



# Overview of Ancillary Data in the SCPS

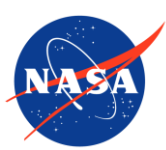
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*Remote Sensing Systems,*

*Santa Rosa, CA*

SCP-OSST Meeting, Virtual Meeting

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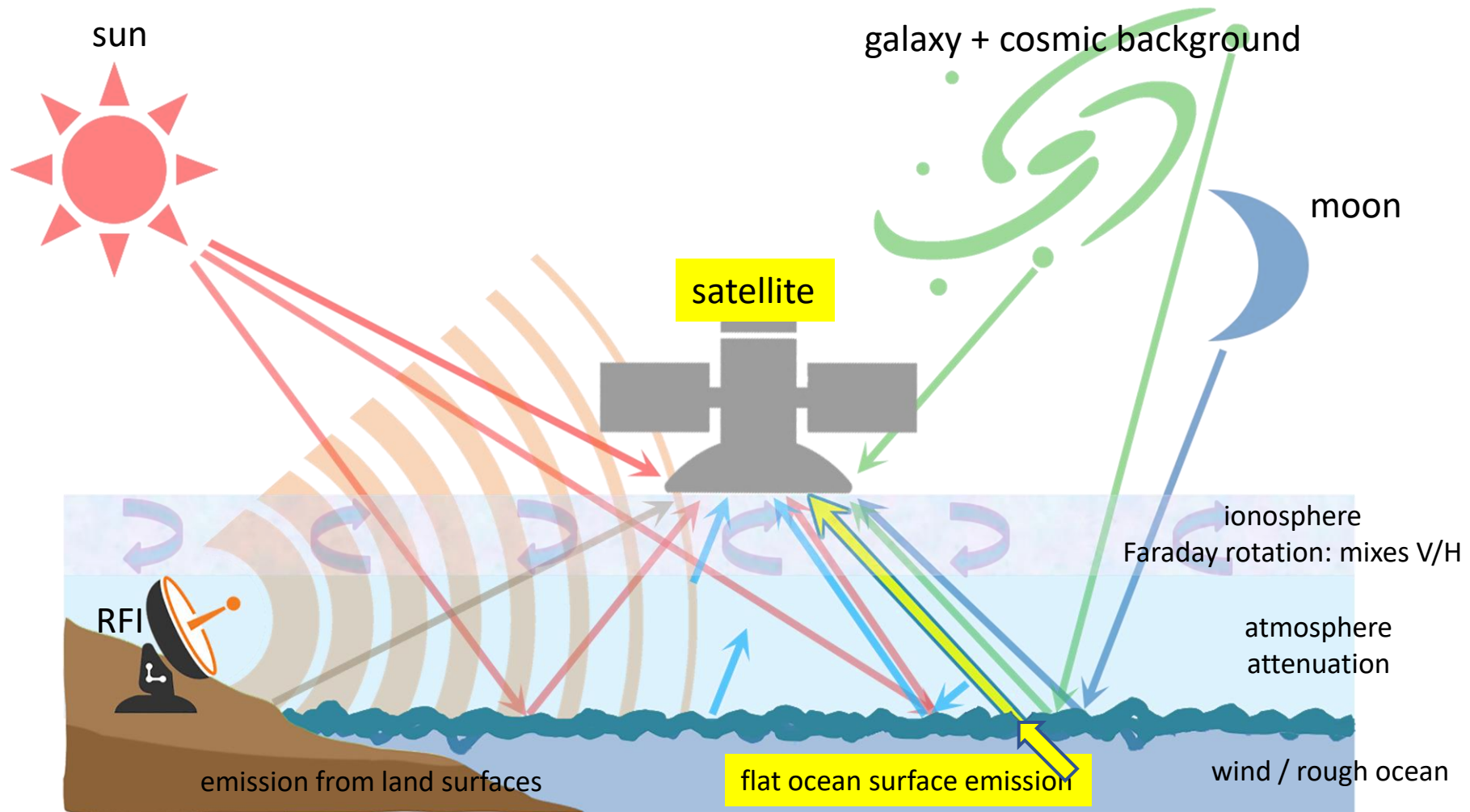
# Salinity Continuity Processing System

