Short Term Predictability of the North Atlantic

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Funded by the Canadian Foundation for Climate and Atmospheric Sciences

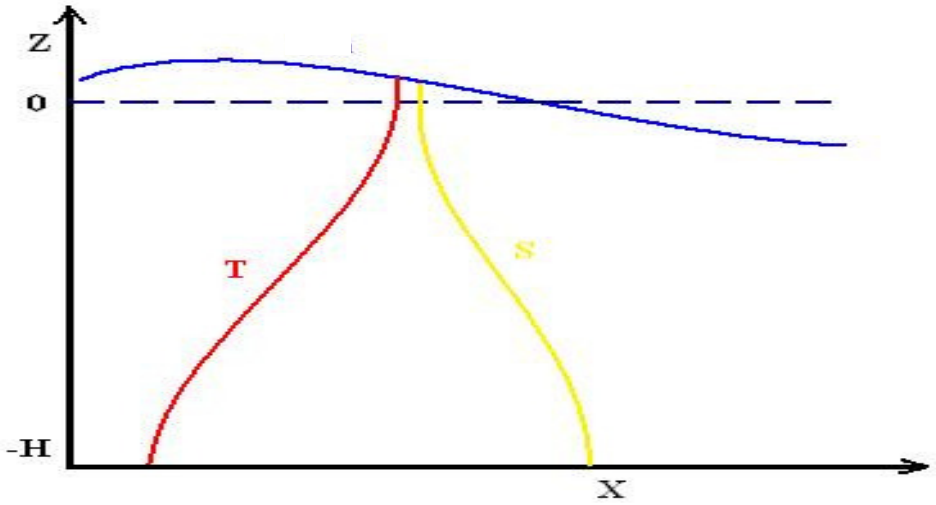
Goals

This Study: Assess impact of ocean initial conditions on the short term (1 to 60d) predictability of the North Atlantic.

Outline of Talk

- Assimilation of altimeter and Argo data
- North Atlantic Model
- Free, assimilation and predictability runs
- Regions of high and low predictability
- Discussion

Simple Scheme for Multivariate Assimilation Of Altimeter and Argo Data



$$\eta^a = \eta^f + \Delta\rho\varsigma_D + \int(\alpha_T\varsigma_T + \alpha_S\varsigma_S)dz$$

$$T^a = T^f + T_b'\varsigma_D + \varsigma_T$$

$$S^a = S^f + S_b'\varsigma_D + \varsigma_S$$

Estimate auxiliary variable ς, and the increment, by minimizing

$$J = [Y - h(X)]^T R^{-1}[Y - h(X)] + \varsigma^T B^{-1}\varsigma$$

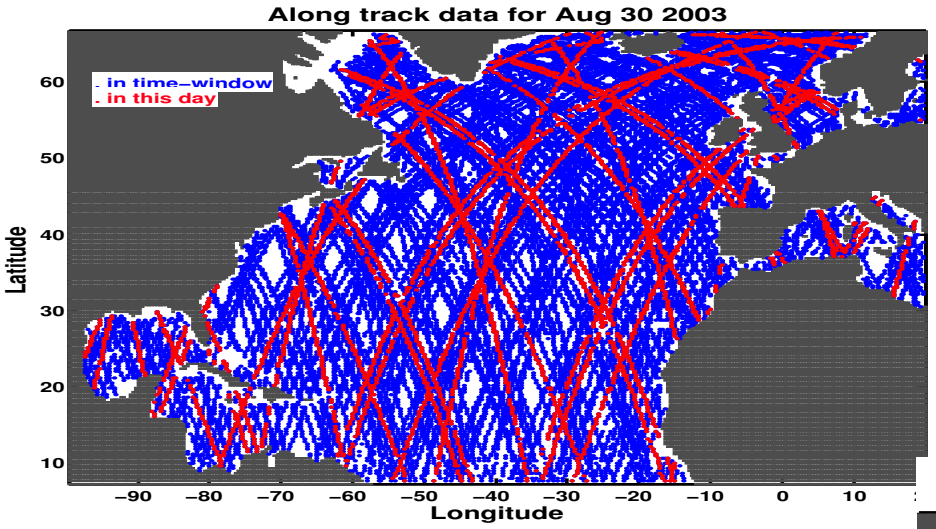
$$B = B_{\varsigma_D} \oplus (B_H \otimes B_V)_{\varsigma_T,\varsigma_S} \qquad B_V = \begin{bmatrix} B_{TT} & B_{TS} \\ B_{TS}^T & B_{SS} \end{bmatrix}$$

