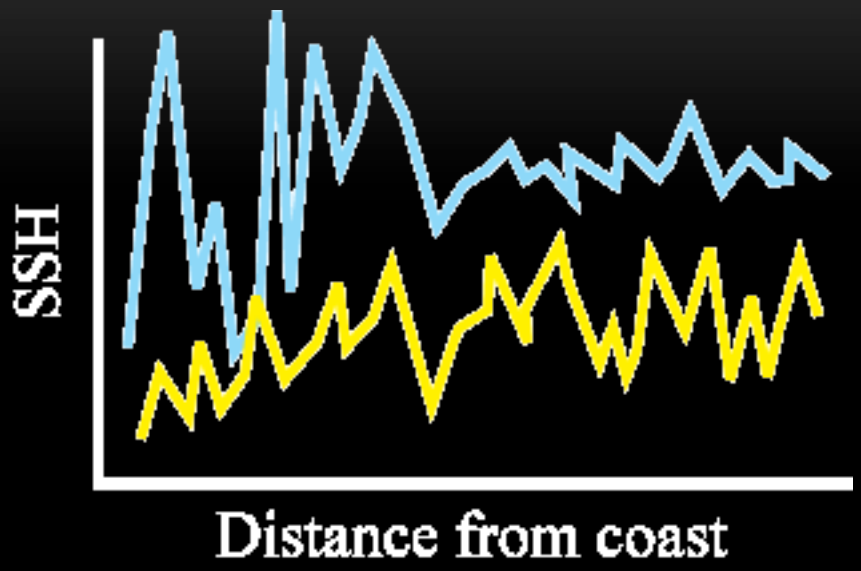


Sometimes, small peaks are fitted

➔ No regression with respect to MLE3

➔ Very important to assure the continuity between retrackings when approaching the coasts (assures also the continuity of the SSB correction)

Minimize effect of switching retrackers



Open Ocean retracker

- At what distance does its variability increase?

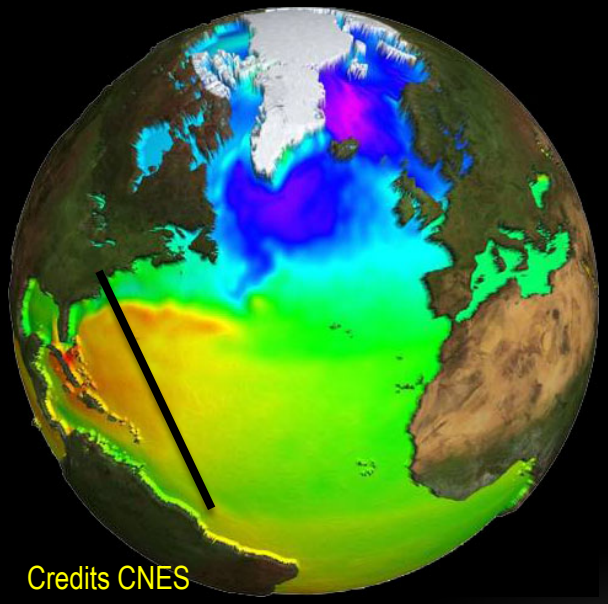
Coastal retracker

- How variable in open ocean?
- Is it biased relative to open ocean tracker?
- How variable is the offset?

