ESA Climate Change Initiative

Sea Surface Temperature (SST)

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Comparison of long timeseries SST reanalyses using the GHRSST Multi-Product Ensemble (GMPE)

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Introduction

Aim:

To assess the relative strengths and weaknesses of various long-term SST analyses.

Results will allow users to make an informed choice about which analysis is most suitable for their application.

Six daily L4 SST reanalyses have been intercompared:

- **ESA SST CCI** *(upgraded OSTIA)* (Met Office)

- **MyOcean OSTIA v1.0** (Met Office)

- **CMC** (Canadian Meteorological Center)

- **AVHRR-OI** (NOAA)

- **HadISST2** *(realisation 396)* (Met Office)

- **MGDSST** (Japan Meteorological Agency)

Dataset information

All analyses have a:

- minimum of 17 years of data from September 1991
- minimum grid resolution of 0.25^o

All use:

- Optimal interpolation assimilation methods
- AVHRR data
- in situ data except for **ESA SST CCI**
- ATSR-series data except for **MGDSST** and **AVHRR-OI**

Only **MGDSST** and **CMC** use microwave data

All bias-correct to ATSR, in situ or a combination of both

Dataset information

All are "SST" products but are intended to represent a variety of near-surface depths, for use in different applications.

- **ESA SST CCI** (daily mean temperature, 20 cm depth)

- **MyOcean OSTIA v1.0** (foundation)

- **CMC** (1 m depth)

- **AVHRR-OI** (daily mean temperature)

- **HadISST2** (20 cm depth)

- **MGDSST** (foundation)

Different SST analyses are designed for different purposes, so not necessarily appropriate to determine which is "correct". However, intercomparison useful to determine outliers and which perform well on comparison with reference data.

GMPE comparisons

- Intercomparison undertaken using the GMPE (GHRSST Multi-Product Ensemble) system

  - Reanalyses regridded to regular latitude-longitude 0.25^o grid

  - Ensemble median and standard deviation calculated for each grid box

- Deviations from the ensemble median can provide information on the products, through whole period and at all available latitudes

- Ensemble (GMPE) median SST is a new product, which has been made freely available through the NEODC (NERC Earth Observation Data Centre)

- Near-real-time version of GMPE run daily at the Met Office and GMPE median SST product available through MyOcean

GMPE comparisons

Monthly mean anomaly of reanalyses to the ensemble median, by latitude on 2x2° grid.

Validation using Argo

- Near-surface temperature data from Argo profiling floats used to determine global and regional accuracies of the analyses for comparison

- Argo data is independent of all the reanalyses

- Argo observations extracted from from EN4 dataset (Good et al., 2014) where they have undergone QC

- Shallowest measurement between 3-5 m depth used to approximate foundation temperature

- Full resolution reanalyses interpolated to observation locations to produce matchups