•Hybrid •Multivariate •Simple B •Complex TS

The North Atlantic Model

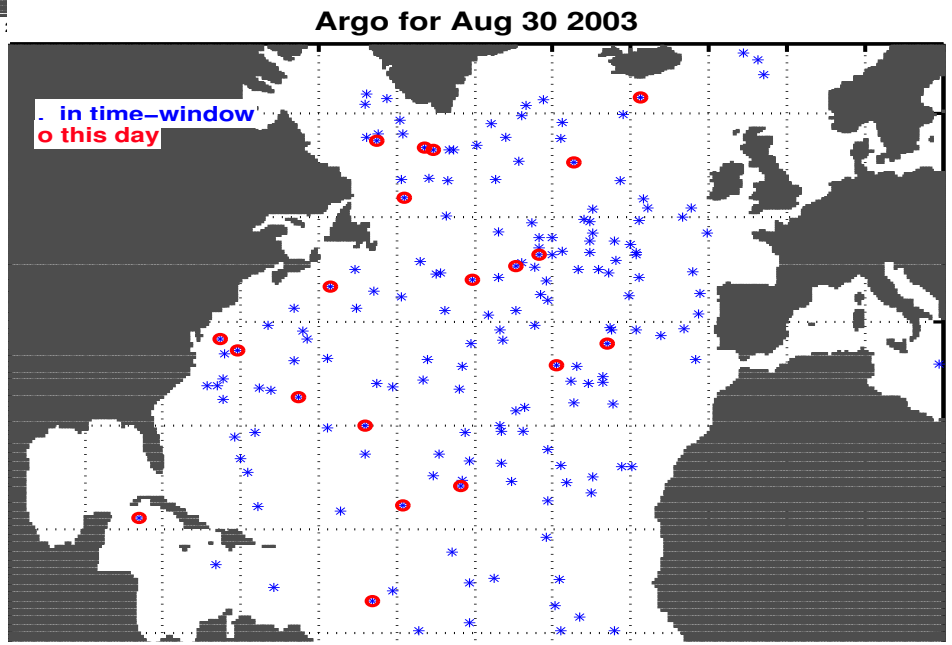
- Based on POP code. 7°N-67°N and Hudson Bay excluded.
- 1°/3 in longitude, equal spacing in x and y, 23 vertical levels.
- Mixing parameterizations: KPP in vertical; biharmonic for momentum; along-isopycnal harmonic for tracers.
- Forcing: daily wind stress, heat flux and E-P from NCEP.
- Integration starts January 1, 1990.
- T and S spectrally nudging to 1°/3 climatology of Yashayaev.

Data for Validation and Assimilation



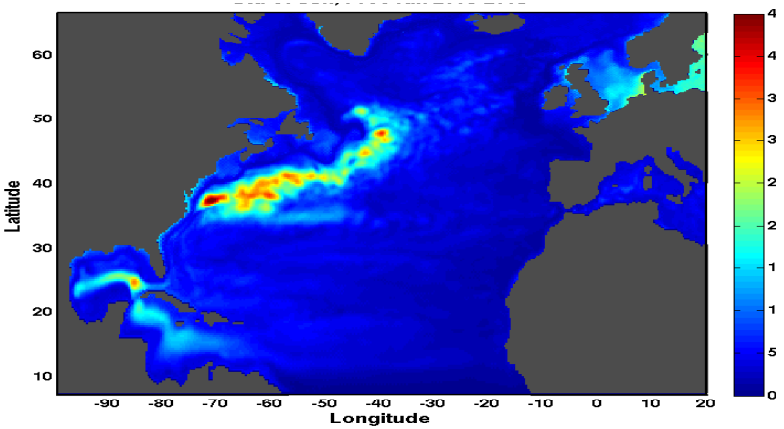
***Altimeter data*: 1992-2006; along track data; mapped to analysis time using 7d sliding window.**

