Global SST Prediction Using HYCOM:

Impact of Atmospheric Forcing

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CONTENTS

- **Global HYCOM**
  - **Climatologically–forced SST simulations**
  - **NO data assimilation or temperature relaxation**

We would like to answer the question:

How does global HYCOM perform

when using various atmospheric forcing products?

GLOBAL HYCOM DESCRIPTION

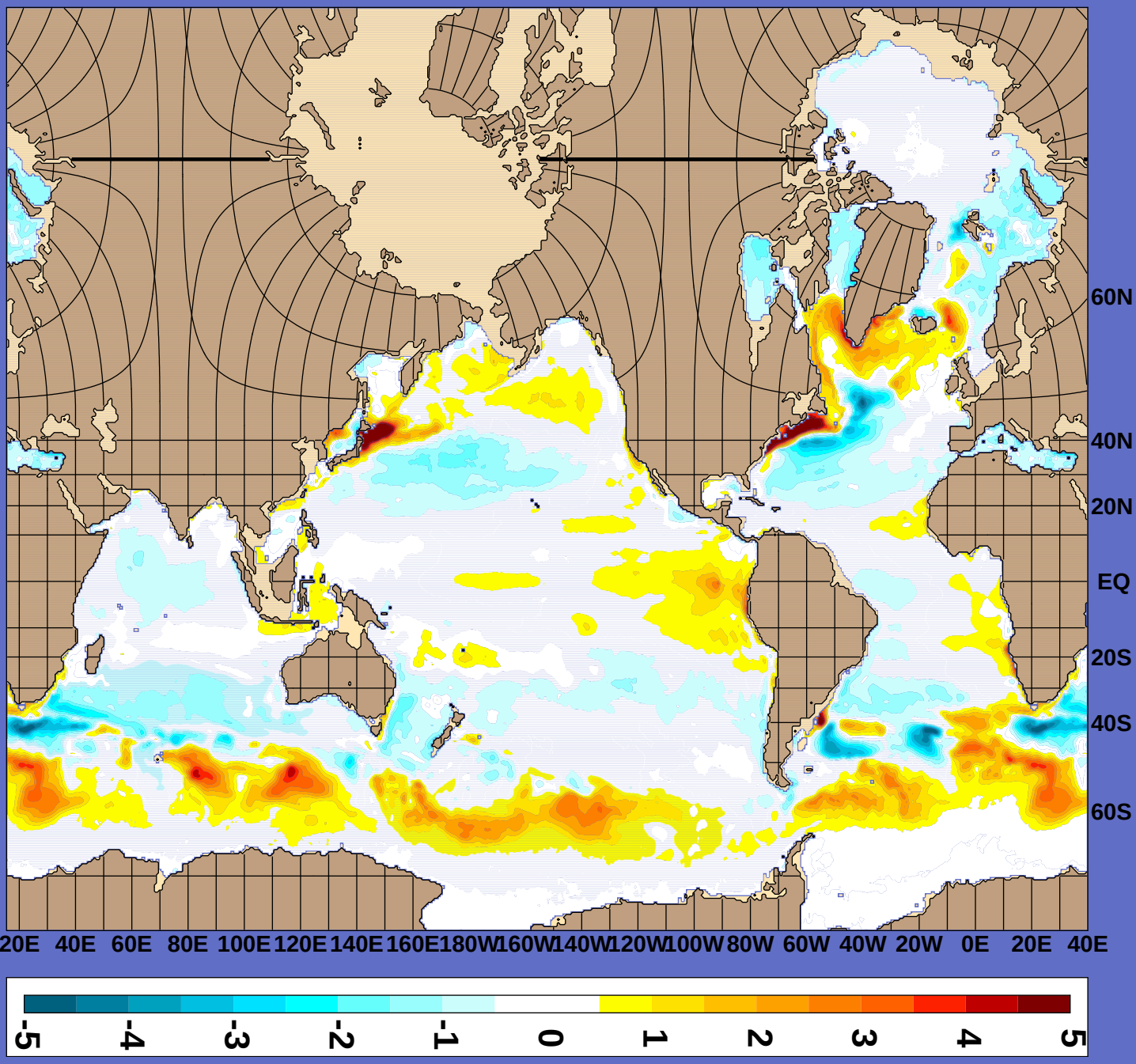
- 0.72° fully global model
    - 0.36° near equator
    - Arctic bipolar patch
- 26–layer HYBRID
- Initialization: $1/8^\circ$ GDEM3 climatology
- Monthly river discharge from NRL database
- Sea surface salinity relaxation to monthly GDEM3

- Bulk formulation for sensible and latent heat fluxes
- Shortwave and longwave radiation from archived products
- Water turbidity based on SeaWiFS ocean color data
    - 2–band scheme for attenuation of shortwave radiation