- Observations used here 2001-2010

Monthly total global near-surface Argo observations

Validation using Argo

Analysis minus Argo SST: mean (dashed lines) and standard deviation (solid lines) of differences
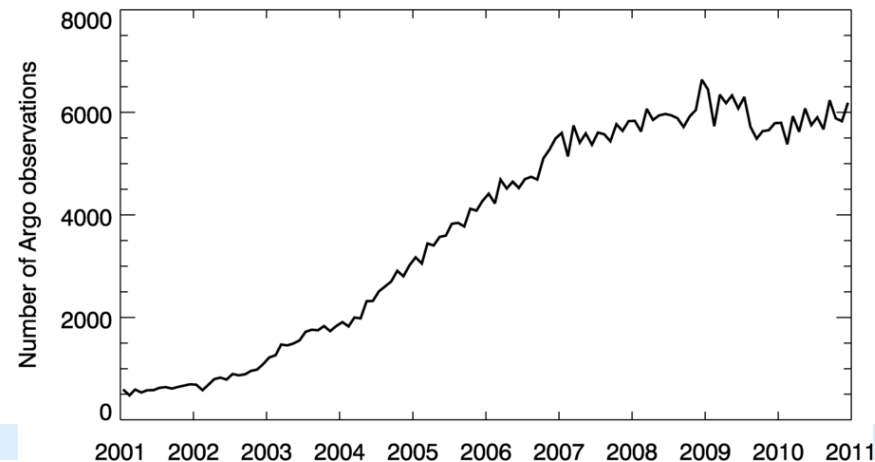
Legend:
- SST CCI