***Argo TS data*: 1997-2006; QC; Lagrangian interpolation to analysis time and grid.**

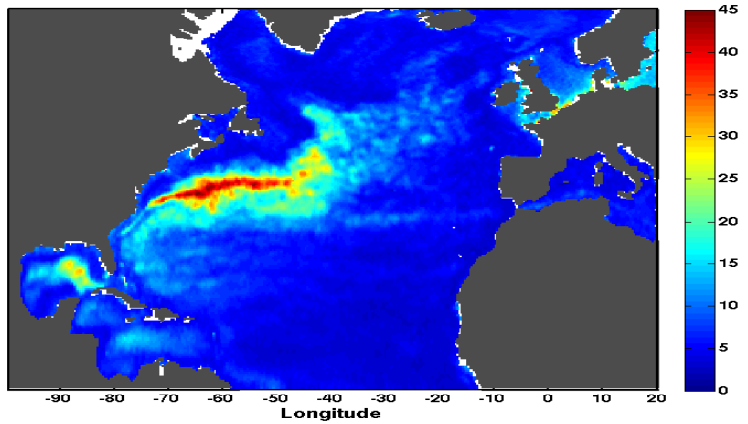


The Free Run (2003-2005)

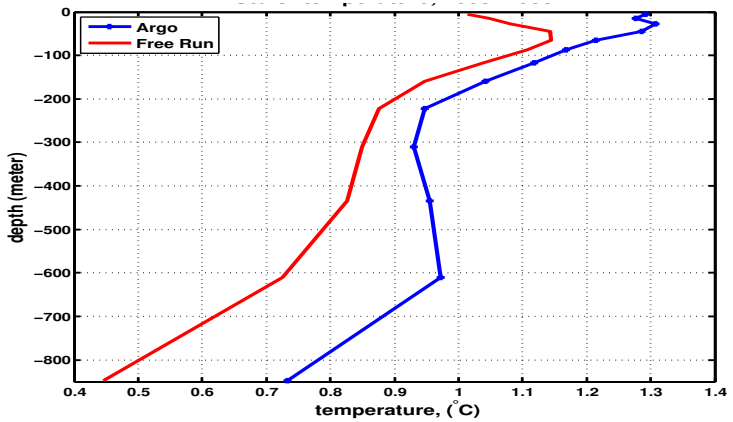
STD of SSH, Free Run



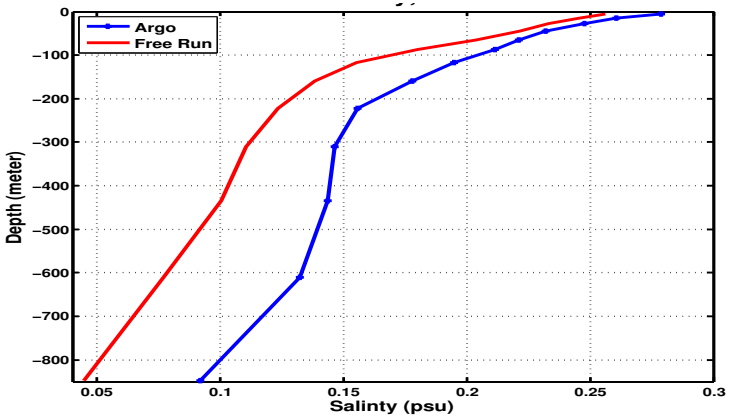
STD of SSH, Obs



