Sea State CCI:
User Consultation
Meeting #2

VISUAL WAVE OBSERVATIONS for SEA STATE ANALYSIS: POSSIBILITIES and LIMITATIONS

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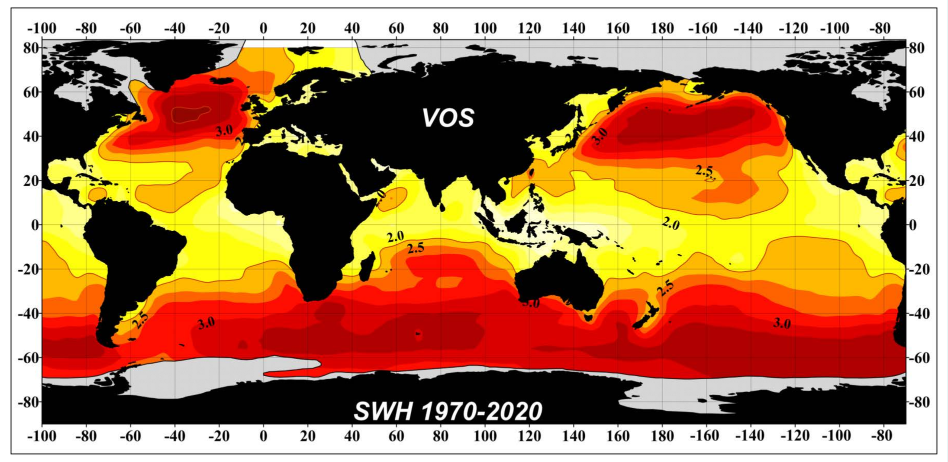
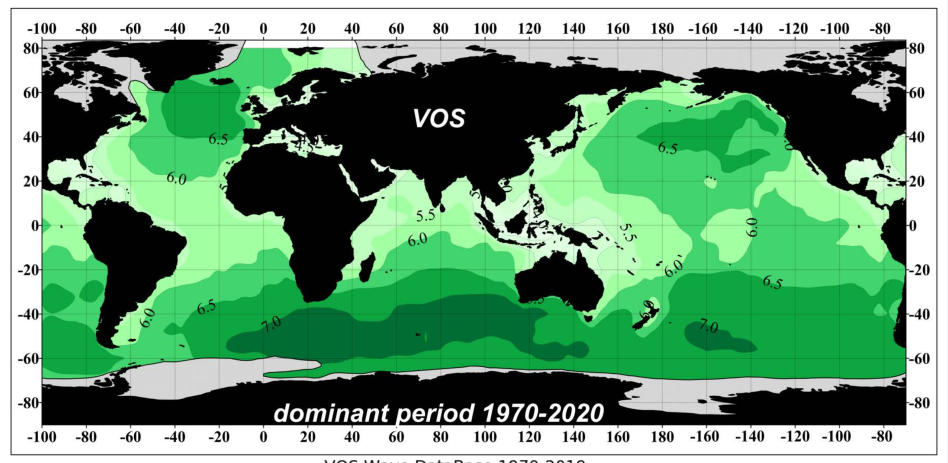
Voluntary Observing Ships: 1970-2020

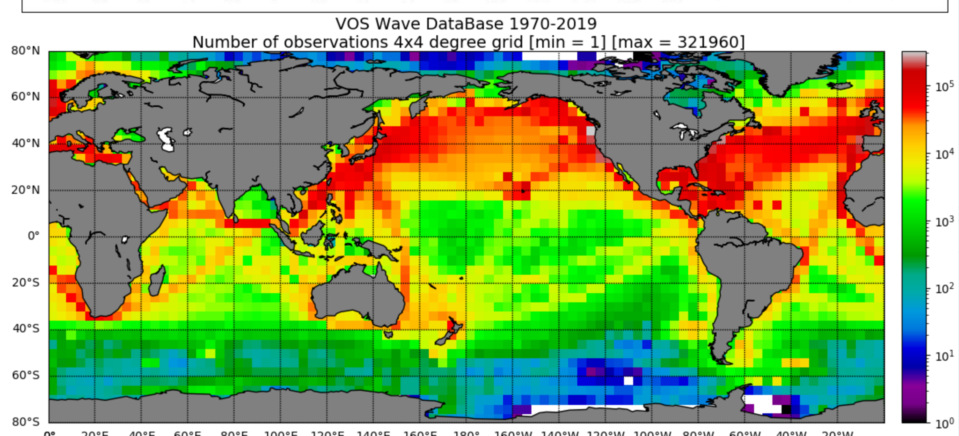
APPLICATIONS:
As an independent source of sea state data, can be used for validating altimetry and model simulations in the open ocean