- OSTIA v1.0
- CMC
- AVHRR-OI
- HadISST2
- MGDSST
- GMPE median
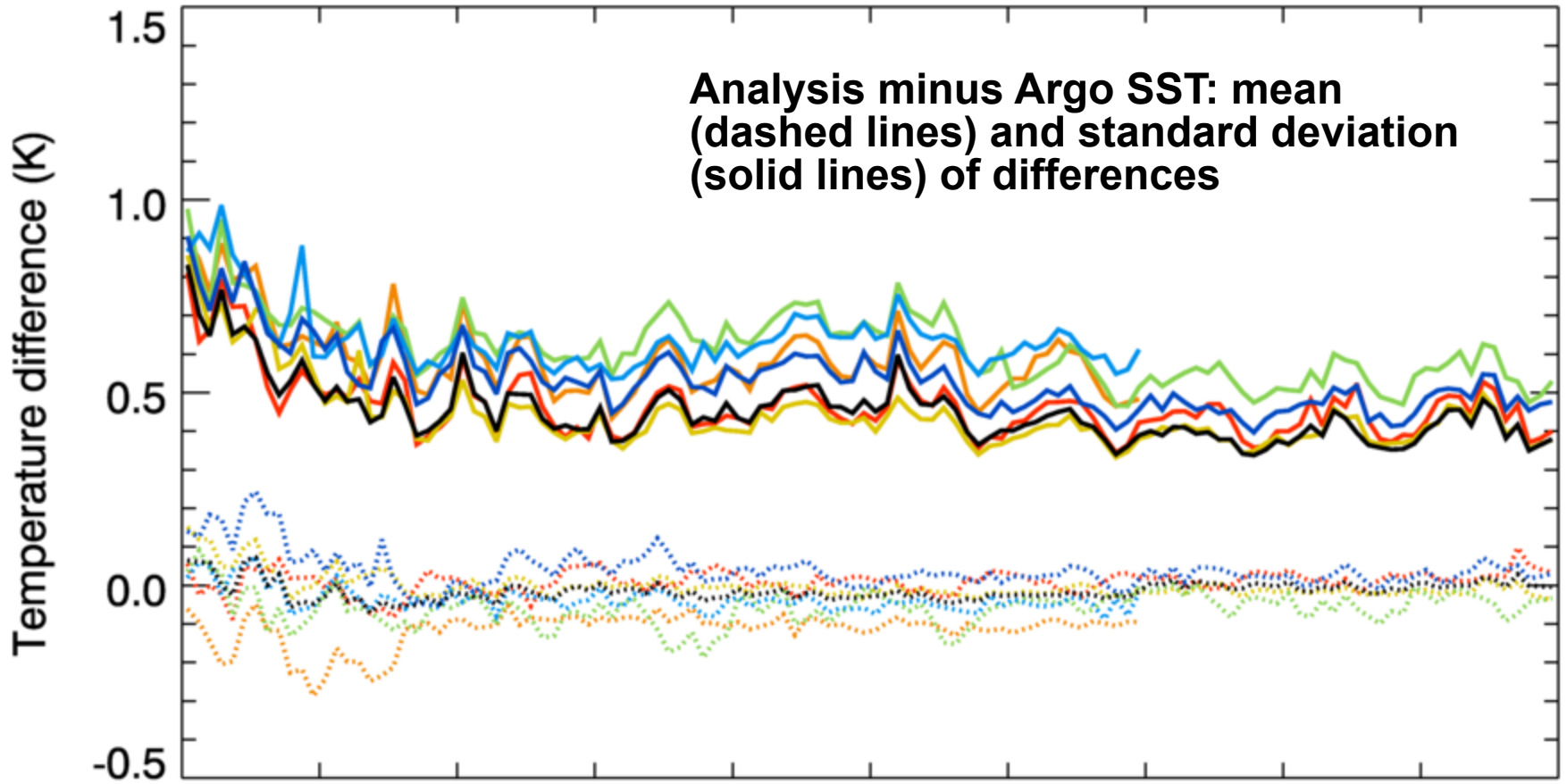
Regional analysis minus Argo SST differences, 2001-2010 mean
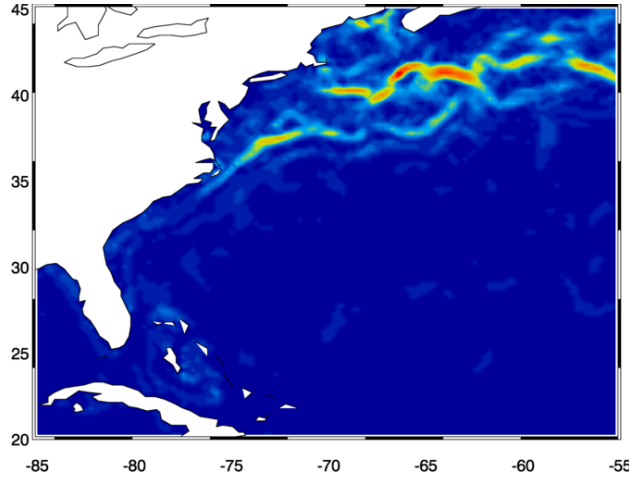
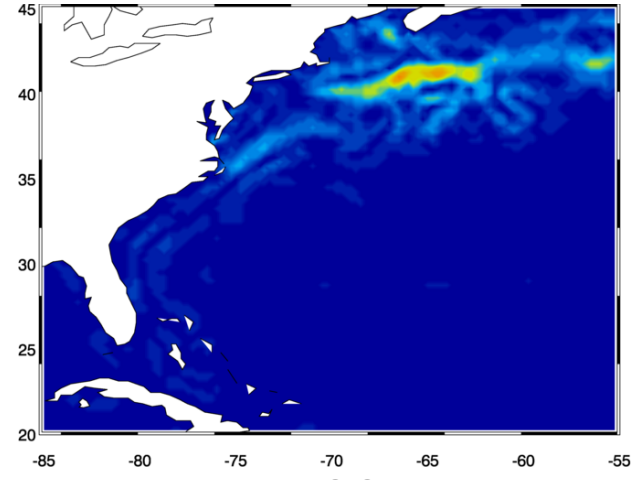## Mean difference