STD of Temp

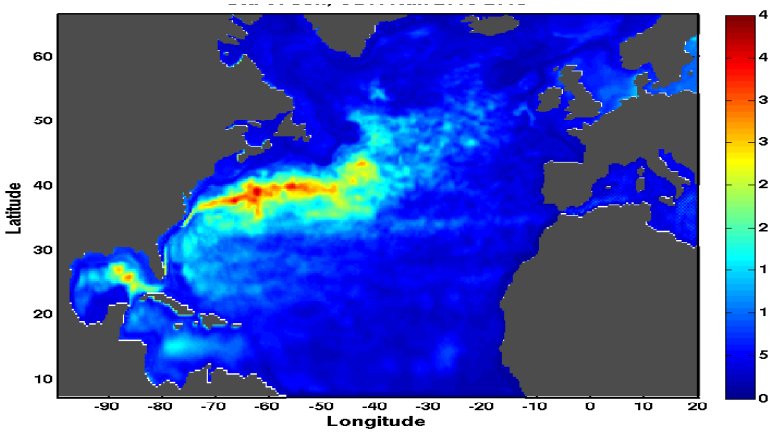


STD of Salt

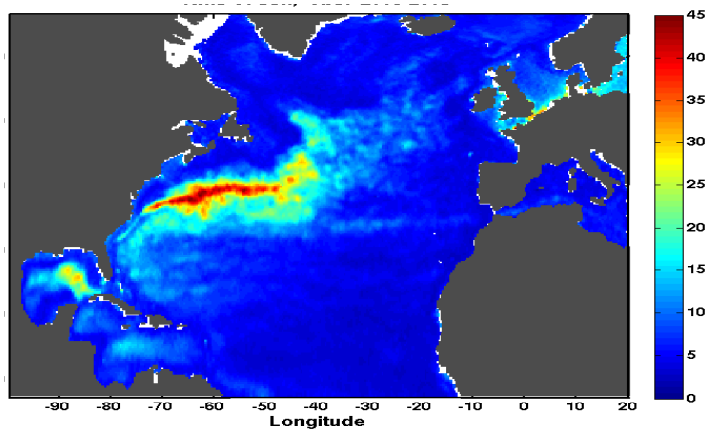


The Assimilation Run (2003-2005)

STD of SSH, ODA Run



STD of SSH, Obs



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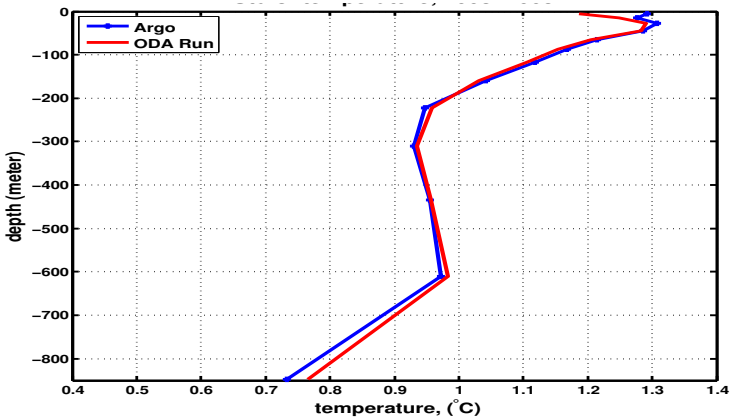