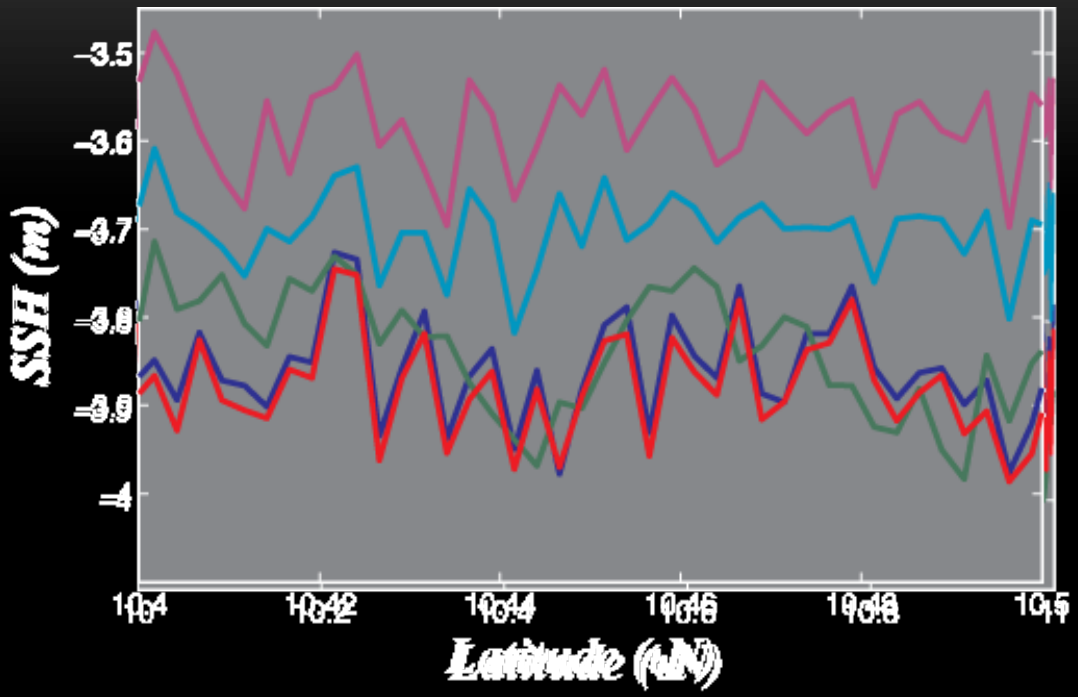
- Is distance from coast the best independent variable to use? (alternative is coastal proximity parameter, developed for SL CCI, see poster at CAW-5)