HYCOM SIMULATIONS

- **Atmospheric forcing**
  - **ECMWF Re–Analysis: ERA–15**
  - **ECMWF Re–Analysis: ERA–40**
  - **Normal Year Forcing: CORE–CNYF**
- **Validation over the seasonal cycle:**
  - **HYCOM SST versus NOAA/NCEP SST**
  - **12 monthly mean SST at each model grid**
- **Produce statistical error maps:**
  - **Mean error, RMS difference and skill score**

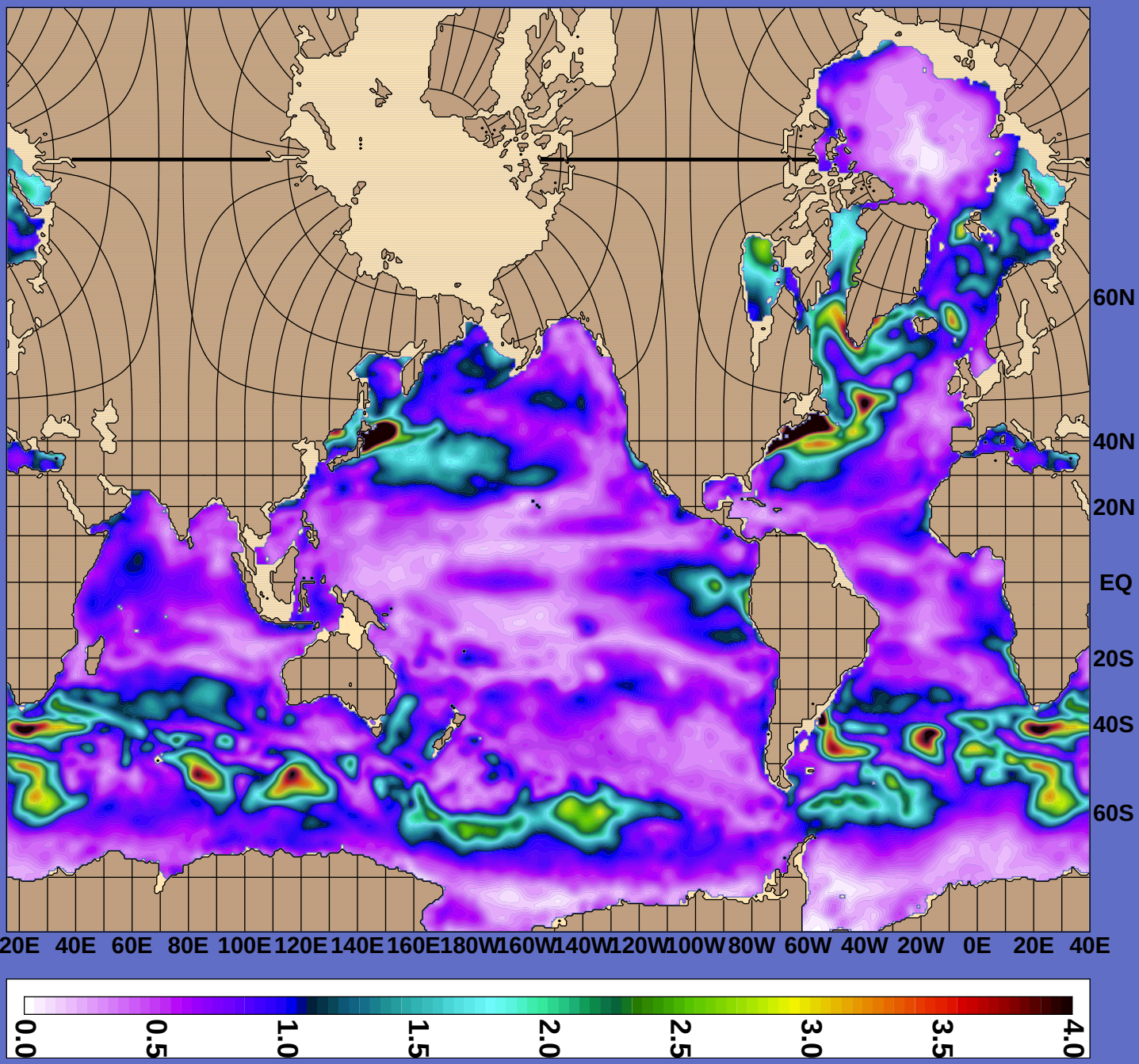
MEAN ERROR (BIAS)



Global average of mean error = –0.06°C

HYCOM uses wind stress and thermal forcing from ERA–15.