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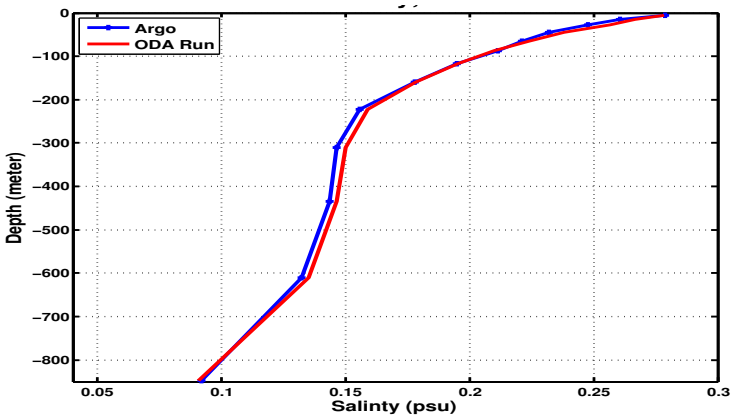
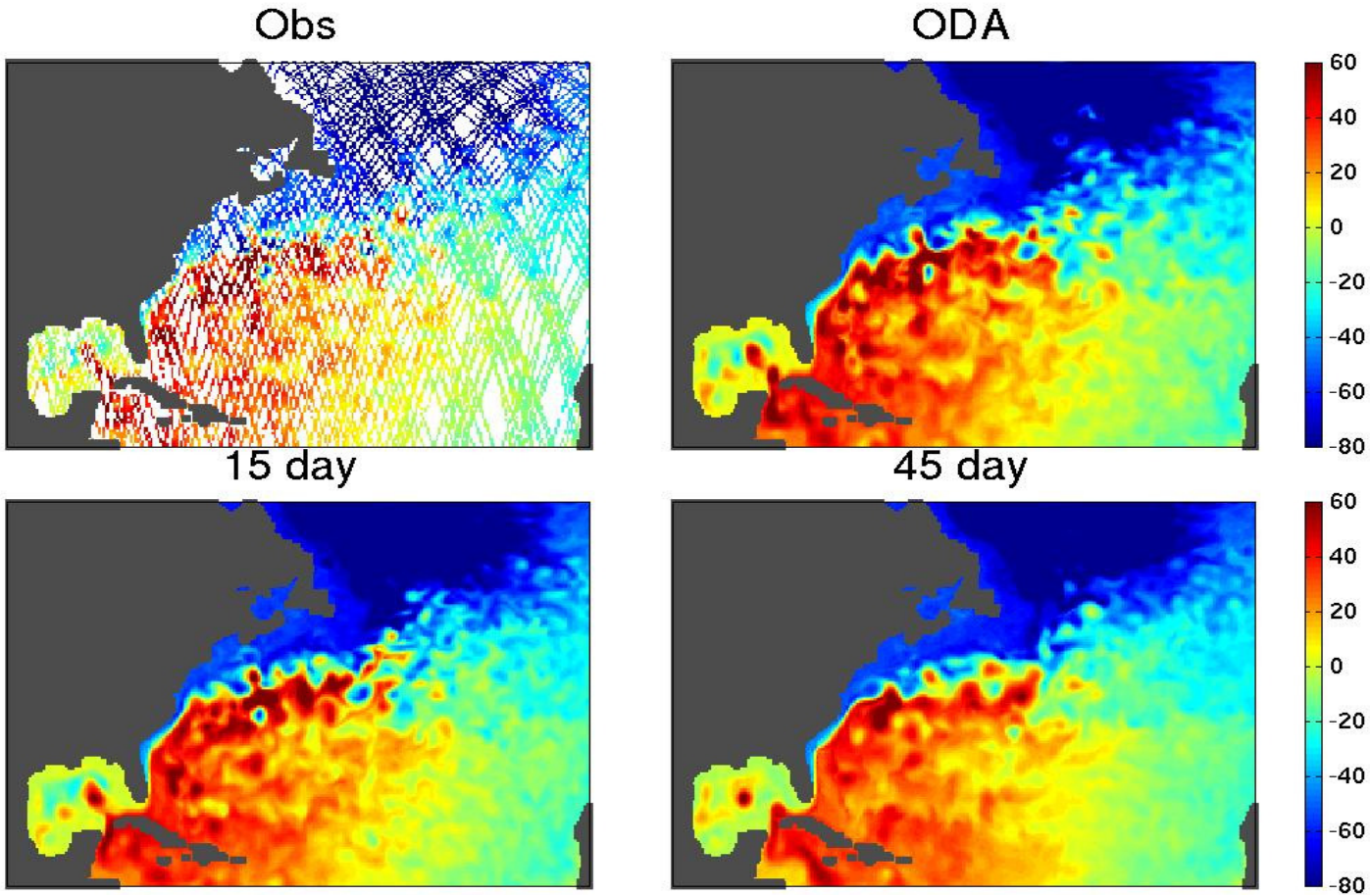


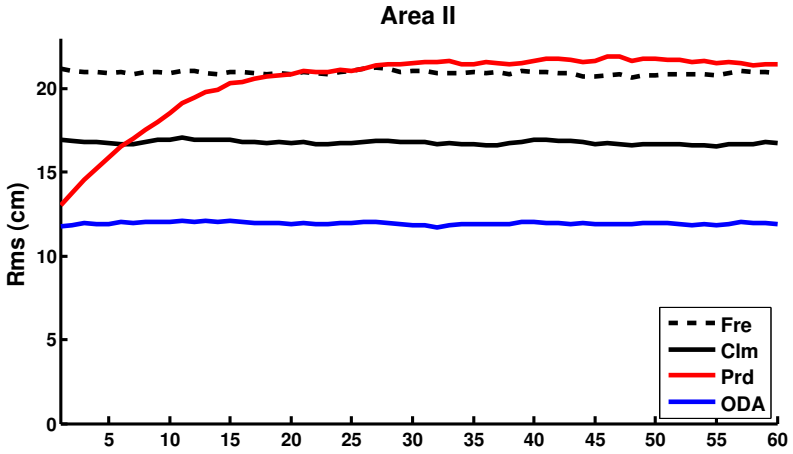
Good fit not surprising. To assess skill need CV or prediction runs …