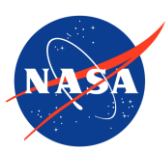
- Remote Sensing Systems (RSS) is responsible for supporting NASA's Salinity Processing System (SPS) by operating and maintaining the Salinity Continuity Processing System (SCPS) with the goal of monitoring, verifying, and improving the quality of spaceborne sea-surface salinity (SSS) observations.
- Many requirements for the operation and maintenance of the SCPS including:
  - Precise sensor calibration
  - On-going verification of output products
  - Verifying version changes and reprocessing
  - **Monitoring and evaluation of ancillary data used in SSS retrievals**



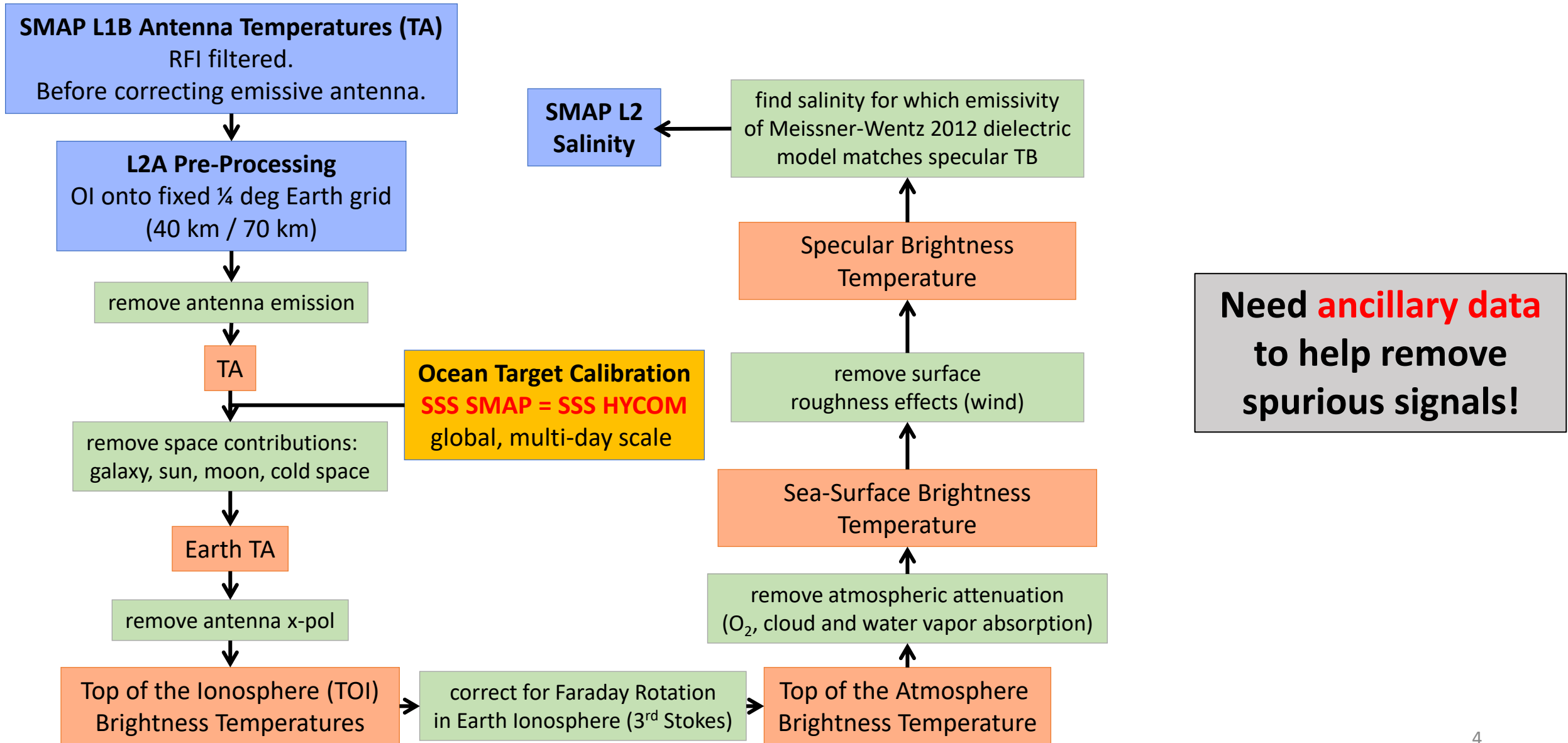
# Many Large Spurious Signals!

