Daily ICOADS R3.0.2 and Its impact on OISST

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Outline

1) Introduction to the International Comprehensive Ocean-Atmosphere Data Set (ICOADS);

2) Merging the TAC (ASCII) and BUFR(Binary) into Daily ICOADS R3.0.2;

3) Improvement Impact Example: OISST.

What is ICOADS?

The International Comprehensive Ocean-Atmosphere Data Set (ICOADS)
Marine and weather observations made by ships, buoys, Argo, etc. spanning the years 1662 to present.

- Release 1, **1985**
  1854-1979

- Release 2, **2002**
  1784-1997

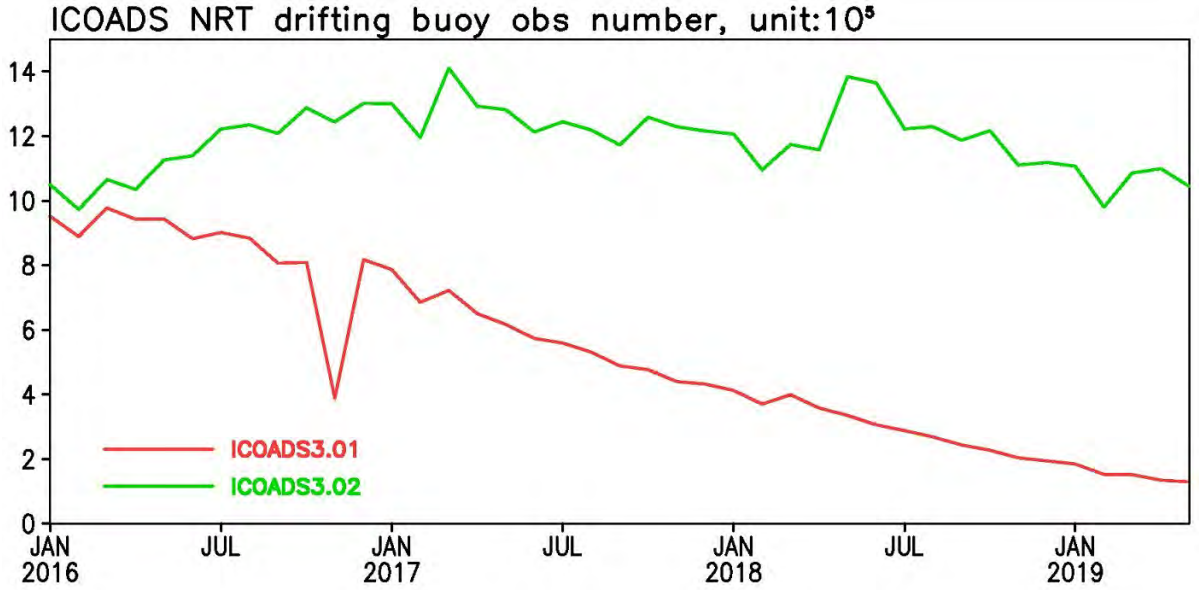
- Release 2.5, **2009**
  1662-2007

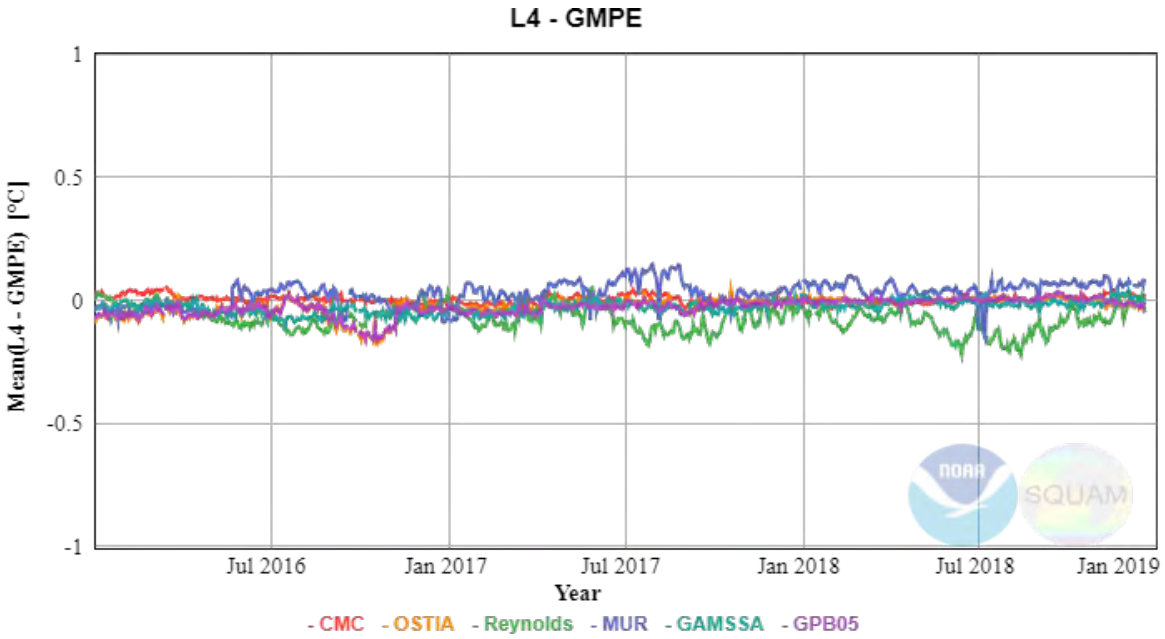
- Release 3.0, **2017**
  1662-2014

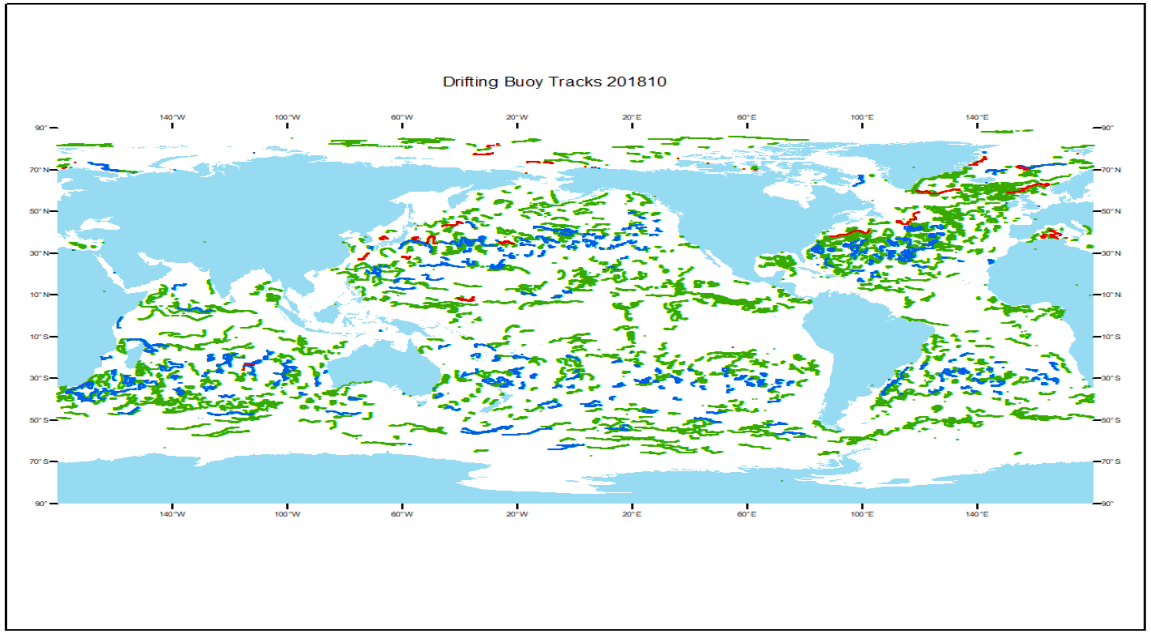
  - R3.0.1, Jan 2015 – ongoing: monthly updates based on NCEI and NCEP GTS)
  - R3.0.2, Jan 2015 – ongoing; NCEI GTS and BUFR Merged) Monthly + Daily

Why Daily ICOADS R3.0.2?