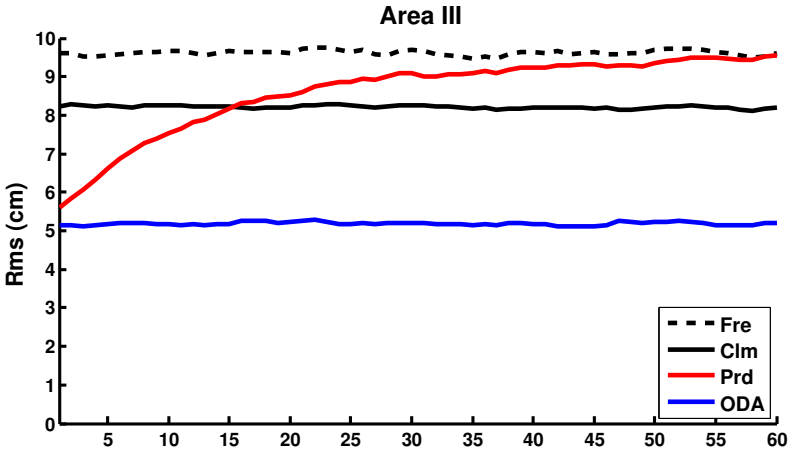
Prediction for August 7 of 2004

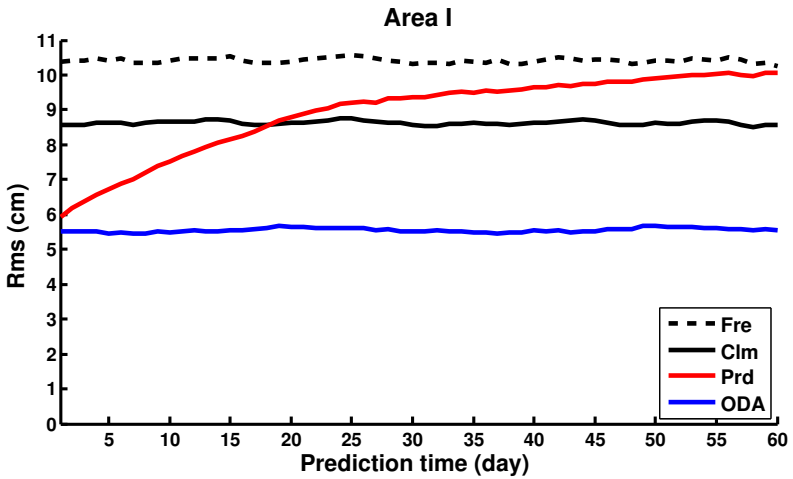


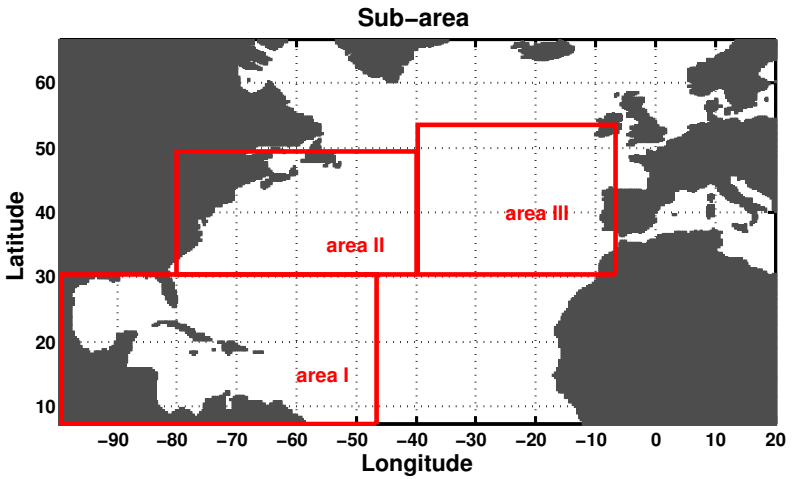
Predictability as a Function of Lead Time