Example from Pistach

Standard (MLE-4)
Oce3
Red3
Ice3
Ice



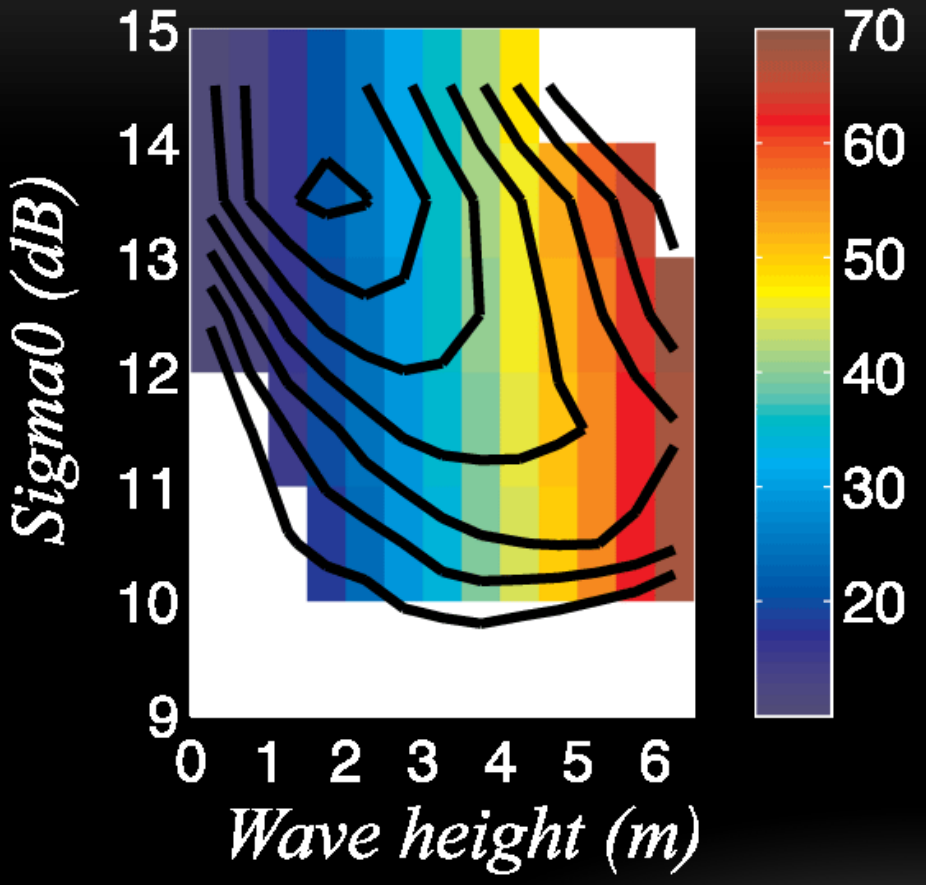
Credits CNES

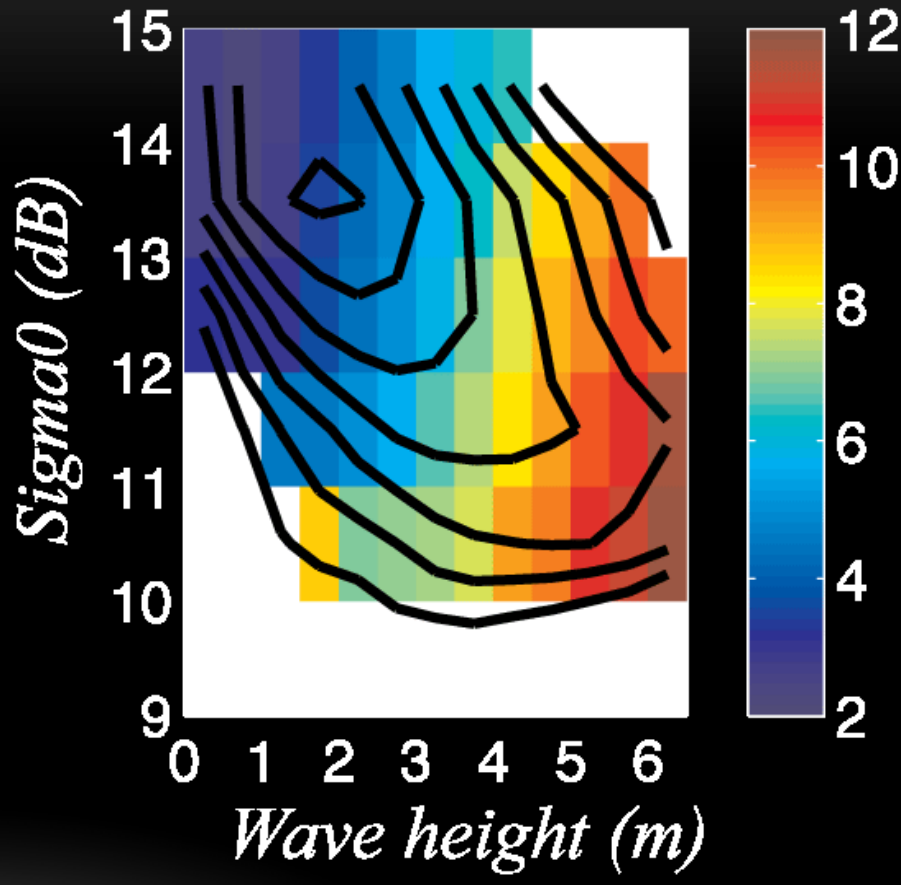


Note ice retrackers are intended for hydrology applications, not open ocean or coastal; simply included here to show diversity of behaviour

http://www.aviso.oceanobs.com/en/data/products/sea-surface-height-products

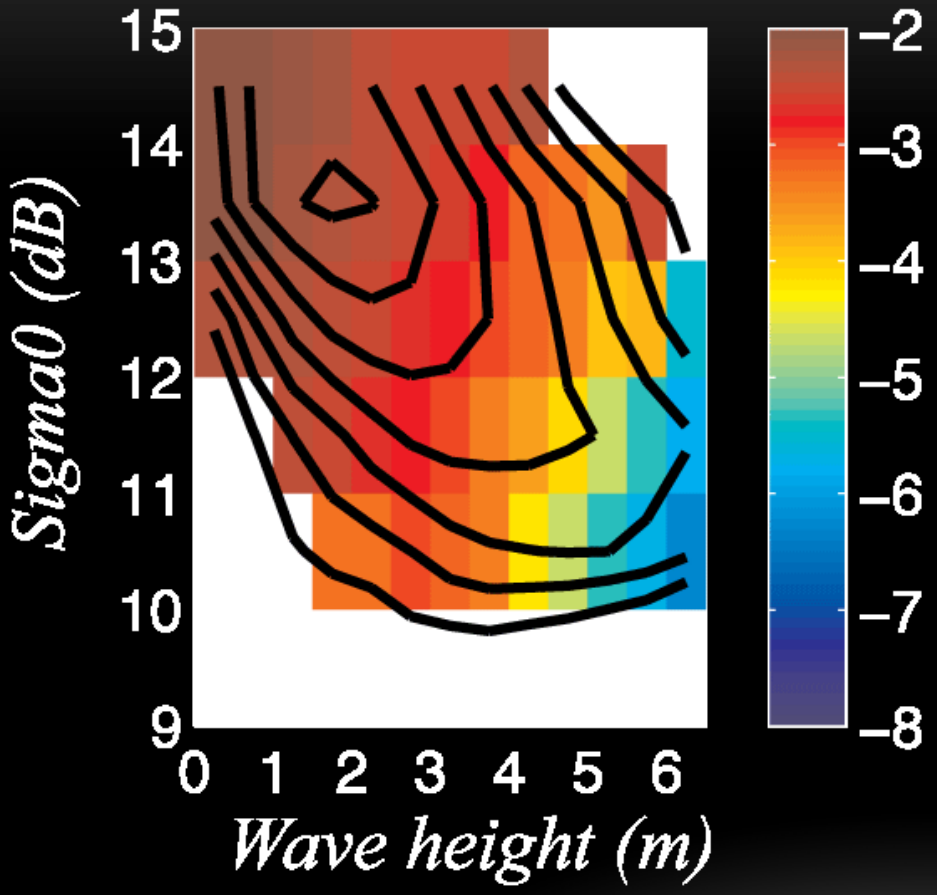
Bias and variability of ice3 rel. to MLE-4