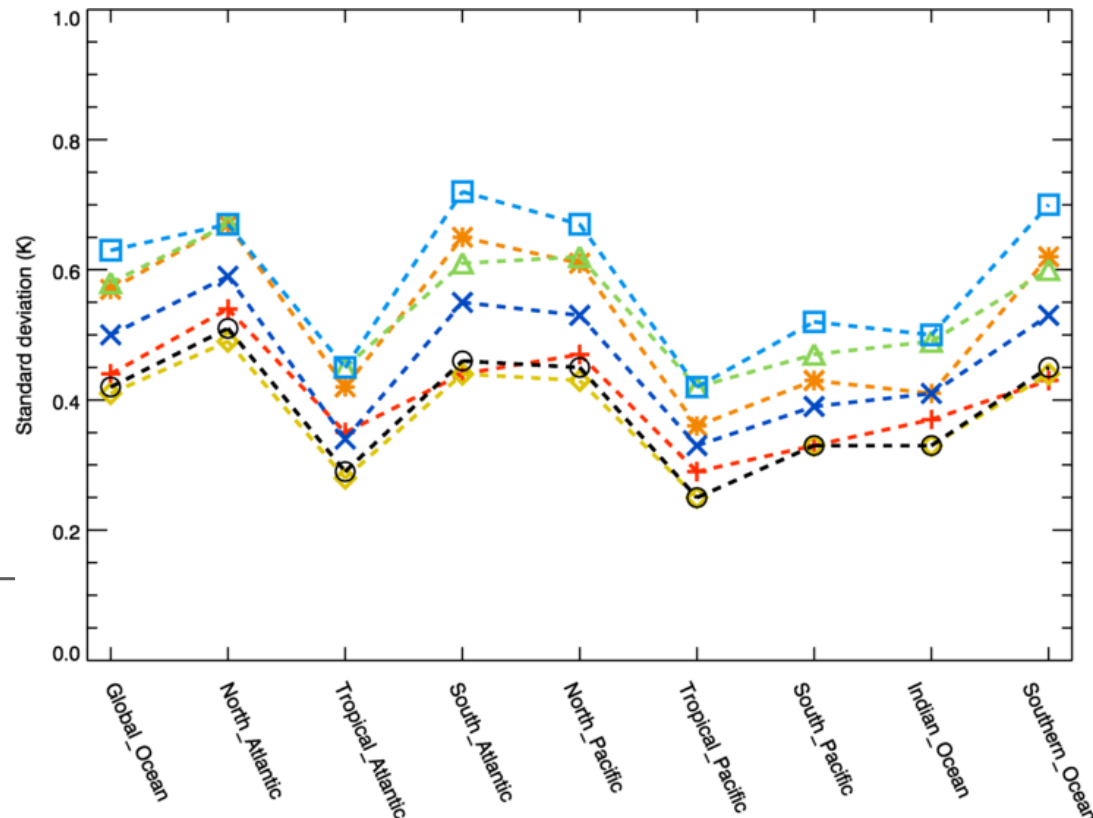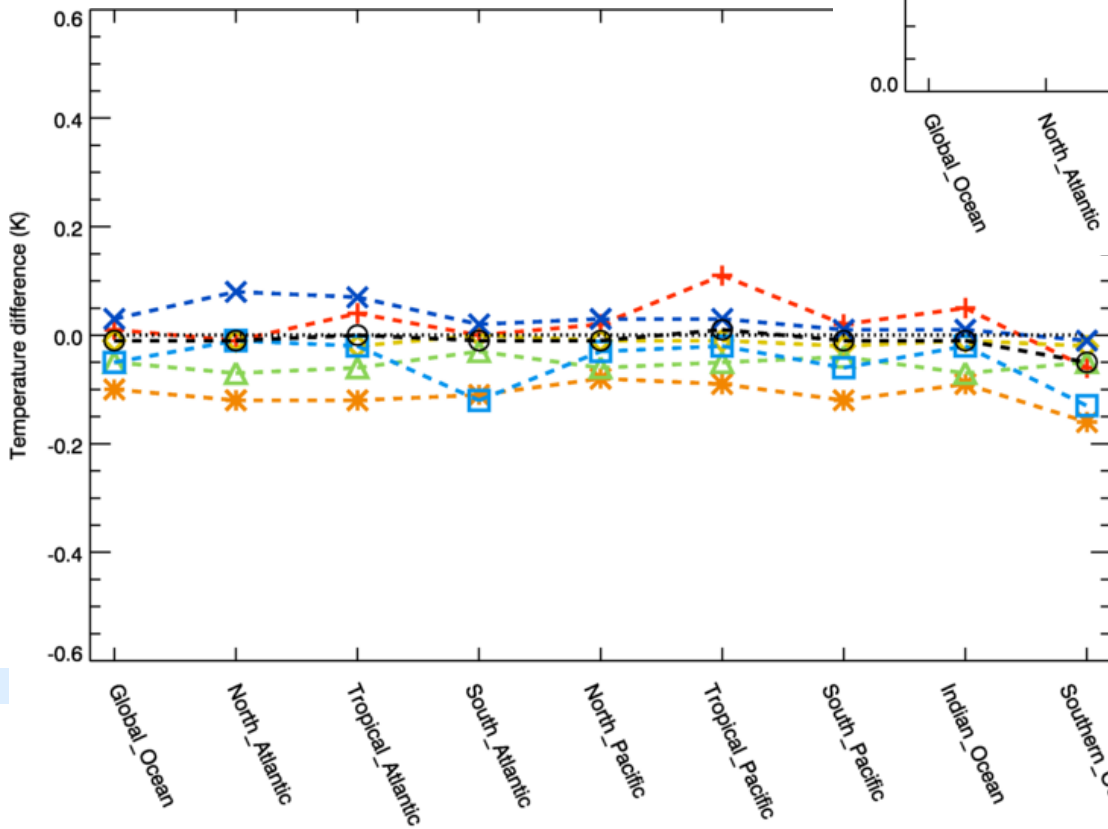
Standard deviation
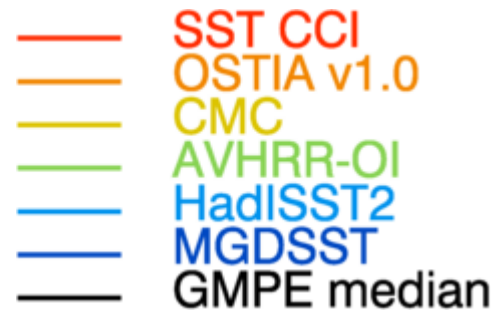
Feature resolution
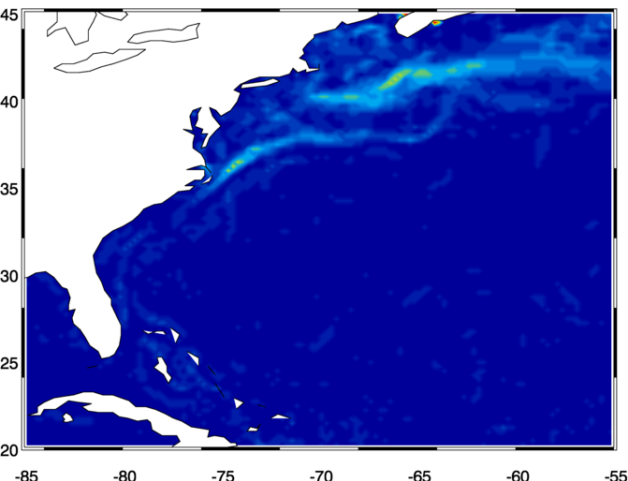
Horizontal gradients in Gulf Stream region, 01 July 2007