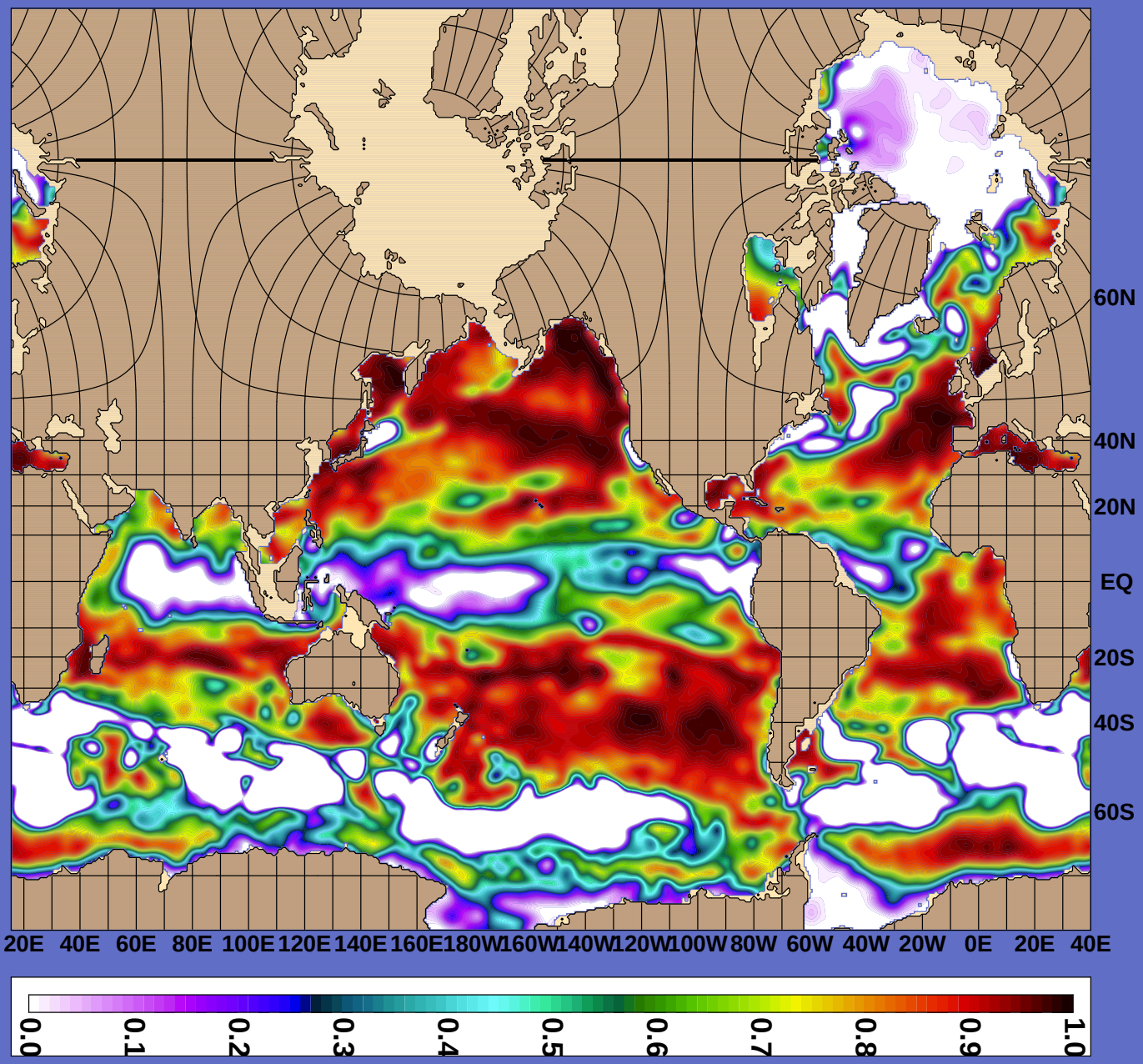
RMS SST DIFFERENCE



Global average of RMS SST difference = $0.77^{\circ}\mathrm{C}$

HYCOM uses wind stress and thermal forcing from ERA–15.