- The marine in situ reports in TAC format dropped dramatically since November 2016 especially for drifting buoy observations.
- To align with WMO policy, many countries have switched from TAC to BUFR.
- Other platforms going to BUFR directly such as saildrone data.
- Numerous user requests for an ICOADS daily product, such as OISST.







Legend

- common
- icoads_unique
- bufr_unique

Input data for Daily ICOADS R3.0.2

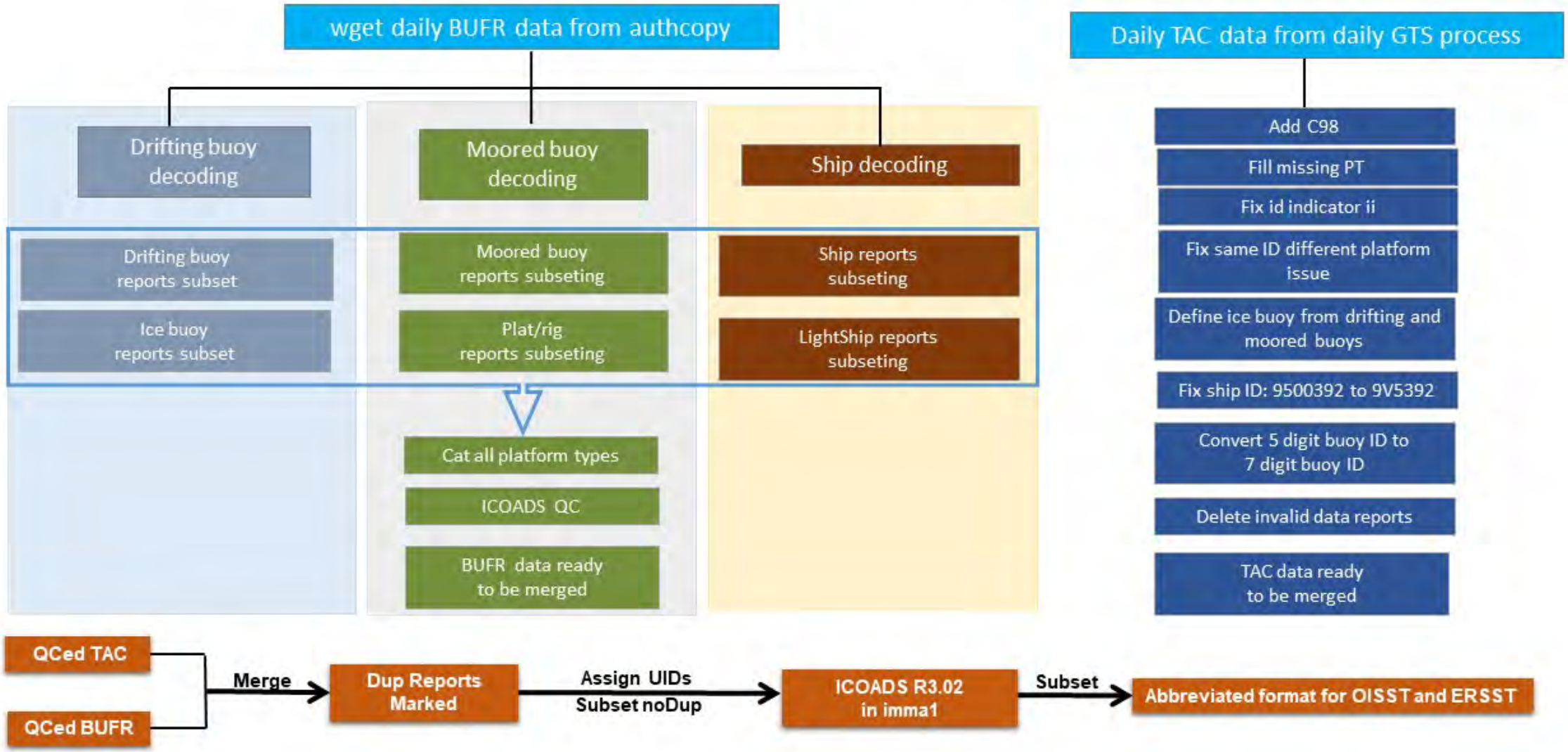
BUFR input data:

Data Source	Time period
GDAC-CA+NDBC	01/2015-12/2015
GDAC-CA+NDBC+NWSTG	01/2016-08/2017
NWSTG	09/2017-Present

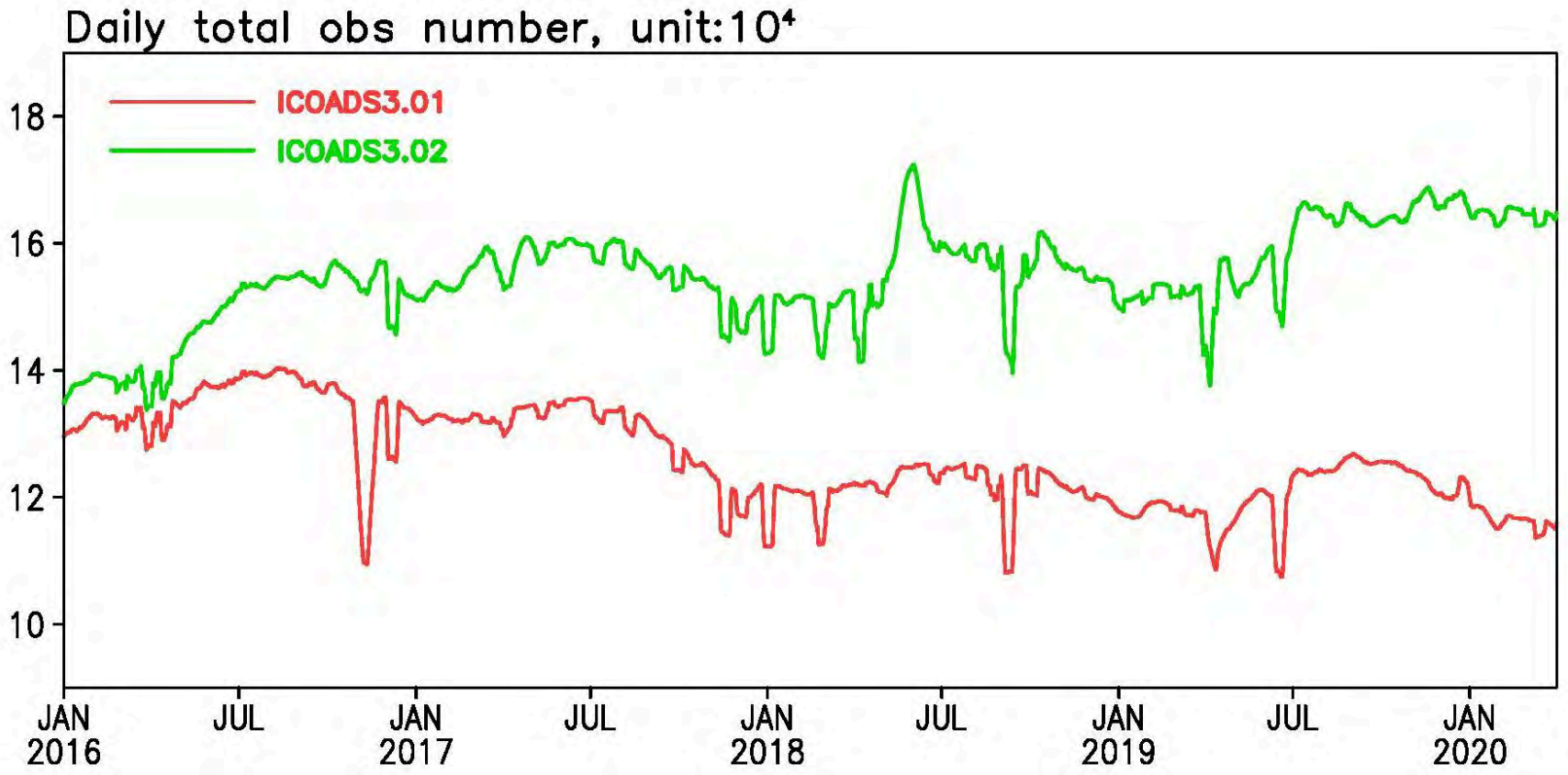
TAC input data:

Data Source	Time period
NCEI GTS + NCEP GTS	01/2015-12/2019
NCEI GTS	01/2020-Present