(mK per km)
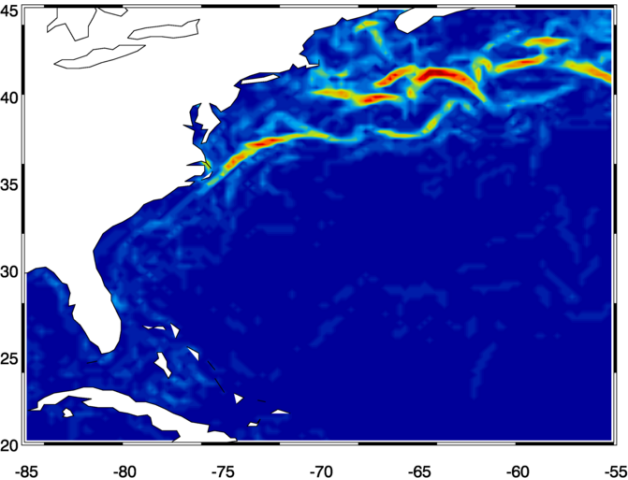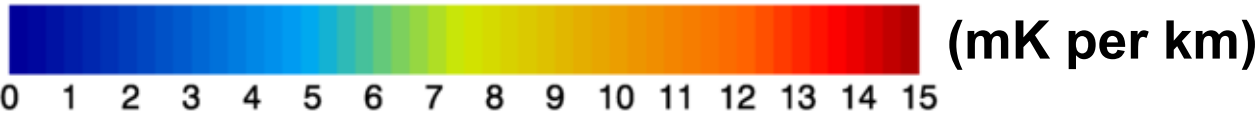
ESA SST CCI