Need to be removed in order to retrieve SSS



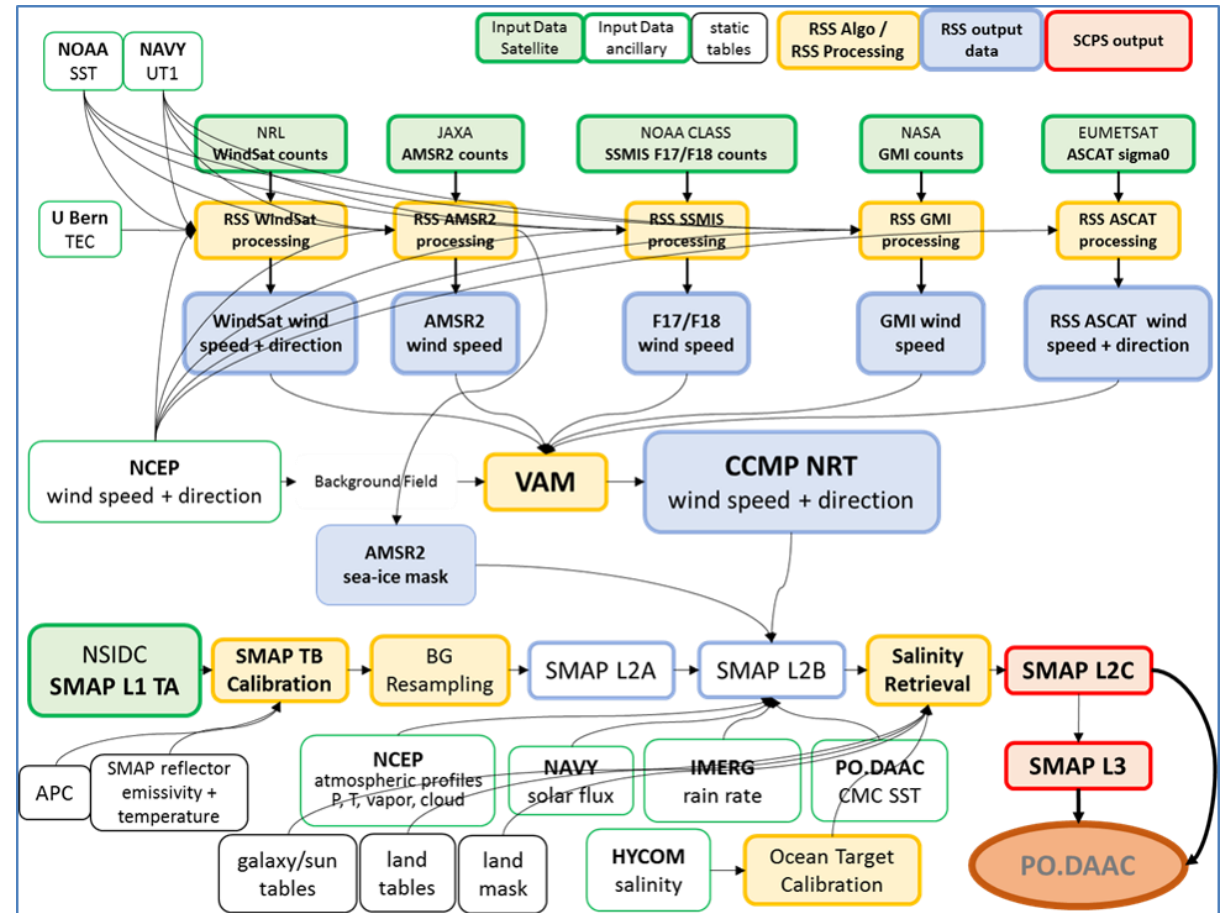


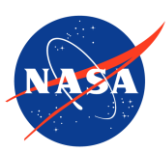
# SMAP V4 Salinity Retrieval Algorithm



# Salinity Continuity Processing System

- Many different ancillary data required to make an accurate retrieval of sea-surface salinity.
- These include: wind speed, sea-surface temperature, rain rate, profiles of atmospheric parameters etc...
- Since wind roughening of the ocean surface is one of the biggest error sources in the salinity retrieval, a particularly good wind product is needed.
  - We use the Cross-Calibrated Multi-Platform (CCMP) for this purpose, which uses data from many satellites as input.