Daily ICOADS R3.0.2 process

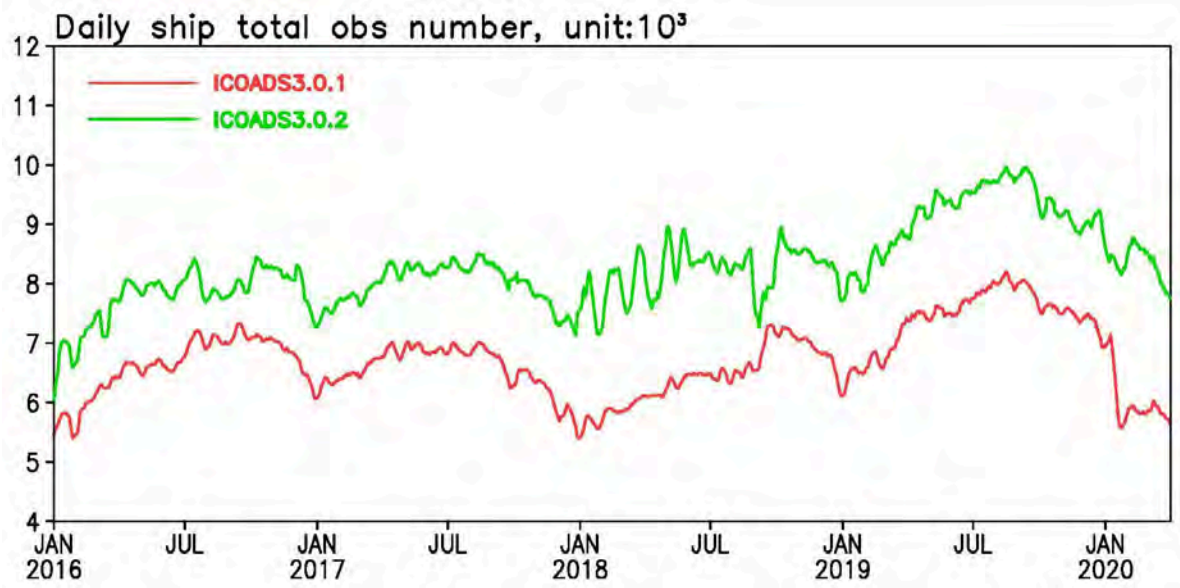


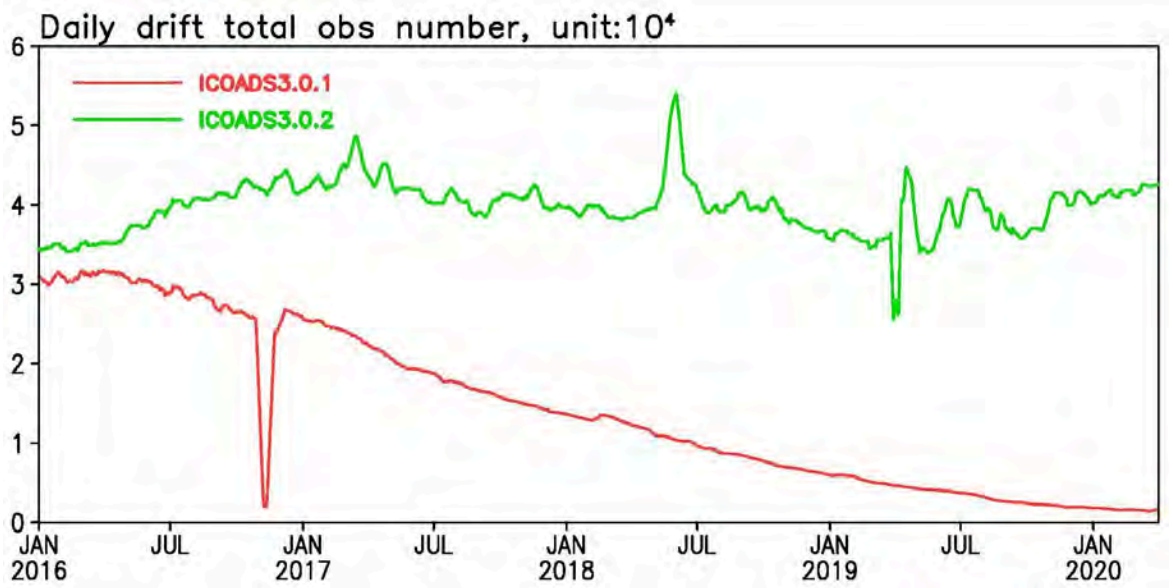
Total reports number

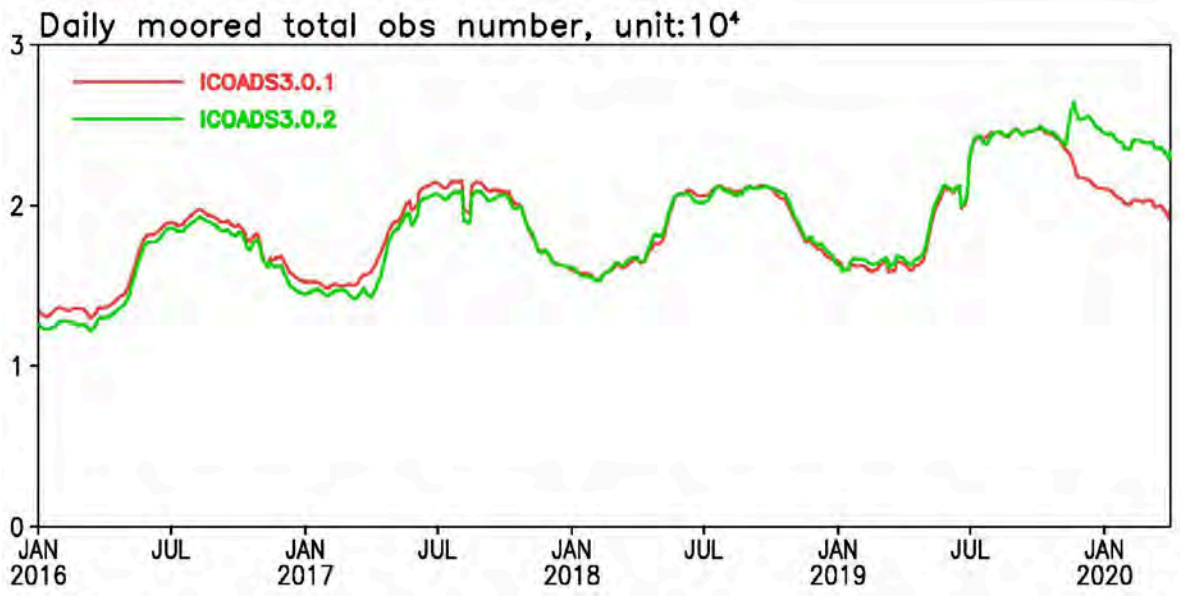


Number of reports increases globally in R3.0.2 compared to R3.0.1.