Due to a consistent observational practice, can provide homogeneous time series of wind sea and swell characteristics

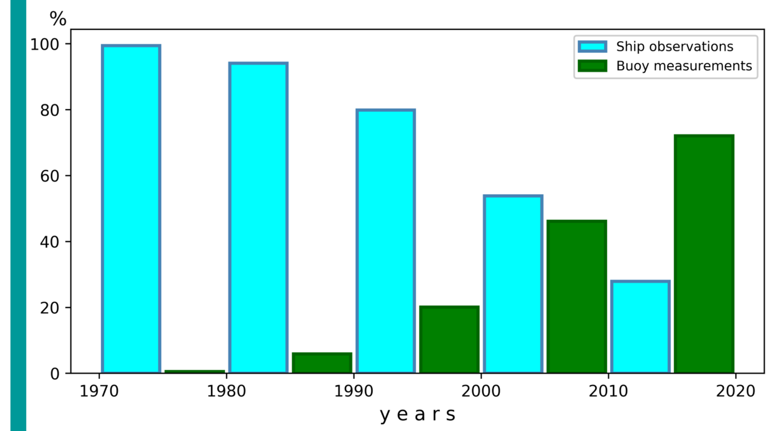


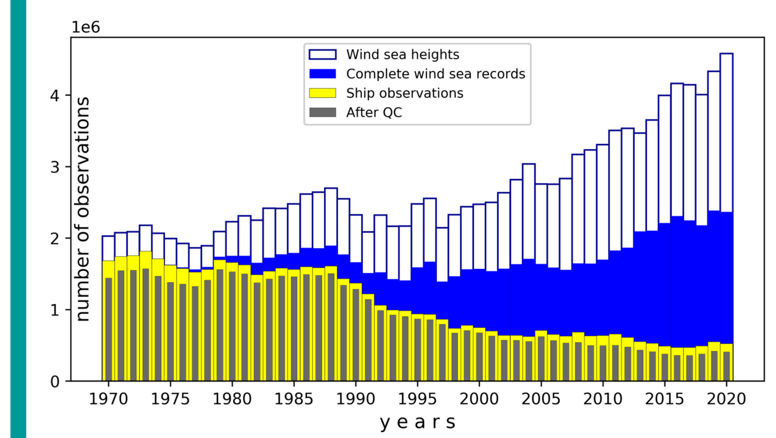
With exceptional continuity, can help identify different wave systems and quantify their parameters over long time periods