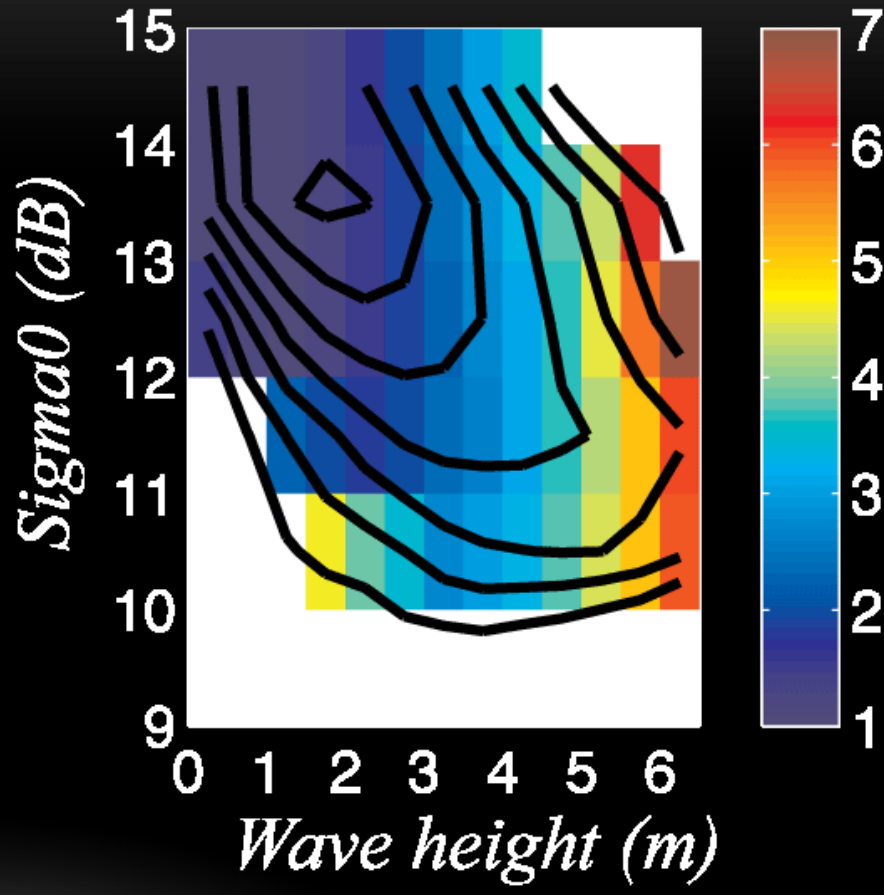




Offset between trackers is f (Hs,σ^0) — effectively an adjustment to SSB

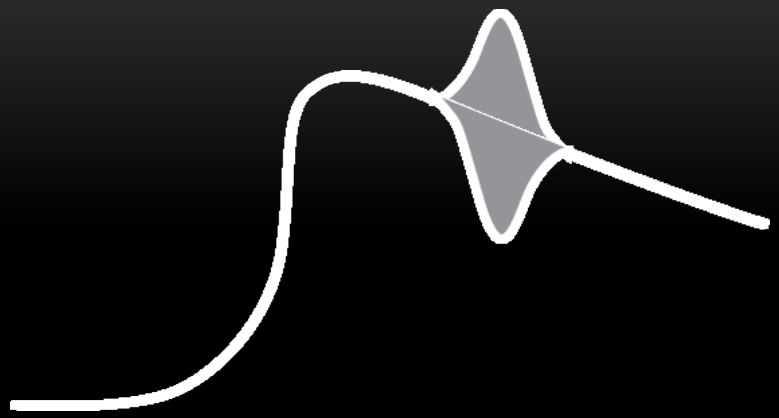
Bias and variability of red3 rel. to MLE-4