RMS(Observed sea level - Prediction)







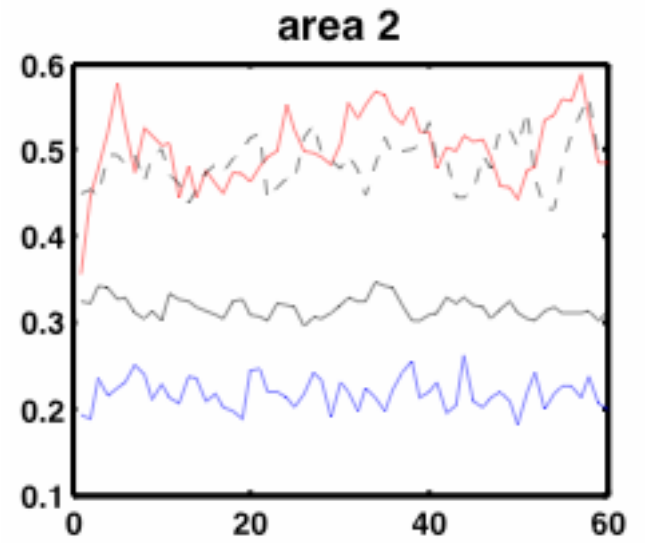


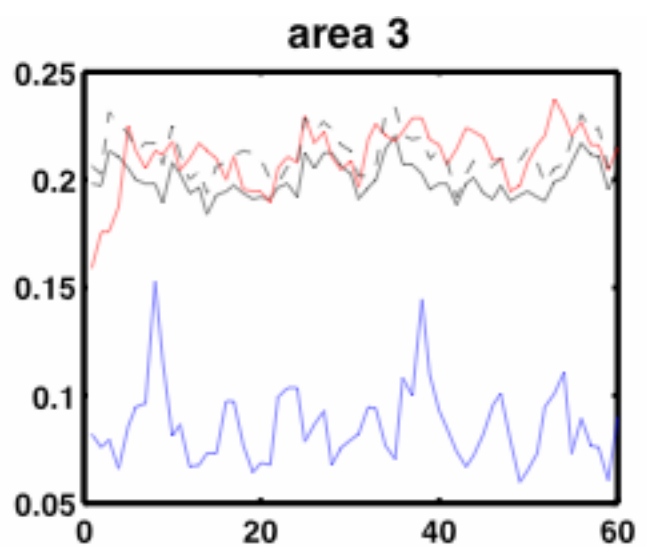
Discussion

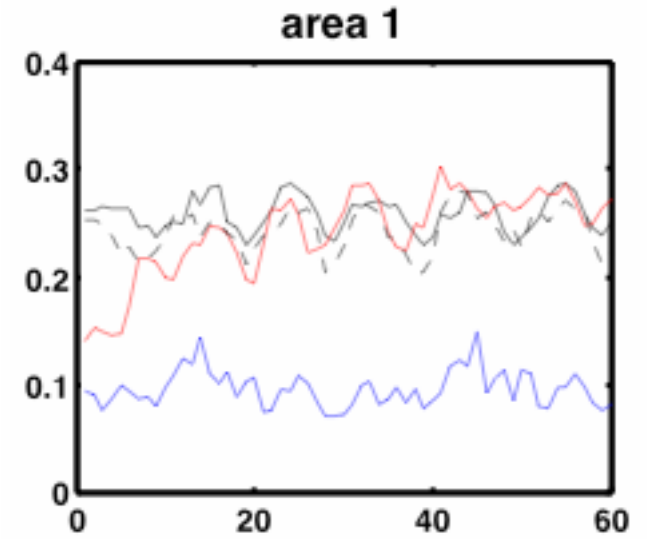
- **New hybrid method for assimilating altimeter and Argo data shows promise.**
- **Computationally efficient, multivariate, simplifies specification of B, allows for complex TS relationships.**
- **Regions of high and low predictability in the North Atlantic have been identified and physically explained.**
- **Low skill in the GS region may be due to model deficiencies.**
- **Next steps include use of better model with higher resolution, and comparison with results from SEEK filter.**