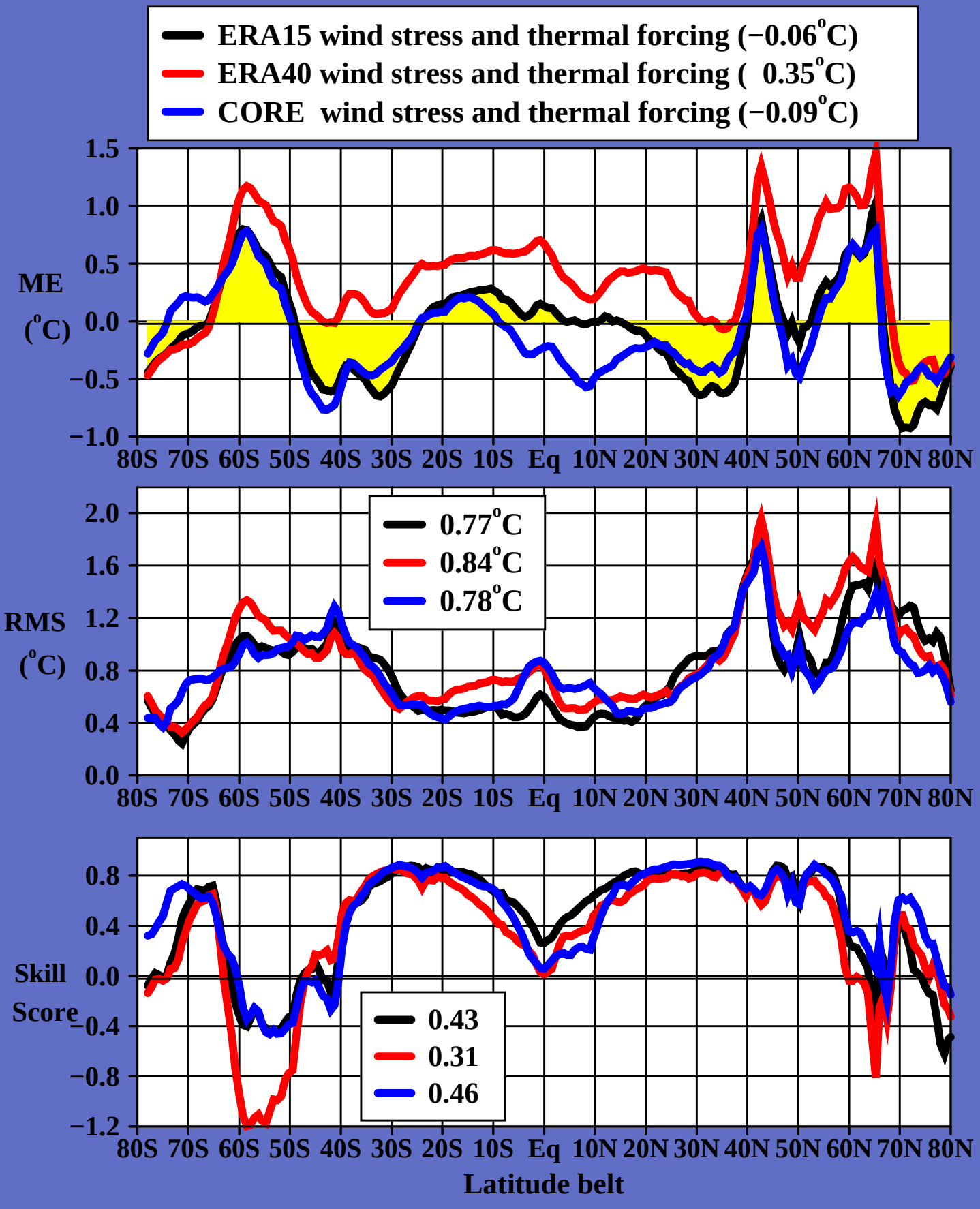
SST SKILL SCORE

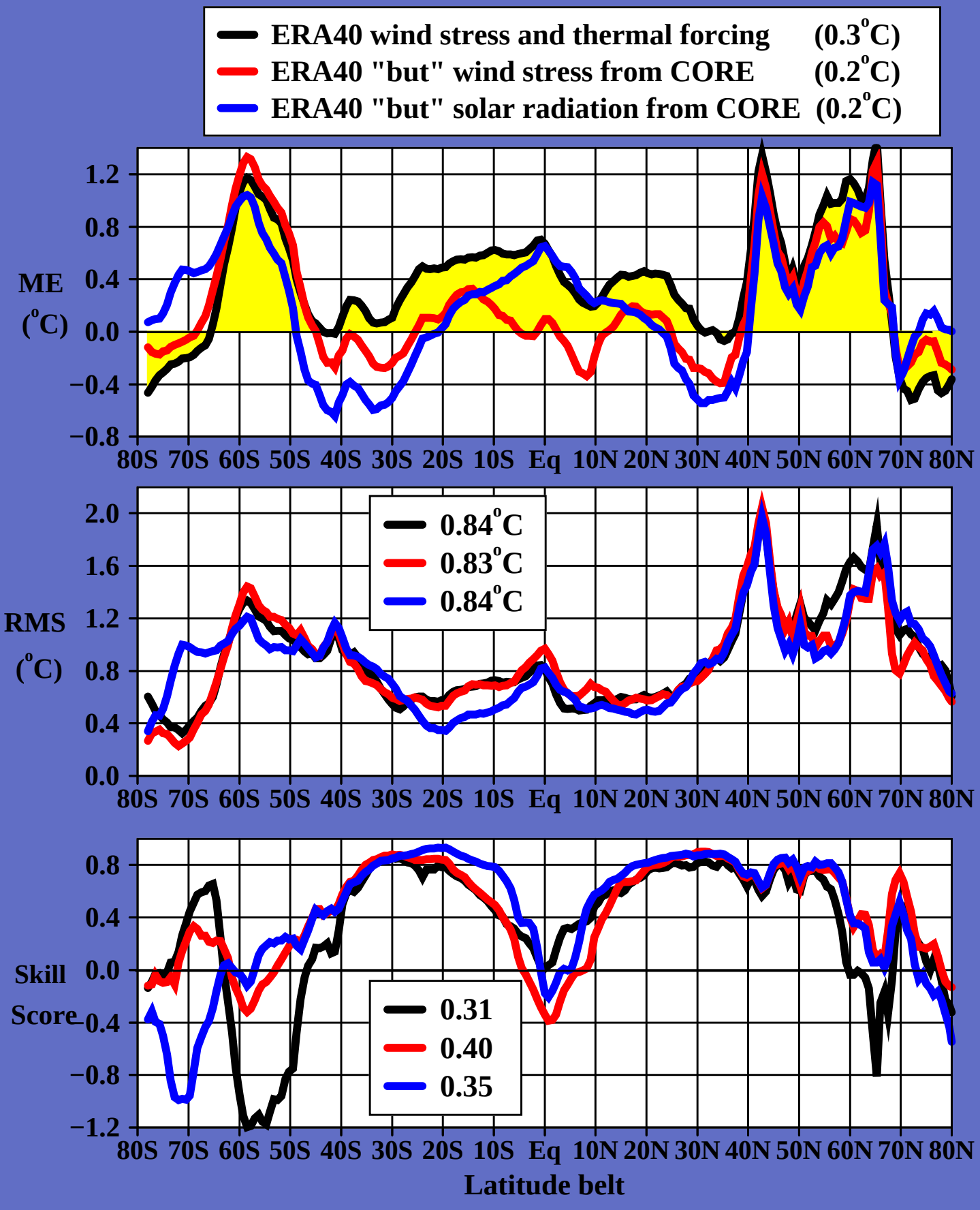