Total reports number of ship, moored buoy, and drifting buoy





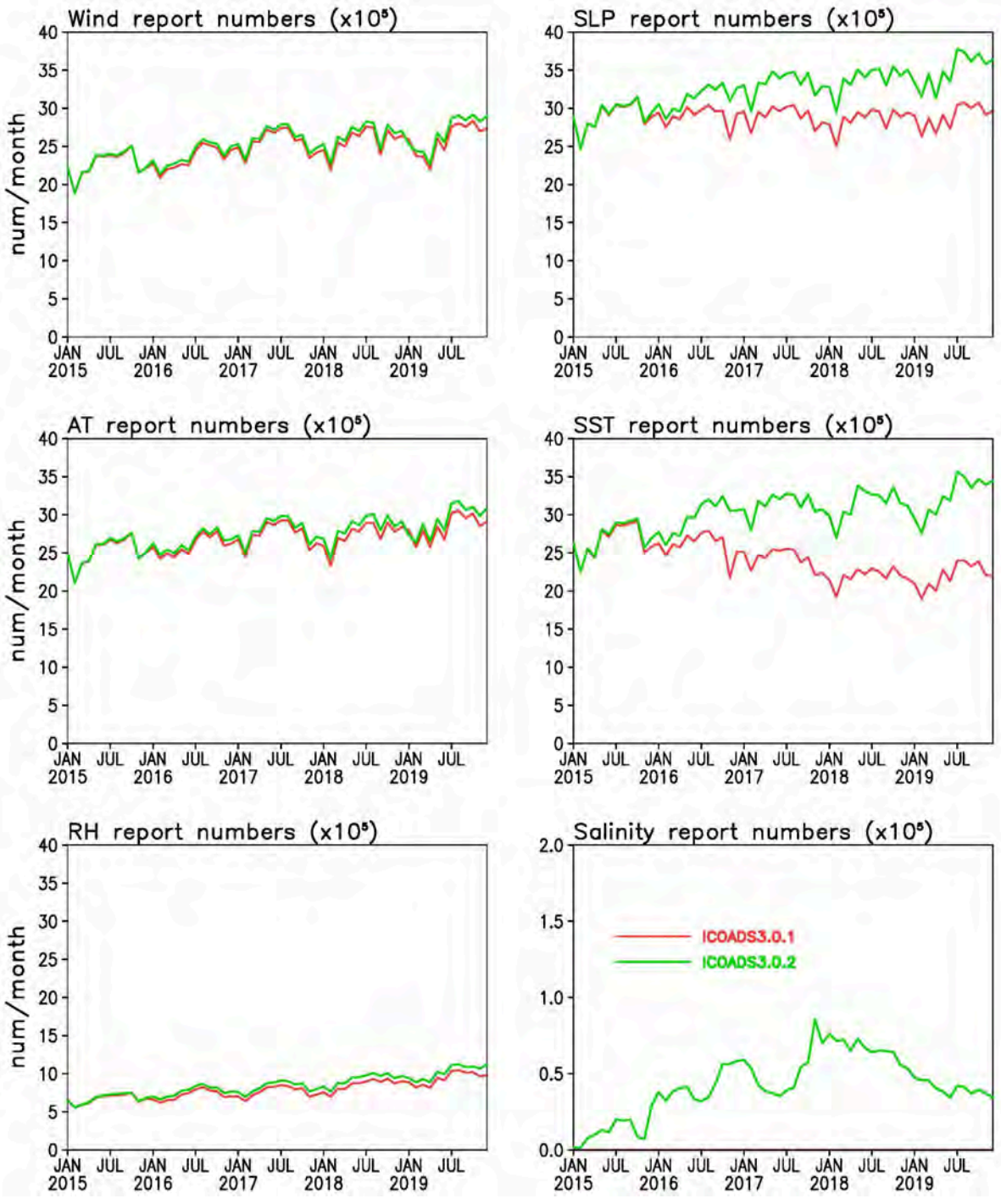


Ship and drifting buoy reports increase in ICOADS R3.0.2

Drifting buoy reports missing in R3.0.1 in November 2016 are recovered with BUFR in R3.0.2

Moored buoy reports are increasing in recent months

In 2020, the ship observation decreased since January, this maybe COVID-19 related

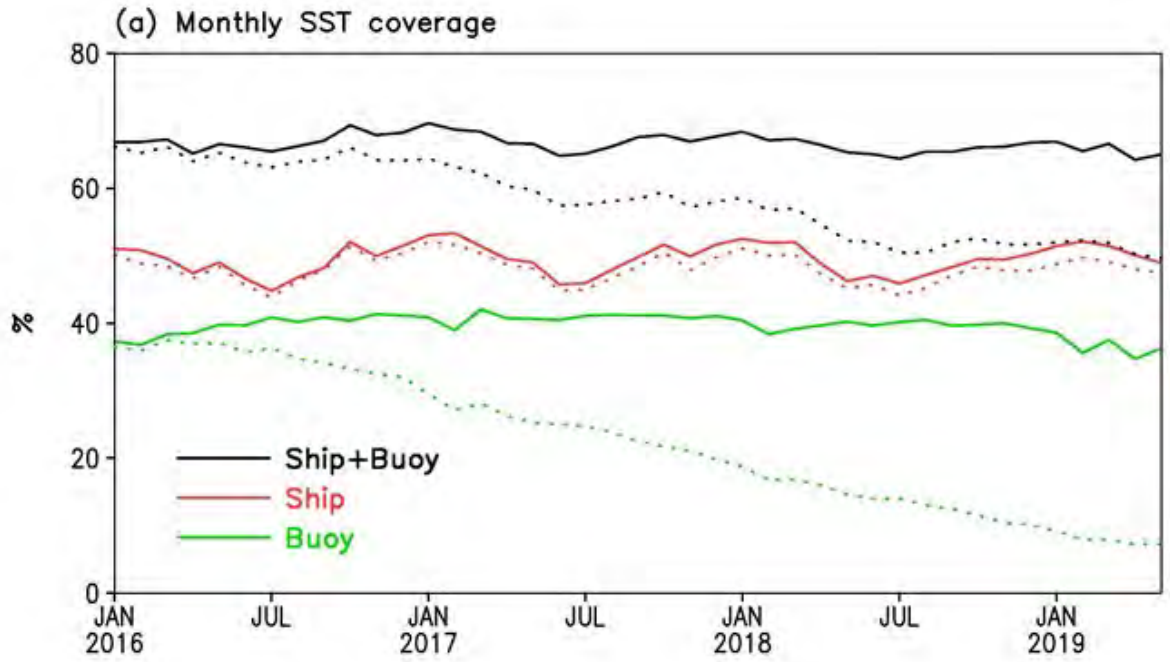


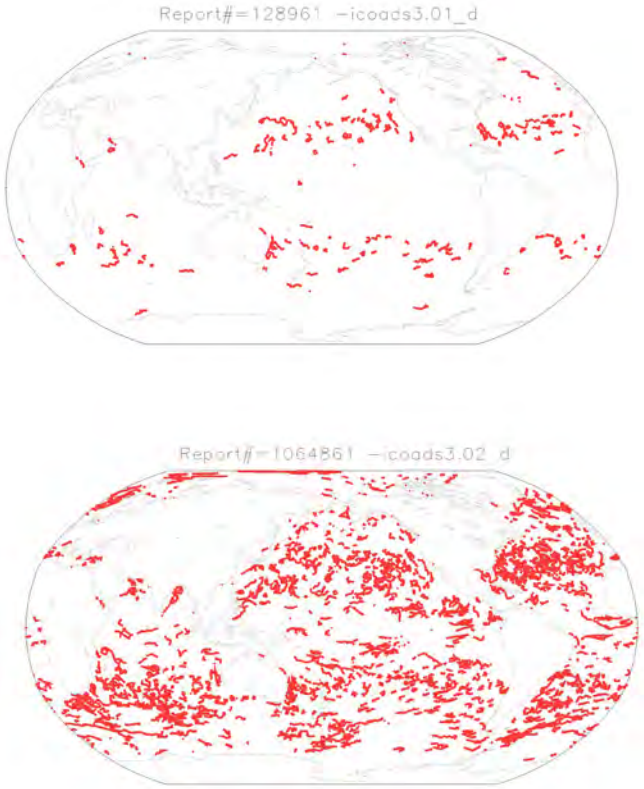
Essential Climate Variables (ECVs)

BUFR stream has more observations of
Wind speed and wind direction
SST (Sea Surface Temperature)
SLP (Sea Level Pressure)
AT (Air Temperature)
RH (Relative Humidity)

Especially, **SSS** (Sea Surface Salinity) is available in R3.0.2 but not in R3.0.1

Data spatial coverage





Global SST coverages on monthly 2°×2° grids

Dotted lines represent the coverage in ICOADS R3.0.1 and solid lines represent the coverage in ICOADS R3.0.2