# Monitoring and Evaluating Ancillary Data

- SCPS requires a large array of ancillary data from many different sources.
- All data need to be sampled to the same location and time as satellite observations.
- However, defining characteristics of the ancillary data change over time. This includes (but is not limited to):
  - Formats
  - Spatial/temporal sampling
  - Version changes
- Maintenance and operation of SCPS requires us to keep track of ancillary data sources and make appropriate adjustments as well as monitor the quality of incoming ancillary data.



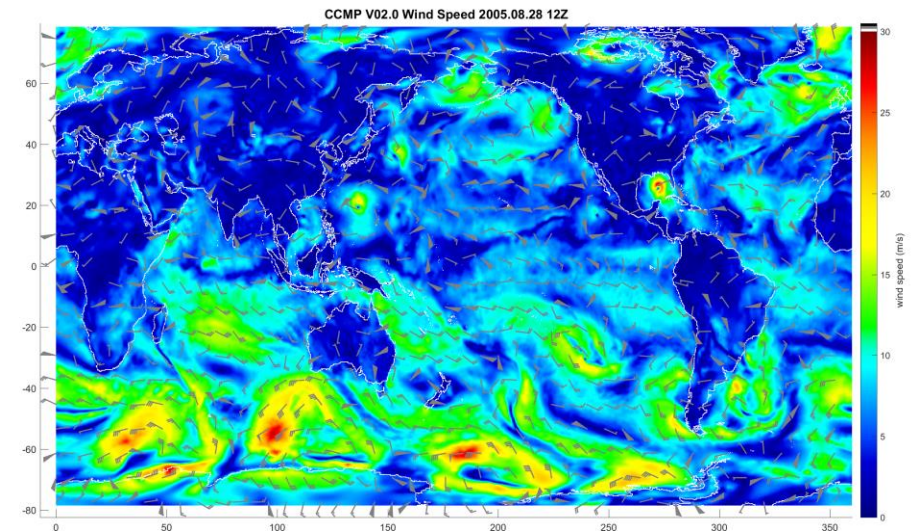
# Ancillary Datasets

(SMAP Focused)



# Wind Speed (CCMP)

- Product Description:
  - The near-real time Cross-Calibrated Multi-Platform (CCMP NRT) vector wind product is created at RSS using a Variational Analysis Method (VAM) in order to blend winds from many different radiometers and scatterometers as well as a background wind field of NCEP winds.
- Used for:
  - Removing ocean surface roughness effects caused by wind. SMAP has no active sensor and is therefore unable to perform a wind retrieval in conjunction with a sea-surface salinity retrieval i.e., ancillary wind is required.
- Source:
  - CCMP winds are produced by RSS and are available here: [www.remss.com/measurements/ccmp/](http://www.remss.com/measurements/ccmp/).
- Latency:
  - 24-48 hours



<http://www.remss.com/measurements/ccmp/>





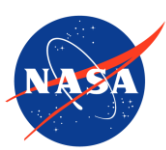
# Atmospheric Profiles (NCEP)

- Product Description:
  - Atmospheric profiles for pressure, height, temperature, relative humidity, and cloud water mixing ratio.
- Used for:
  - Correcting for the intervening atmosphere between the satellite and the Earth's surface.
- Source:
  - The National Centers for Environmental Prediction (NCEP) Global Data Assimilation System (GDAS). Files are available at 6-hour intervals at a resolution of  $1^{\circ} \times 1^{\circ}$ .
- Latency:
  - ~24 hours