Thank You

Predictability of Salinity at 15m







Blue: ***ODA run***

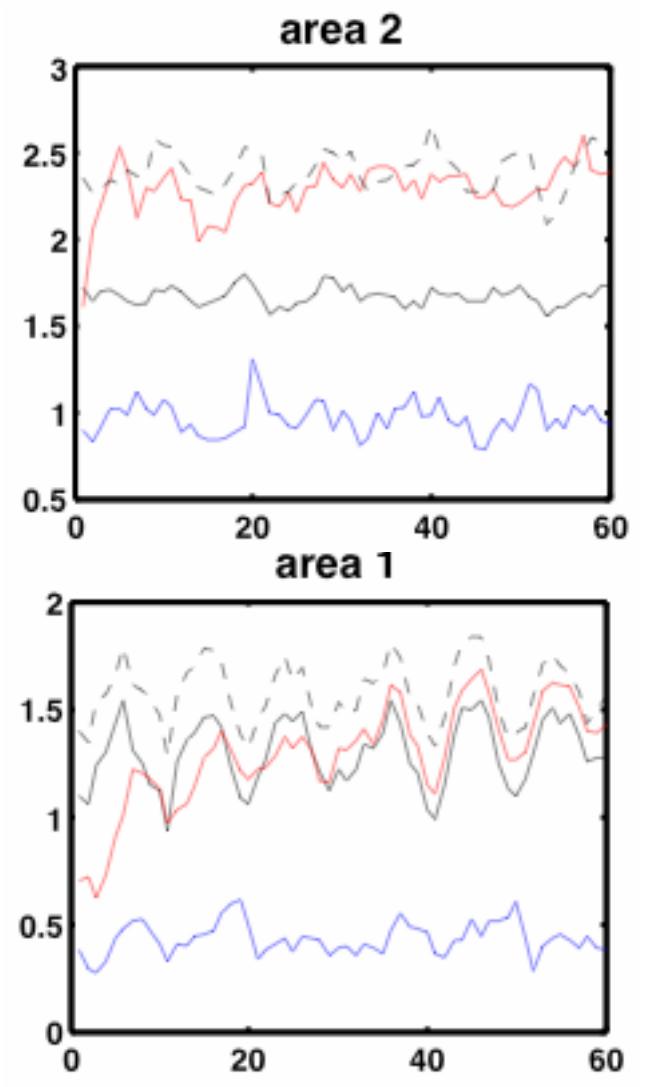
Black: ***Climate mean***

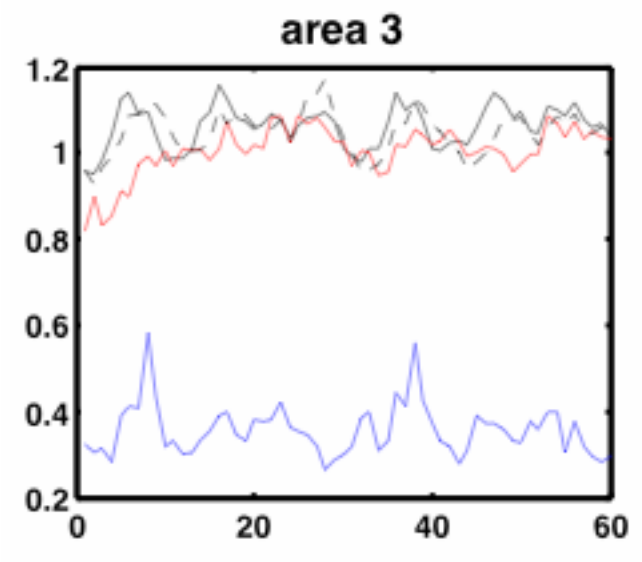
Dashed: Free run

Red: ***Predictability run***

Rms(y-free)=rms(y-climate)⇒ corr(y,Free)>0 ⇒ impact of surface fluxes

Predictability of Temperature at 15m





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The Predictability Runs