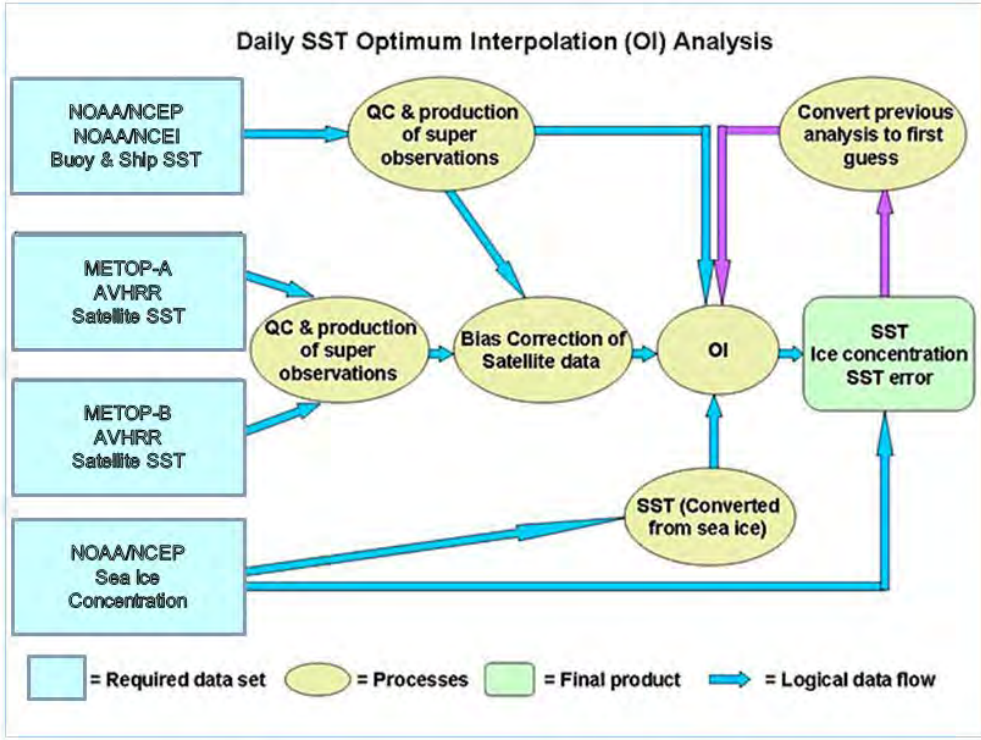
The right is the drifting buoy tracks of a month.