# Sea Surface Temperature (CMC)

- Product Description:
  - A Group for High Resolution Sea Surface Temperature (GHR SST) Level 4 blended Sea Surface Temperature (SST) produced by the Canadian Meteorological Center (CMC).
  - Blends in situ and satellite data (including microwave satellites).
  - When compared to other SST products, CMC was found to give the best overall performance in L-band radiometer SSS retrievals (Meissner et al. 2016\*).
- Used for:
  - SST is needed in the dielectric model of sea-water to match the SMAP specular surface emissivity (after atmospheric + roughness corrections are performed) to the radiative transfer model using a maximum-likelihood estimator.
- Source:
  - Version 3 of the daily CMC SST files at an resolution of  $0.1^{\circ} \times 0.1^{\circ}$  are downloaded from the PO.DAAC ([podaac.jpl.nasa.gov](http://podaac.jpl.nasa.gov)).
- Latency:
  - 24 hours



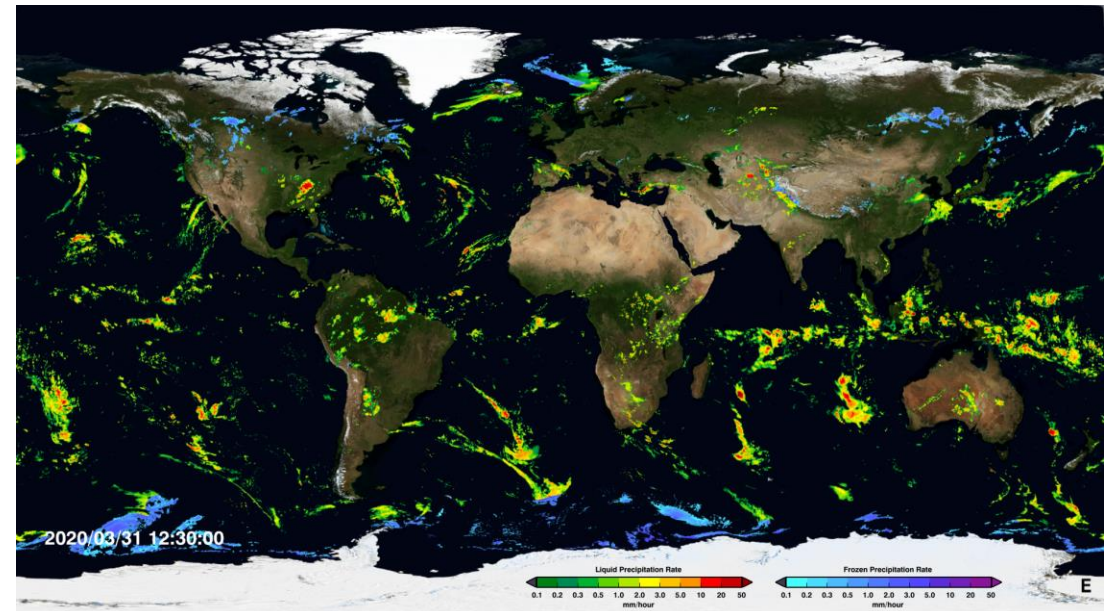
# Reference Salinity (HYCOM)

- Product Description:
  - An ancillary dataset of reference sea-surface salinity from the Hybrid Coordinate Ocean Model (HYCOM) developed by the U.S. Navy.
- Used for:
  - The ocean-target calibration, which ensures that the global average SMAP salinity matches that of the reference salinity.
  - Note that HYCOM is NOT used in the retrieval itself. Only its global average is used in the ocean-target calibration.
- Source:
  - Data are available at and downloaded from [www.hycom.org](http://www.hycom.org).
- Latency:
  - 24 hours



# Rain Rate (IMERG)

- Product Description:
  - The Integrated Multi-satellite Retrievals for GPM (IMERG) is a Level 4 rain rate product that is largely based on observations by NASA's Global Precipitation Mission (GPM). Widely regarded as the best available merged rain product by the scientific community.
- Used for:
  - The IMERG product is used at several stages in the processing including:
    - Correction for liquid cloud water absorption in the L2 algorithm.
    - Rain-flagging in the ocean-target calibration and producing the rain-flagged monthly Level 3 data.
  - Note that rain-flagged data are not necessarily "bad," but care must be taken when comparing them to ARGO/HYCOM data due to stratification.
- Source:
  - We currently use IMERG Version 6 gridded at a  $0.1^\circ \times 0.1^\circ$  resolution. Data are resampled to the native SMAP 40km resolution and can be found at: <https://pps.gsfc.nasa.gov/>.
- Latency:
  - < 24 hours