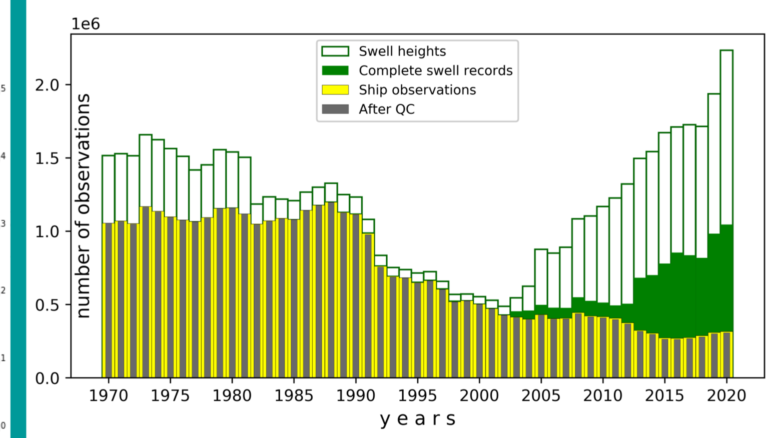


LIMITATION: spatio-temporal inhomogeneity

CHANGES in VOS DATA STRUCTURE: 1970-2020





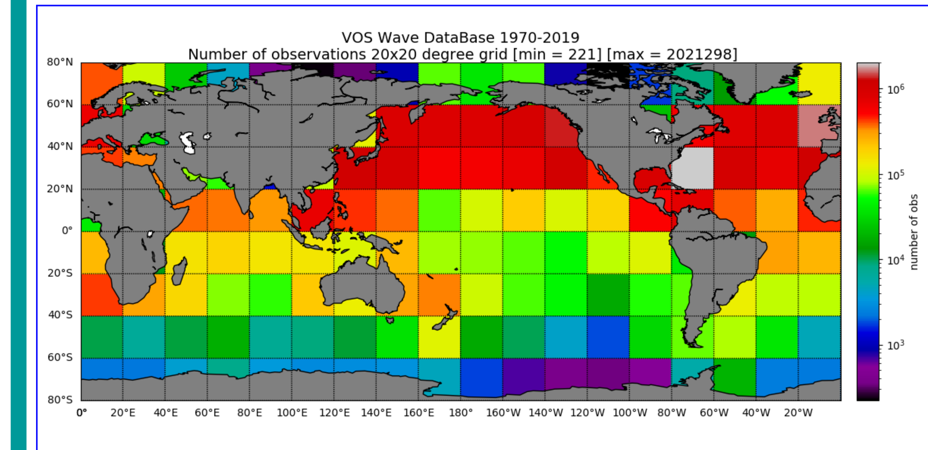


Amid the growth of the total number of observations in VOS data (with >45*10^6 obs in 2020), the input from ship observations, both absolute and relative, has dropped in the last 25 years. Buoy measurements act as the leading source of new records, now constituting more than 70% of waves. Buoy records adjusted to the VOS format can act as an additional source for intercomparison with other types of data inside ICOADS and significantly homogenize observational density in the coastal areas

LIMITATION: the decrease of observational density in the open ocean does not let ship data produce reliable monthly wave fields on their own, especially in the SH

GLOBAL WAVE DATABASE 1970-2019

https://sail.ocean.ru/gwdb/



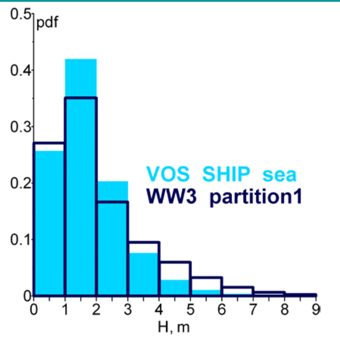
The original VOS data was taken from the ICOADS archive of marine meteorological observations (https://icoads.noaa.gov/) and now records:

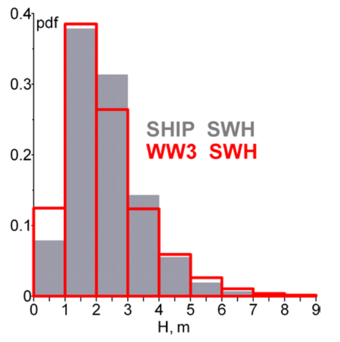
- covers the globe from 80N to 80S between 1970 and 2019
- consists of the time series of wave characteristics in 3 streams and 2 different bins: 4º x 4º and 20º x 20º
- have passed thorough multistage quality control
- are presented in NetCDF4 format

APPLICATIONS: the database can be used to get time series of wind sea and swell characteristics in a given box or region, including calculated SWH, dominant wave period, and wave geometry

LIMITATION: the length of time series may vary from box to box because of the differences in the number of observations

VOS vs. WAVEWATCH III, 2019

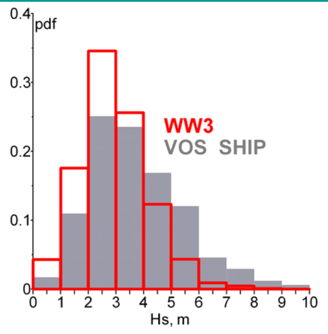


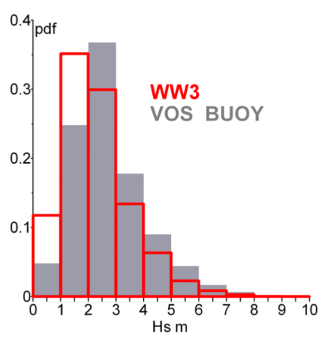


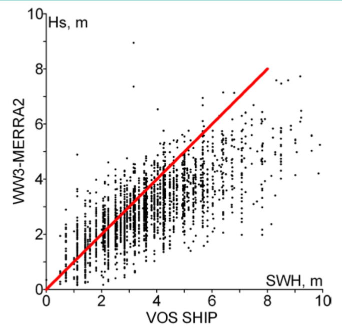
A comparison of ship and buoy data in VOS with WW3 (well-sampled 40º-60ºN) shows:

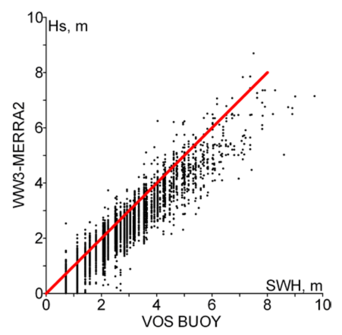
A good agreement for integral distributions of wind sea heights and SWH