Note Pistach product does provide an alternative SSB for oce3 retracker

Inverse example



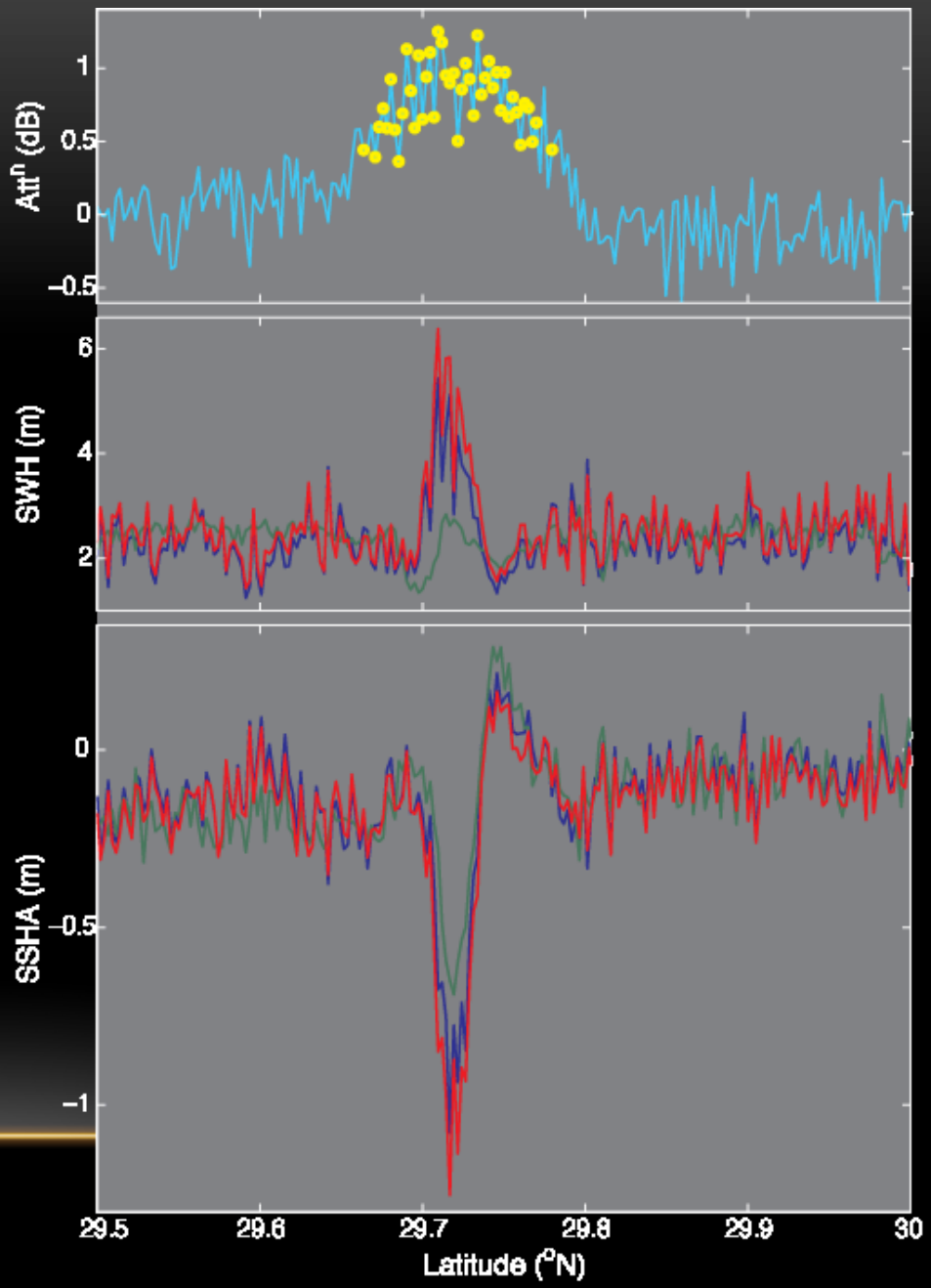
Minor rain event (~1 dB of attenuation)

Both SWH and SSHA affected (useful for studies of wave extremes and storm surges)