Skill=1: PERFECT prediction, Skill< 0: POOR prediction

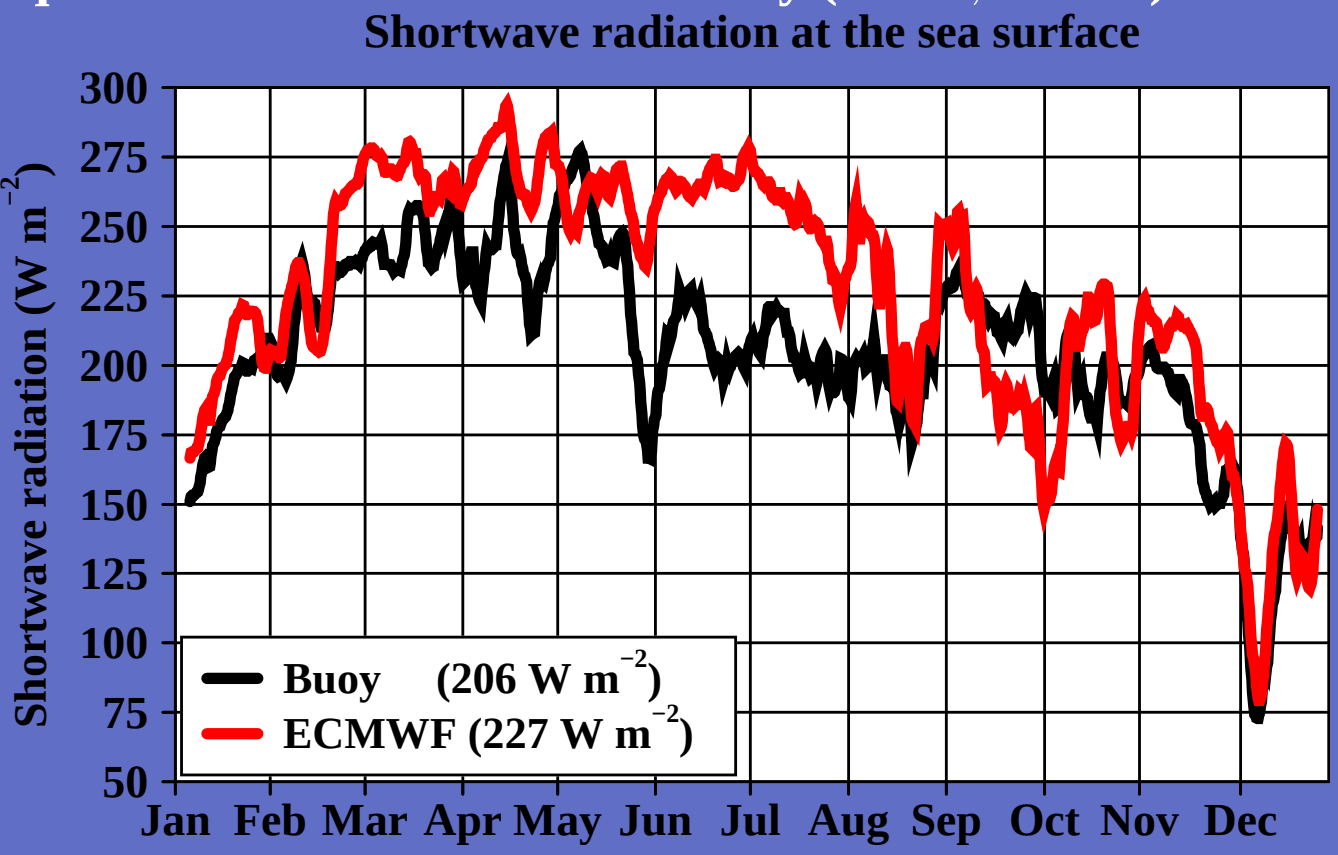
Global average of SST skill = 0.43