ICOADS3.02 impact on OISST

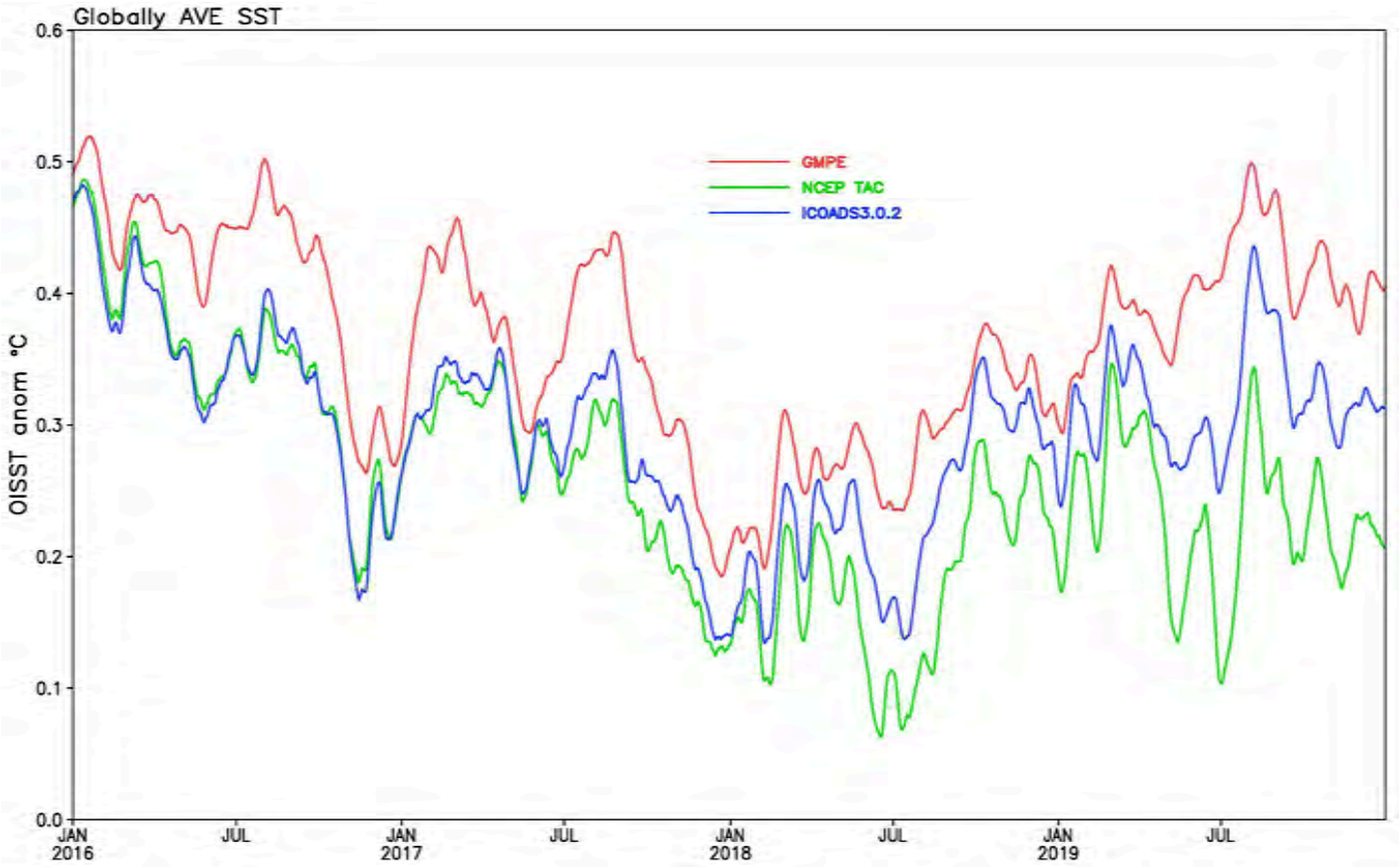
1. METOP-A + METOP-B + NCEP-in situ

2. METOP-A + METOP-B + ICOADS R3.0.2

3. METOP-A + METOP-B + ICOADS R3.0.2 with ship bias from buoy change to 0.01

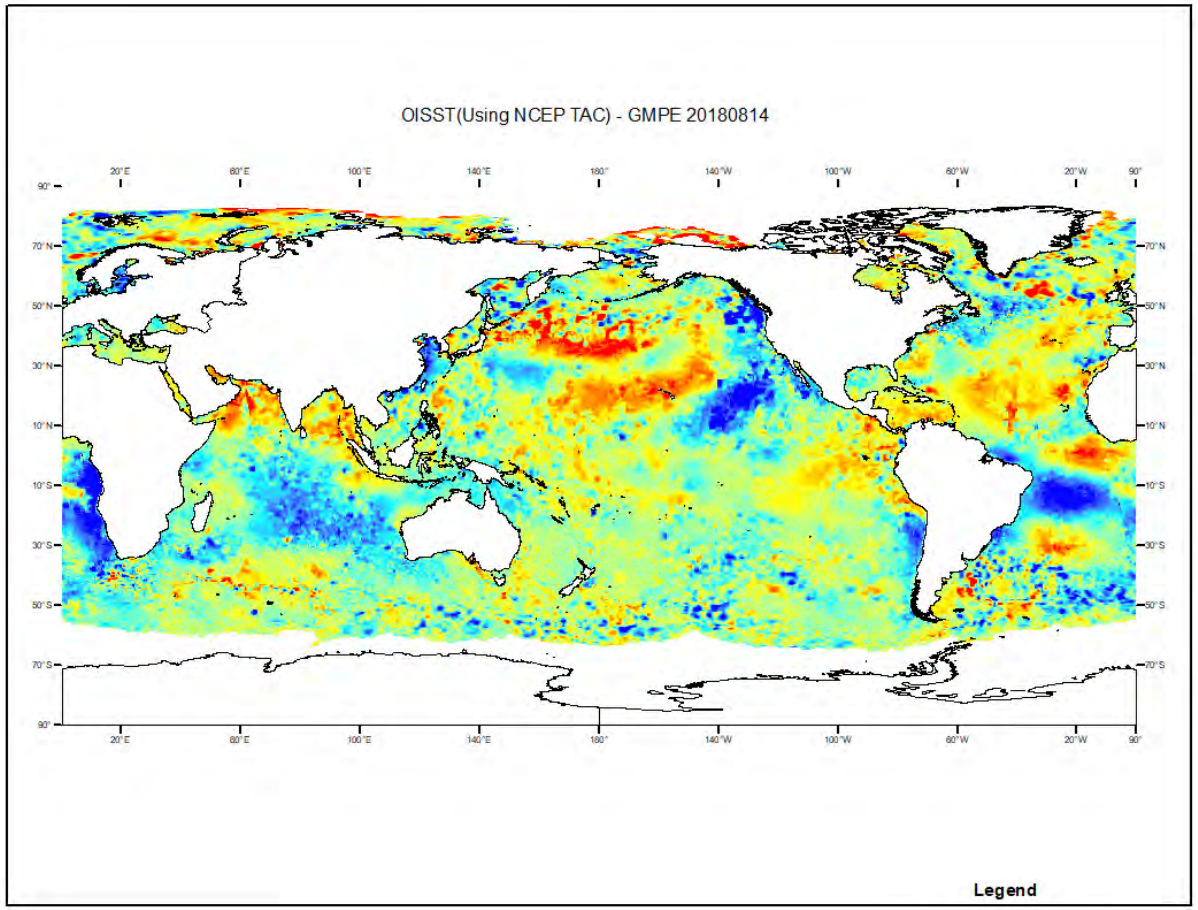


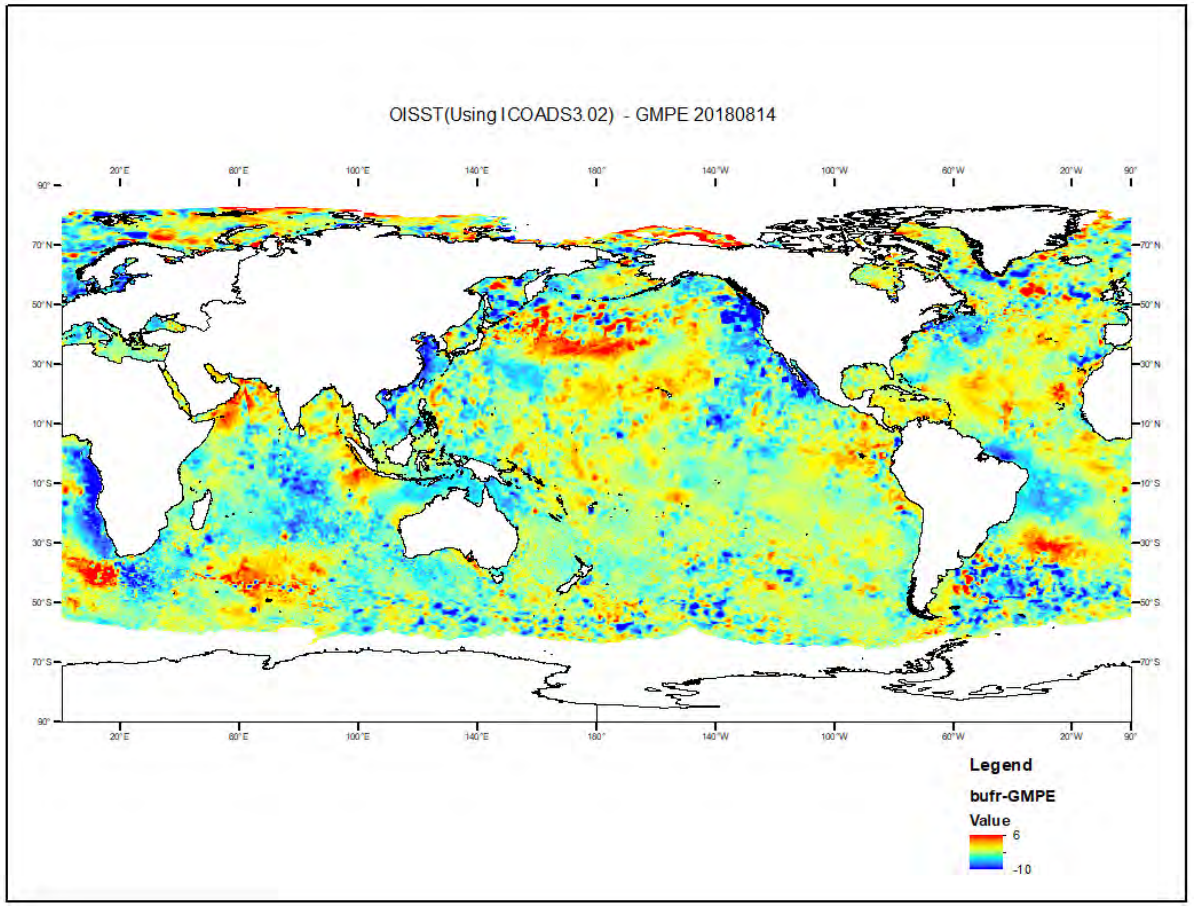
OISST time series of globally averaged SSTAs



The cold bias becomes smaller (blue line) compares with the green line which uses the NCEP TAC only in situ data.