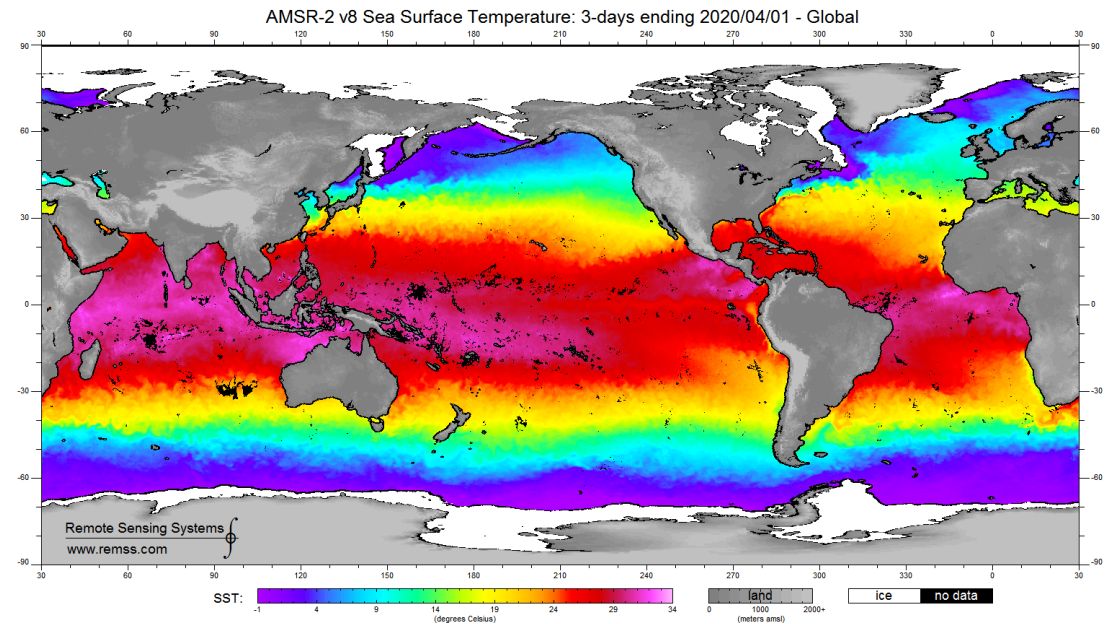


[https://svs.gsfc.nasa.gov/vis/a000000/a004200/a004285/imergert\\_1080p.now.png](https://svs.gsfc.nasa.gov/vis/a000000/a004200/a004285/imergert_1080p.now.png)

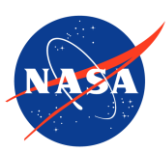


# Sea Ice (AMSR-2)

- Product Description:
  - 3-day average sea-ice mask created using AMSR-2 sea-ice maps. Given as a binary flag (0=no ice; 1=ice).
- Used for:
  - Accurately locating sea ice in order to help retrieve SSS in colder waters.
  - Currently looking into new potential sea-ice datasets.
- Source:
  - RSS Version 8 AMSR-2 Ocean Suite, produced as part of daily AMSR-2 files ([www.remss.com/amr/](http://www.remss.com/amr/))
- Latency:
  - 6 hours



<http://www.remss.com/measurements/amr/>



# Summary

- Many datasets required for the SCPS in order to get accurate salinity retrievals.
- Monitoring quality of incoming ancillary data is an integral part of the SCPS at RSS.
- Focused on a fraction of the datasets used in the SMAP retrieval for this presentation.
  - Aquarius uses some different ancillary datasets for its salinity retrieval.
- In the future, we plan to add as much commonality between Aquarius and SMAP as possible, which includes more of the same ancillary datasets.
- This will result in a more consistent Aquarius/SMAP dataset for studying decadal changes in salinity.