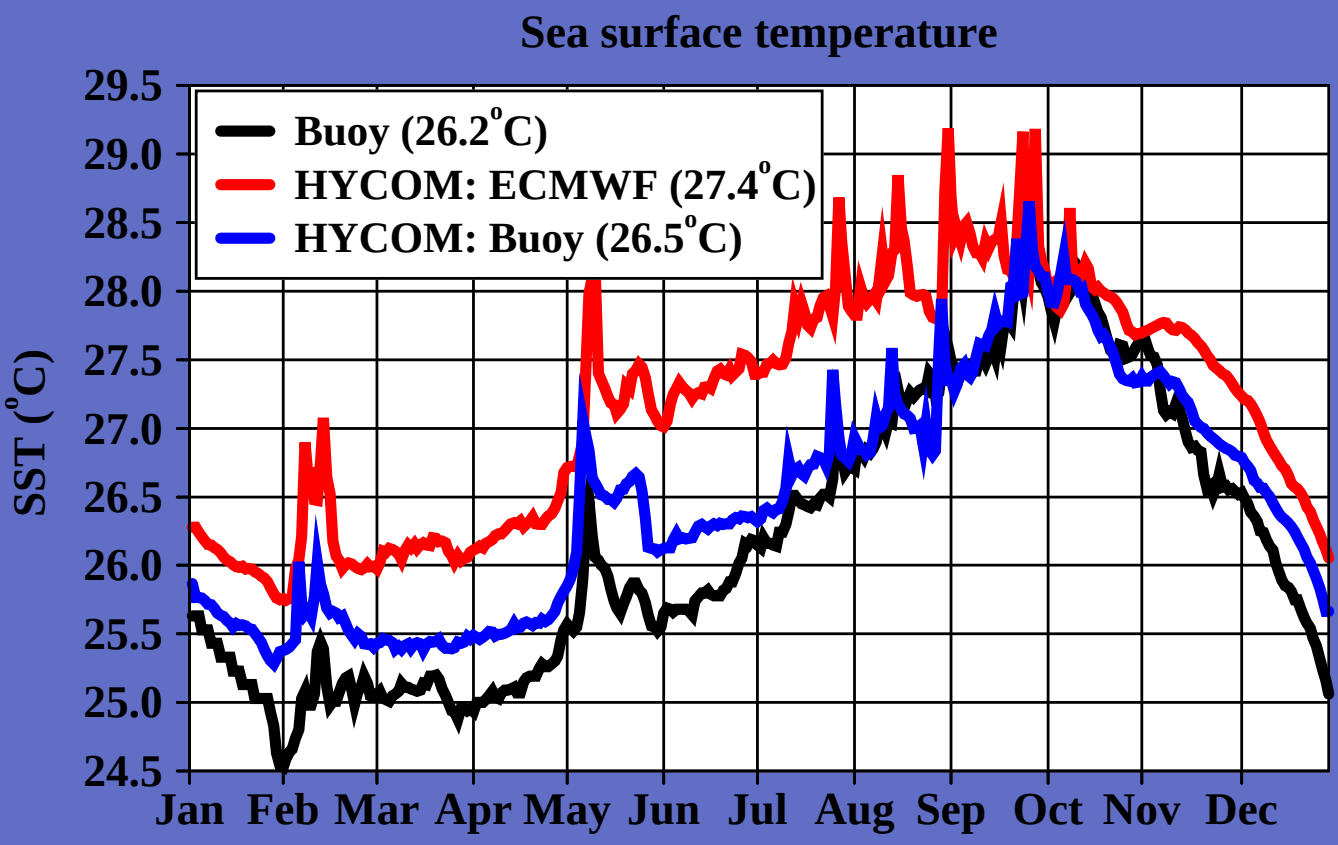
HYCOM uses wind stress and thermal forcing from ERA–15.