CMC

HadISST2

MyOcean OSTIA v1.0

AVHRR-OI
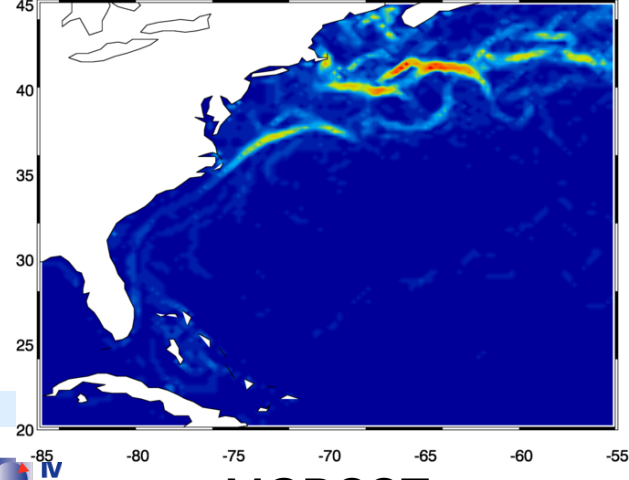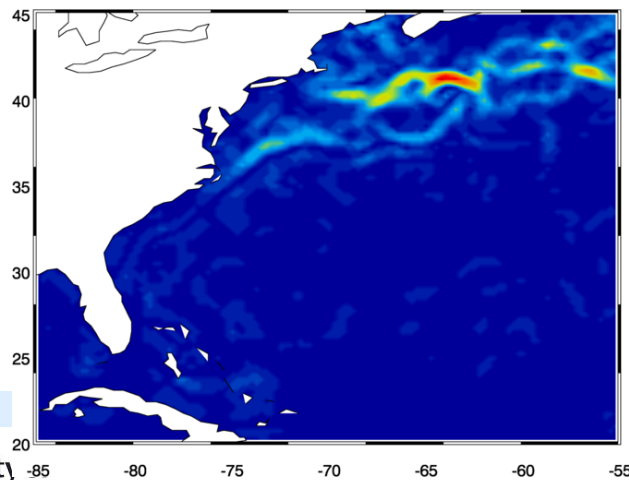
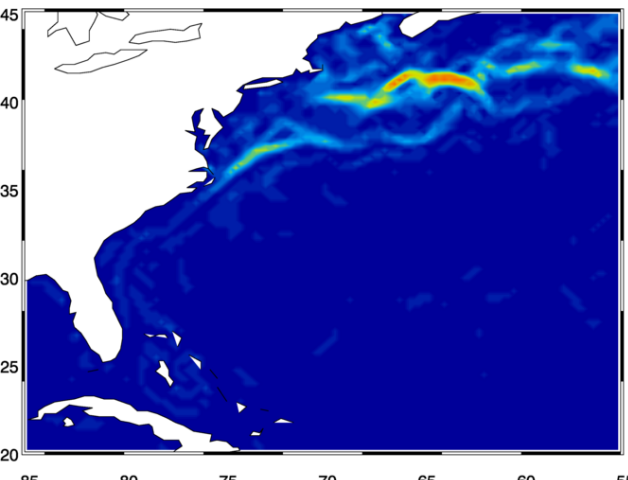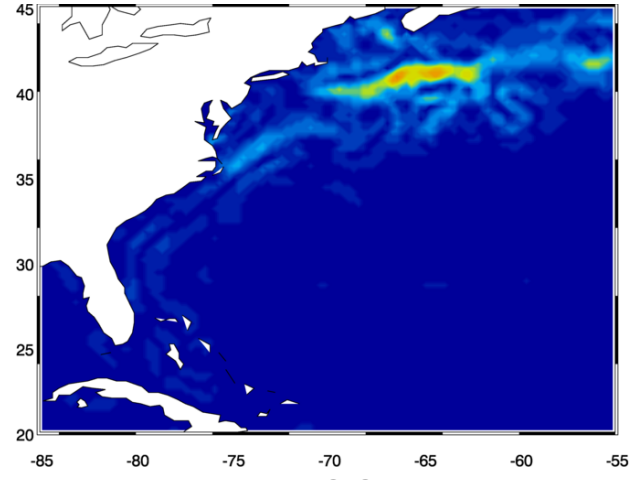MGDSST