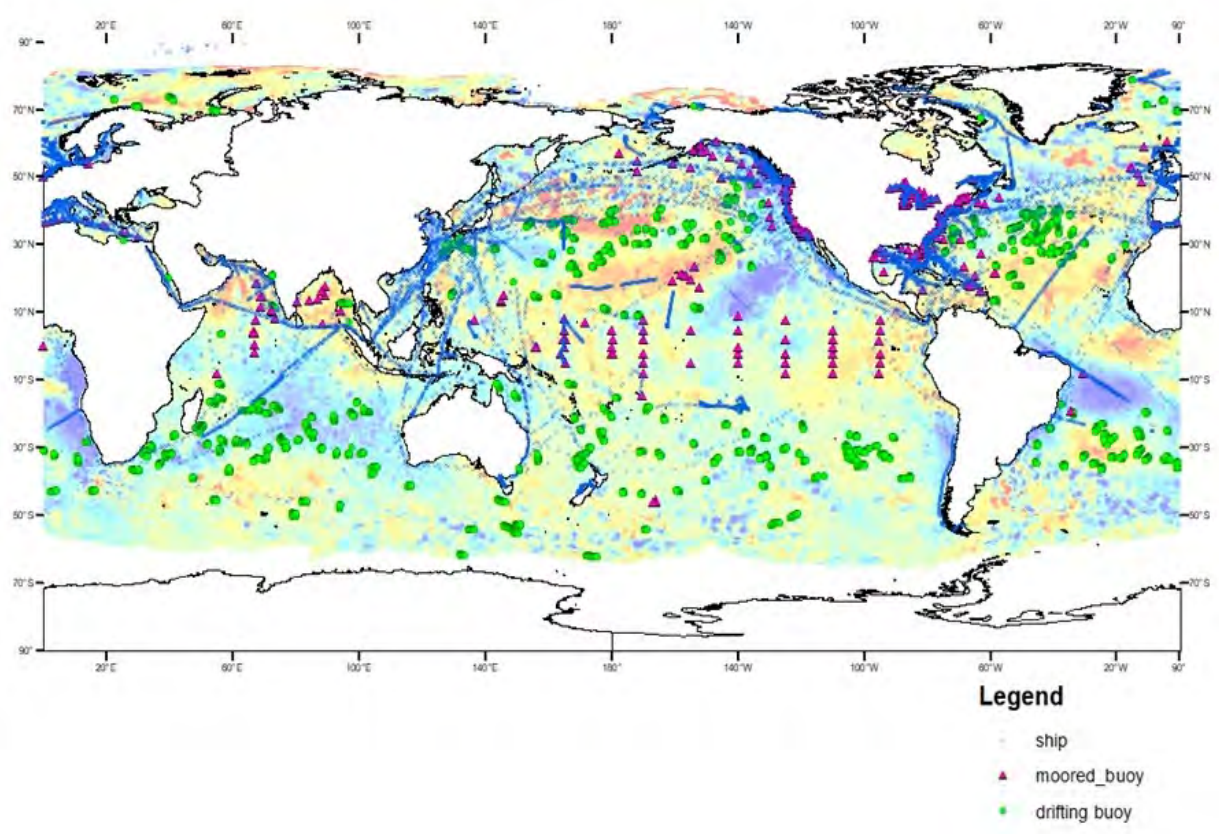
OISST anomaly relative to the GMPE

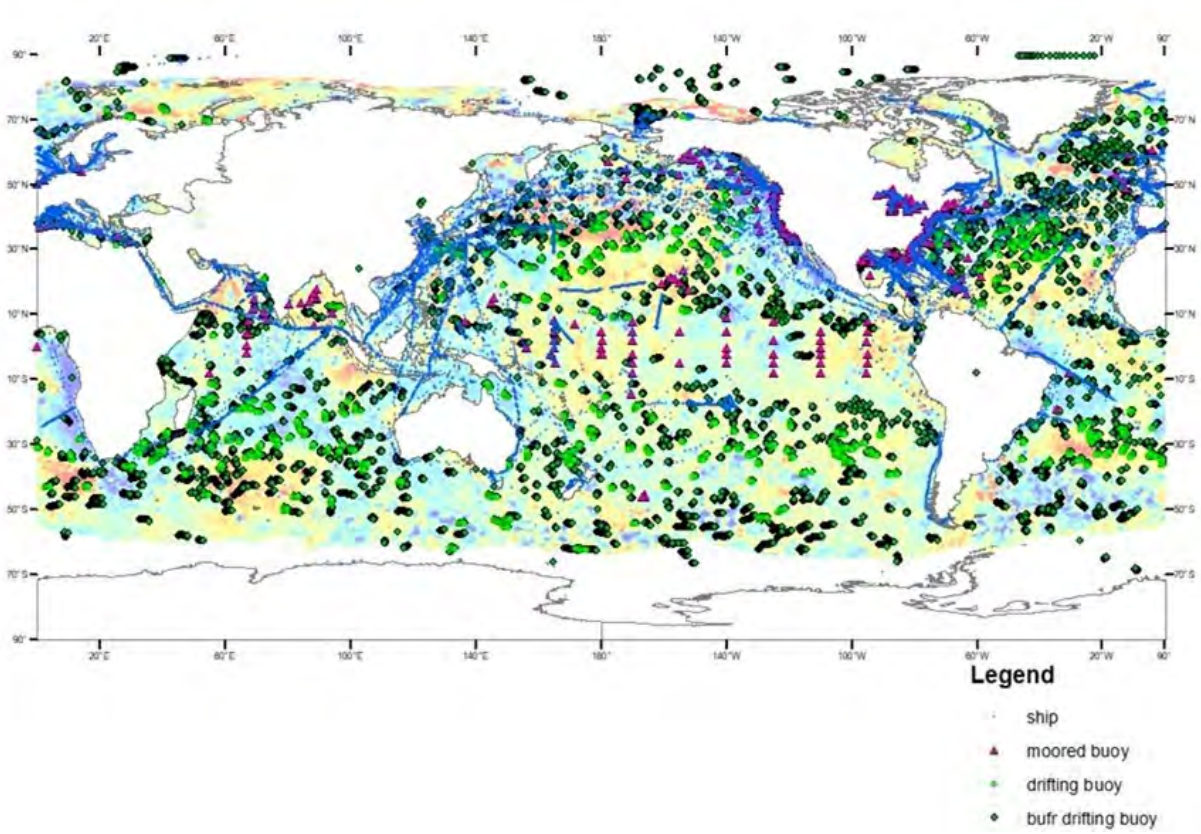




OISST anomaly relative to the GHRSST Multi-Product Ensemble (GMPE) for Aug. 14, 2018.
The cold bias was very noticeable when OISST was run using in situ data from NCEP TAC only (left panel), and much smaller when run with data from ICOADS3.02(right panel)

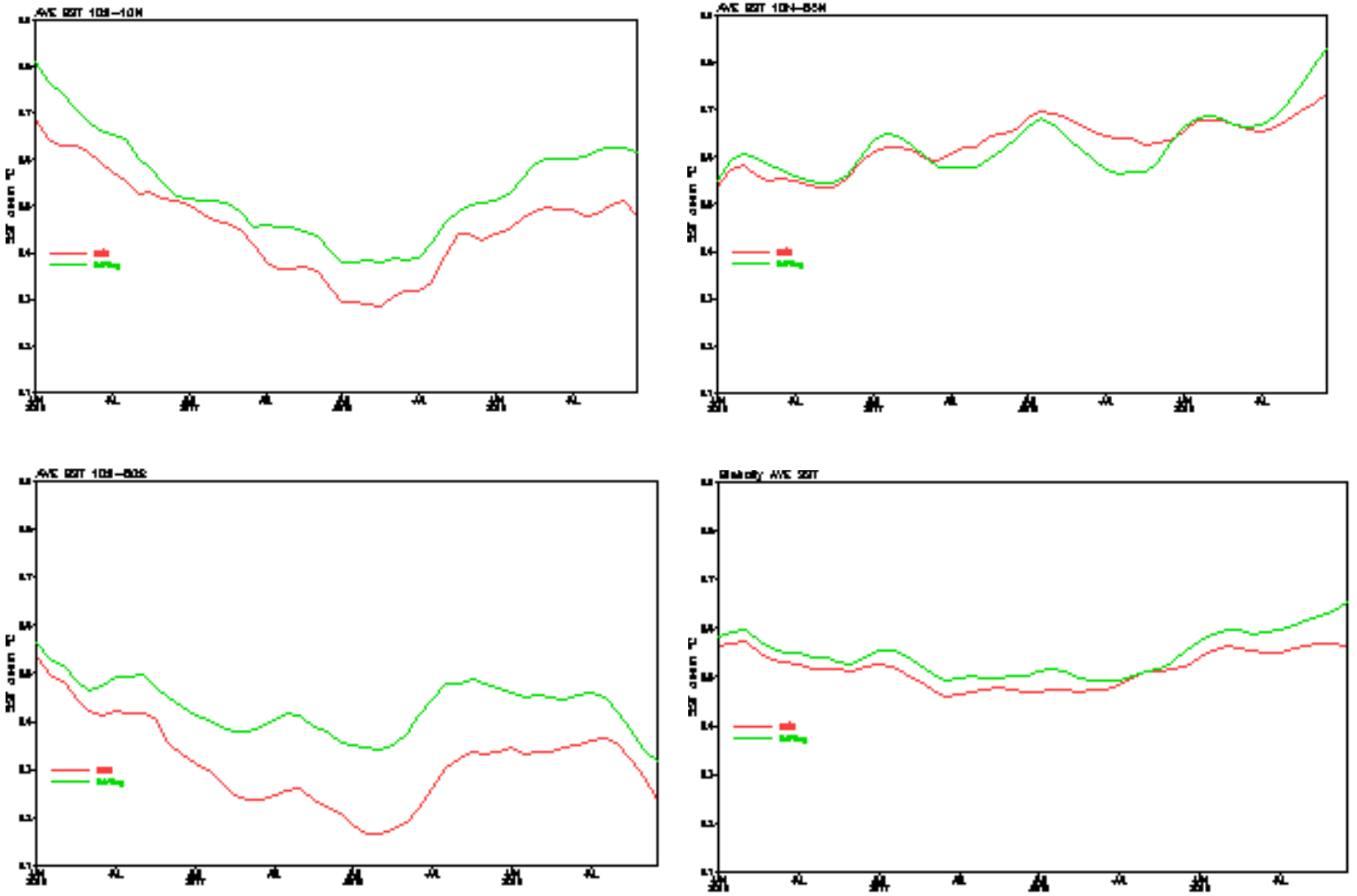
Drifting buoy, moored buoy, and ship observations overlaid on DOISST





The maps show drifting buoy, moored buoy, and ship observations from NCEP TAC (left panel) and ICOADS R3.0.2 (right panel) overlaid on the OISST anomaly relative to the GMPE.
Cold biases (in blue in the maps) tend to occur where drifting buoy observations are sparse.