ERA15 wind stress and thermal forcing (−0.06°C)
ERA40 wind stress and thermal forcing (0.35°C)
CORE wind stress and thermal forcing (−0.09°C)
ME (°C)
1.5
1.0
0.5
0.0
−0.5
−1.0
RMS (°C)
2.0
1.6
1.2
0.8
0.4
0.0
0.77°C
0.84°C
0.78°C
Skill Score
0.8
0.4
0.0
−0.4
−0.8
−1.2
0.43
0.31
0.46
80S 70S 60S 50S 40S 30S 20S 10S Eq 10N 20N 30N 40N 50N 60N 70N 80N
Latitude belt

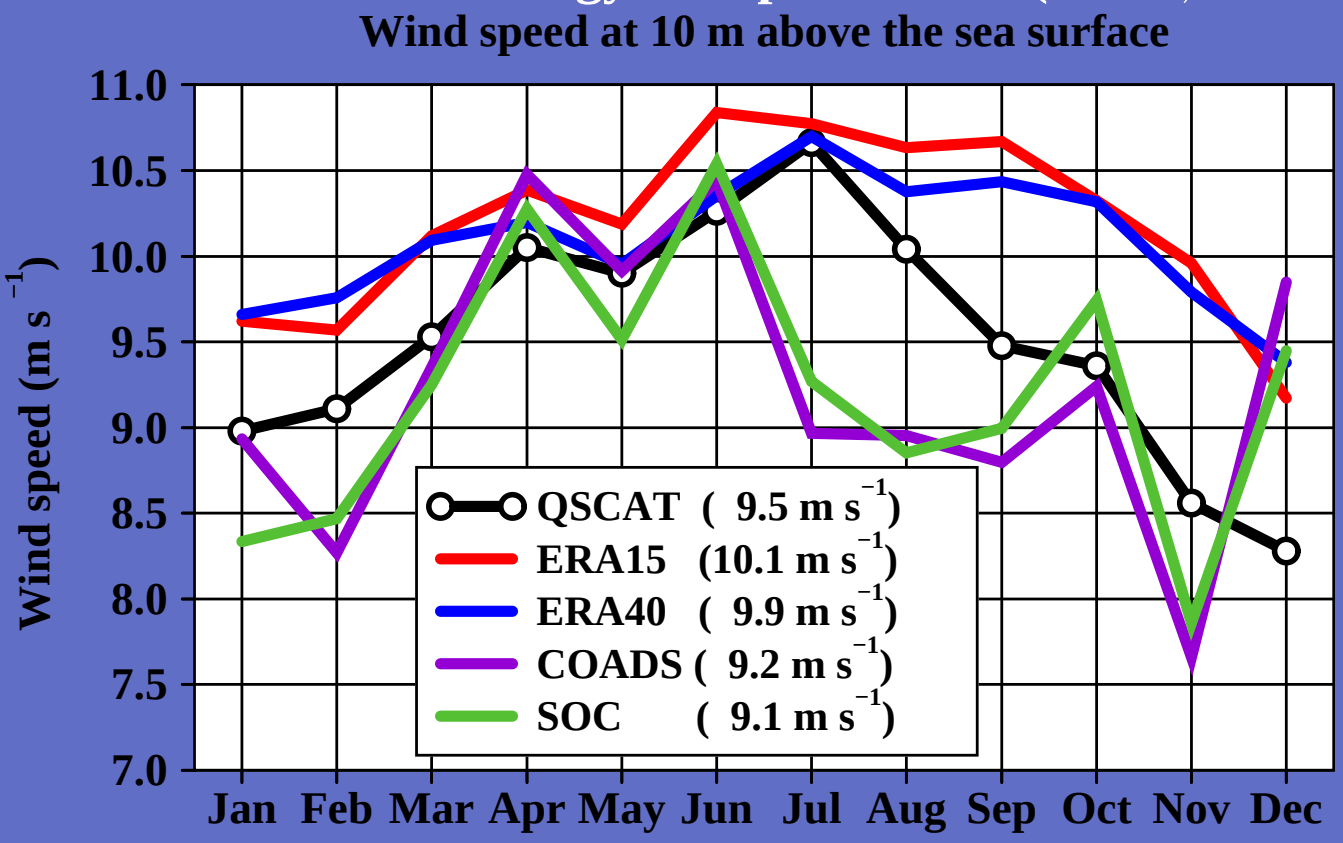

ERA40 wind stress and thermal forcing (0.3°C)
ERA40 "but" wind stress from CORE (0.2°C)
ERA40 "but" solar radiation from CORE (0.2°C)
ME (°C)
1.2
0.8
0.4
0.0
−0.4
−0.8
RMS (°C)
2.0
1.6
1.2
0.8
0.4
0.0
0.84°C
0.83°C
0.84°C
Skill Score
0.8
0.4
0.0
−0.4
−0.8
−1.2
0.31
0.40
0.35
80S 70S 60S 50S 40S 30S 20S 10S Eq 10N 20N 30N 40N 50N 60N 70N 80N
Latitude belt