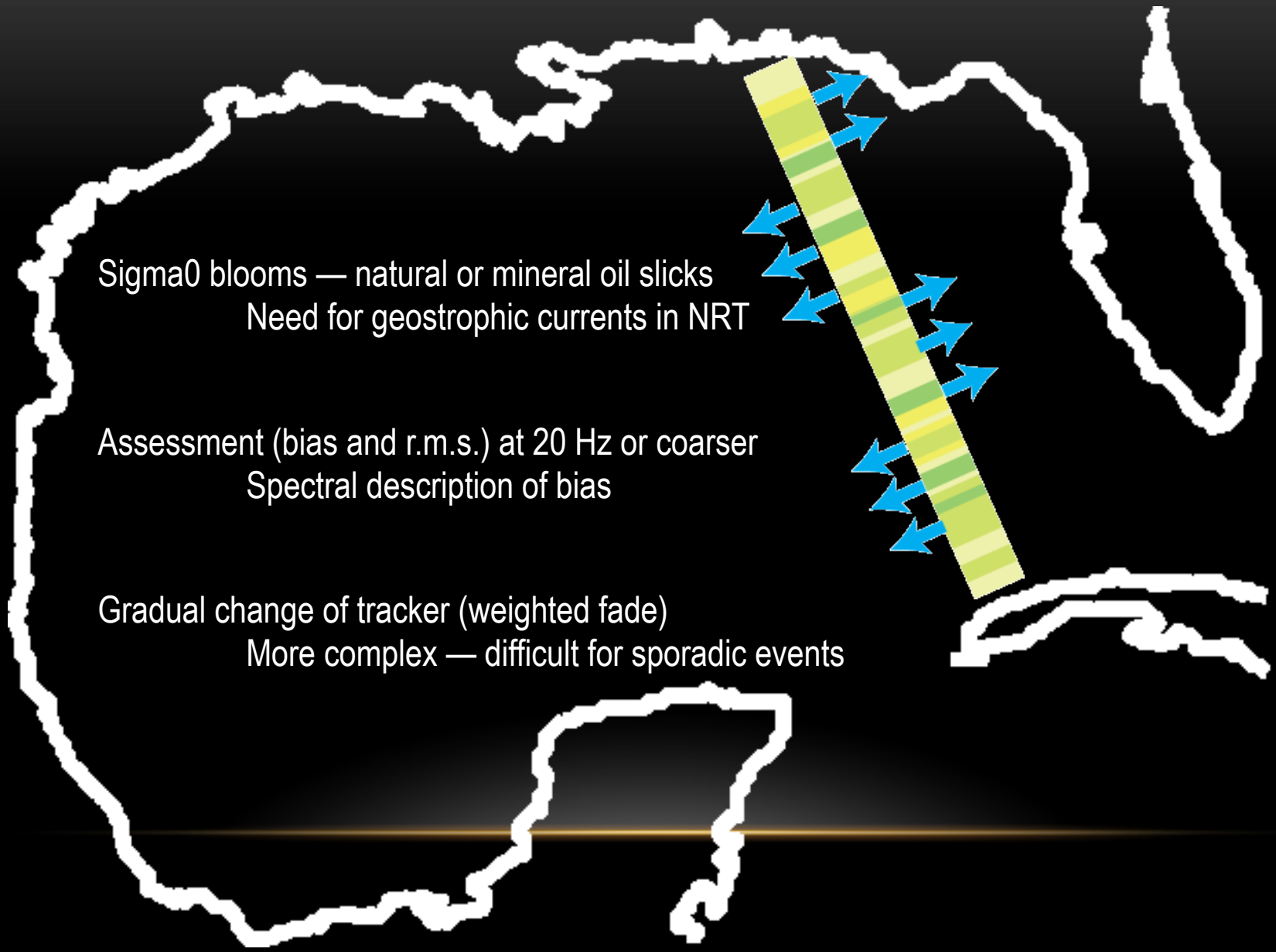
Not all trackers respond the same — need to know which is better

Requirement on relative range bias is less strict

Region to switch trackers is not fixed



Further random thoughts



Sigma0 blooms — natural or mineral oil slicks
Need for geostrophic currents in NRT

Assessment (bias and r.m.s.) at 20 Hz or coarser
Spectral description of bias

Gradual change of tracker (weighted fade)
More complex — difficult for sporadic events

Summary / Points for discussion

Need for specialist retrackers, BAGP might be good as reference

Mean offset can be removed; need to minimize variability of offset

Model offset as f (Hs,σ^0)

Characterise r.m.s. of tracker change

20 Hz??, 5 Hz??, Spectral description

Transition — how near to coast? Sharp or fade?

Non-oceanic returns in open ocean

— storms, slicks & sea-ice