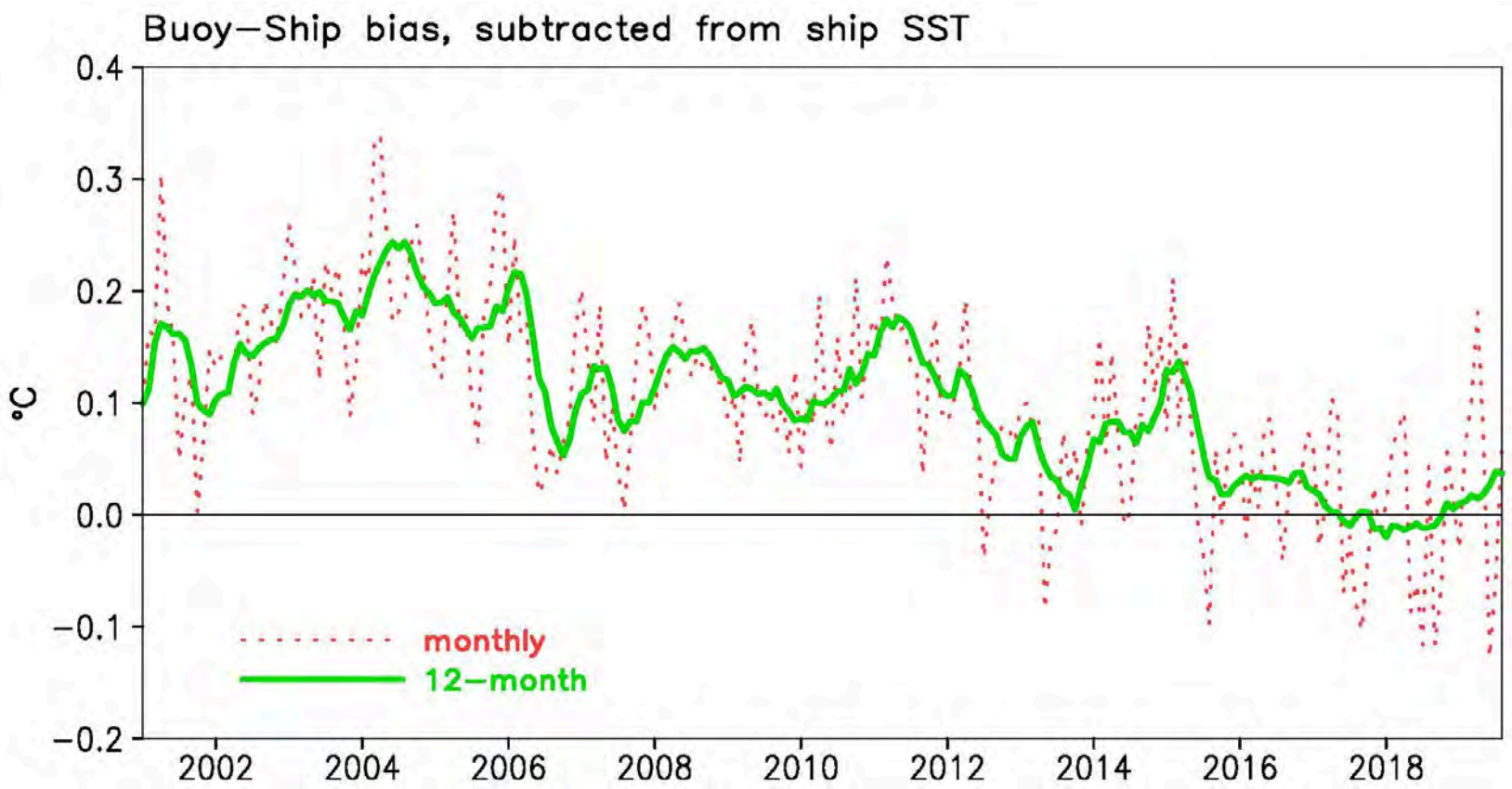
SST anomaly of ship and drifting buoy



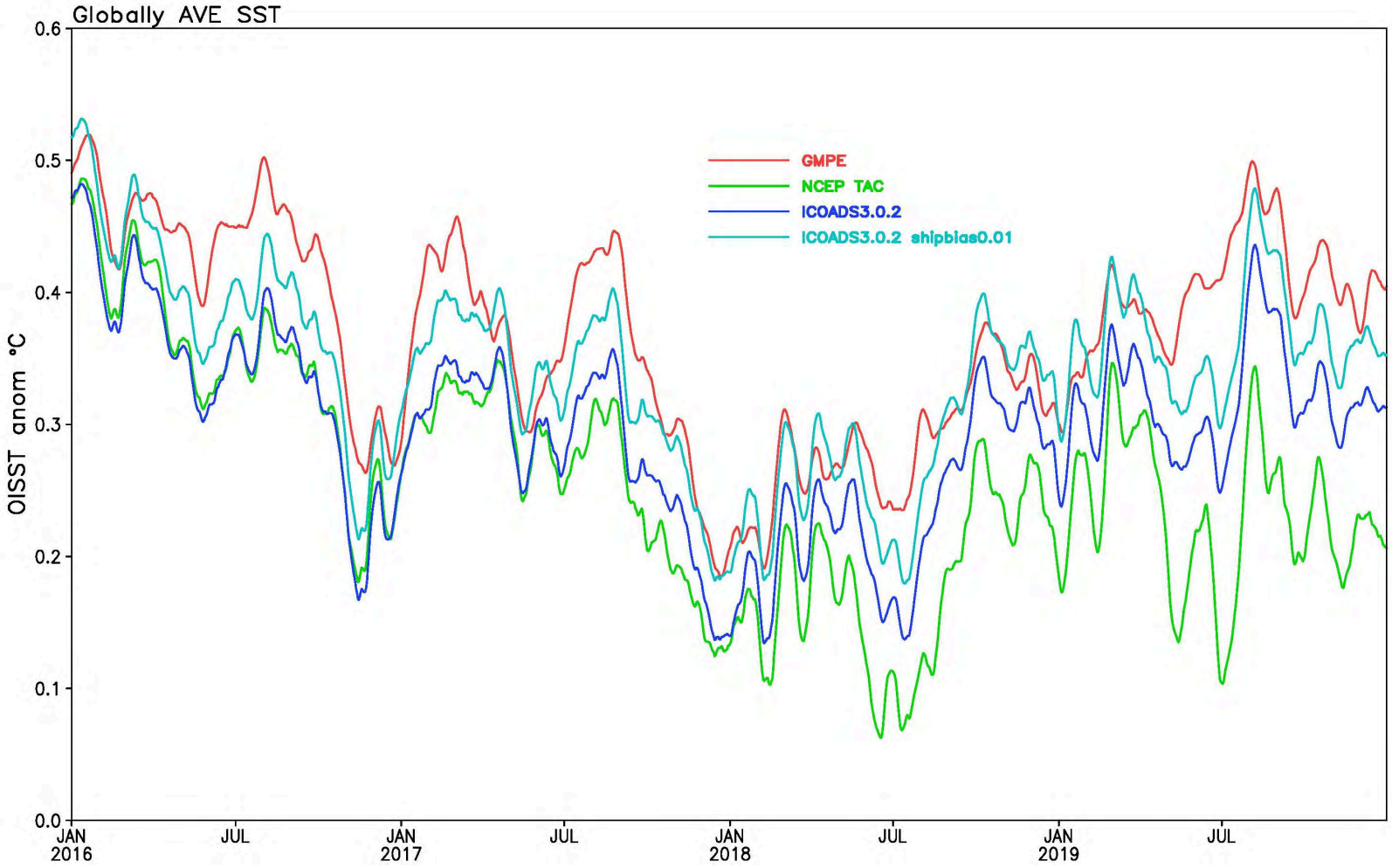
Monthly SST difference between ship and drifting buoy SSTs.

Top left panel: 10S – 10N. Top right panel: 10N – 50N.
Bottom left panel: 10S – 50S. Bottom right panel: global.

Ship Bias Correction



Monthly (dotted red) and 12-month running averaged (solid green) ship SST biases defined as the difference between ship and buoy SSTs.



The light blue line represents the OISST using the new ship bias correction. It is more consistence with GMPE.

Summary

1. ICOADS R3.0.2 is much improved from R3.0.1
    1. Increased data volumes
    2. Improved ocean data coverage
    3. Increased observations of Essential Climate Variables (ECVs)

2. ICOADS R3.0.2 greatly improved OISST
    1. Reducing known cold biases
    2. Improvements on global and regional scales

3. SSTs from different observing platforms in R3.0.2 are heterogeneous on global and regional scales, and the biases change with time. Future study is needed to portrait the SST differences between the different platforms and along the time. By taking a regional scale and dynamic bias correction, we can further improve the quality of OISST as well as other related products.