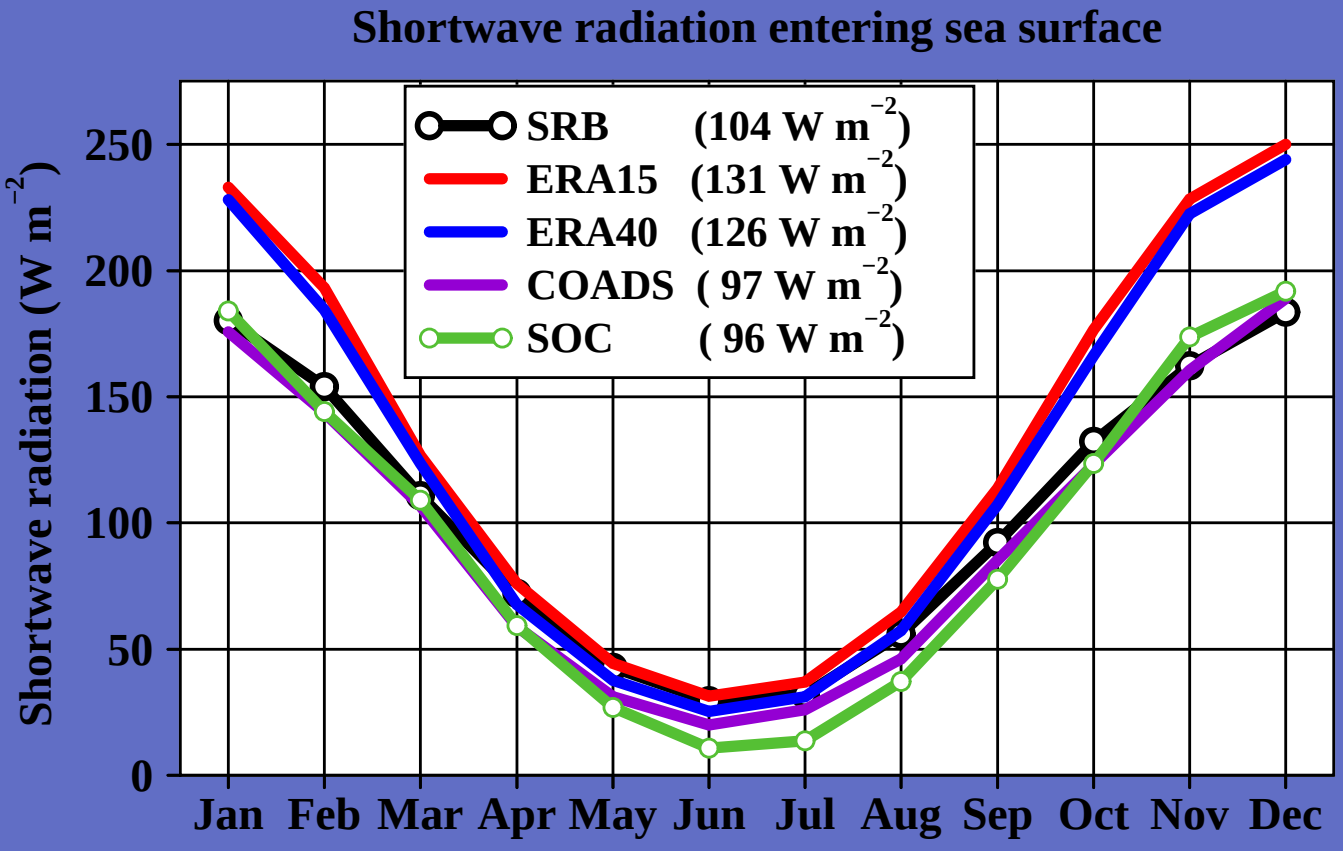
Equatorial Atlantic: PIRATA buoy (15°N, 38°W) in 1998





South Atlantic: Climatology Comparisons at (50°N, 30°W)





SUMMARY

- **HYCOM generally predicts SST well**
- **Low SST skill:**
  - **high southern latitudes**
  - **equatorial Pacific warm pool**
- **Problems in atmospheric forcing**
  - **Corrections must be performed**
  - **Mean correction using other climatologies**
  - **Need satellite–based radiation and wind**