Feature resolution

(mK per km)

ESA SST CCI

CMC

HadISST2
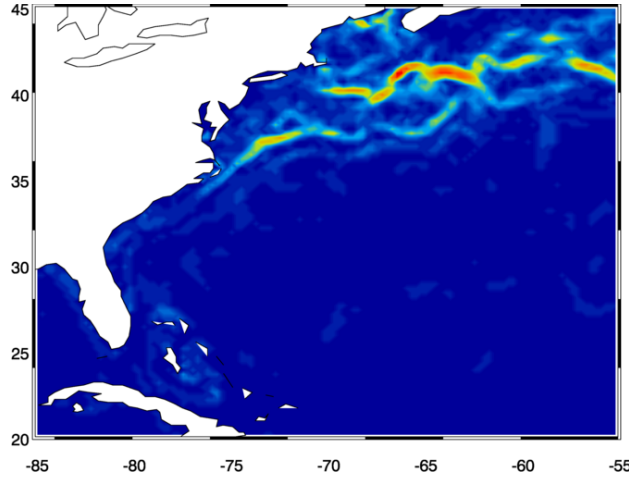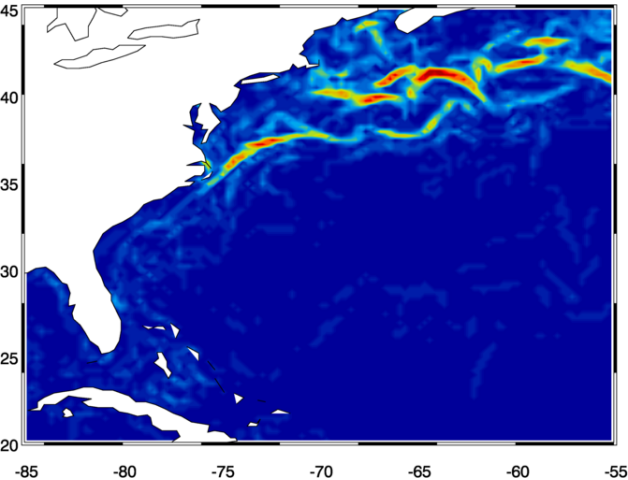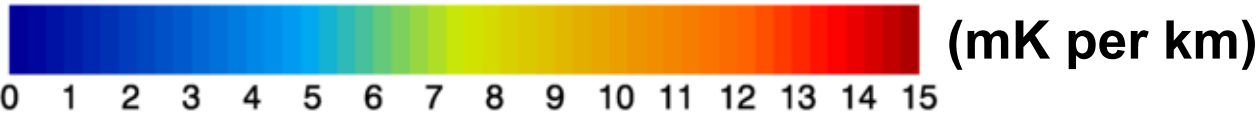
GMPE median

AVHRR-OI

MGDSST

Summary

- Rankings give idea of relative performance

- Not intended to be added up and used as overall "score"

- Most suitable analysis will depend on which criteria are most important for proposed application

Reanalysis	Relative Rank (1 best)		
	Standard deviation	Bias	Feature resolution
SST CCI Daily mean, 20 cm *Independent from in situ*	1	2	1
OSTIA v1.0 Foundation	2	3	3
CMC 1 m *Includes microwave data*	1	1	1
AVHRR-OI Daily mean (all data) *Single sensor product*	3	2	2
HadISST2 20 cm *Long and homogeneous*	3	2	3
MGDSST Foundation *Independent from ATSR*	2	2	2
GMPE median No specific depth	1	1	2

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Questions?

Fiedler E. K. et al. (2014) Intercomparison of long timeseries SST reanalyses using the GHRSST Multi-Product Ensemble (GMPE) system, *in prep.*

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