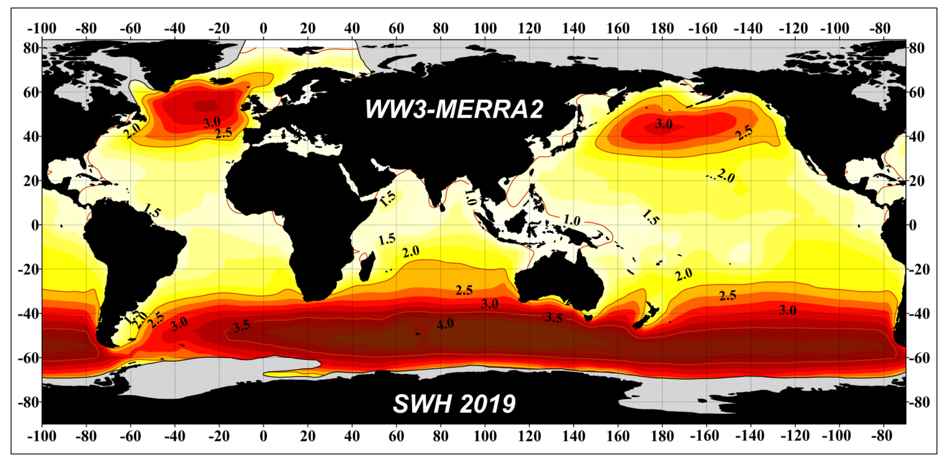
a disagreement for SWH for both ship and buoy data in VOS and WW3 within a 25 km radius



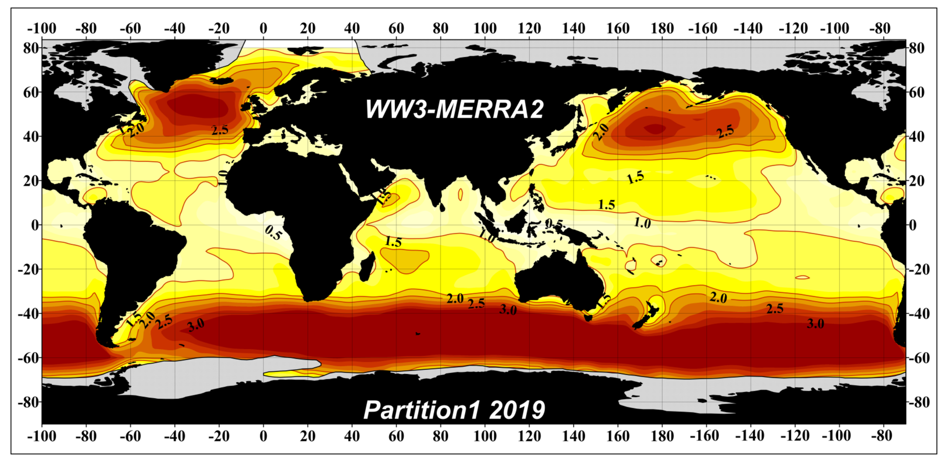


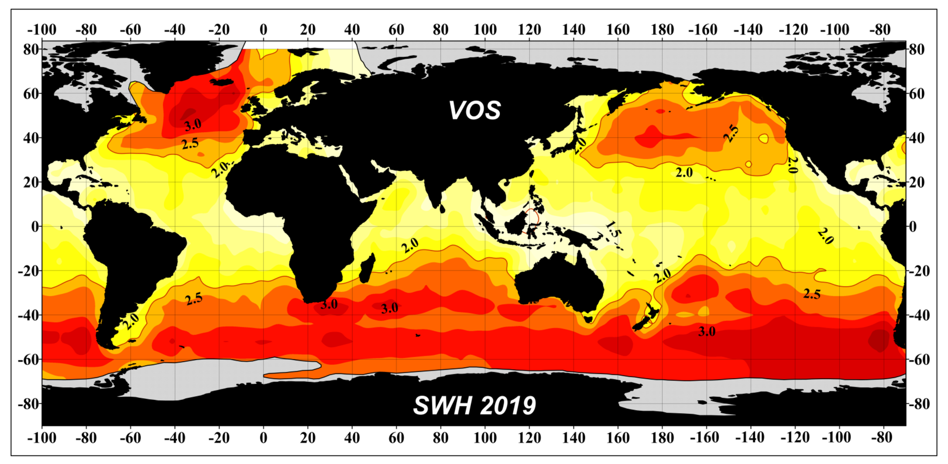




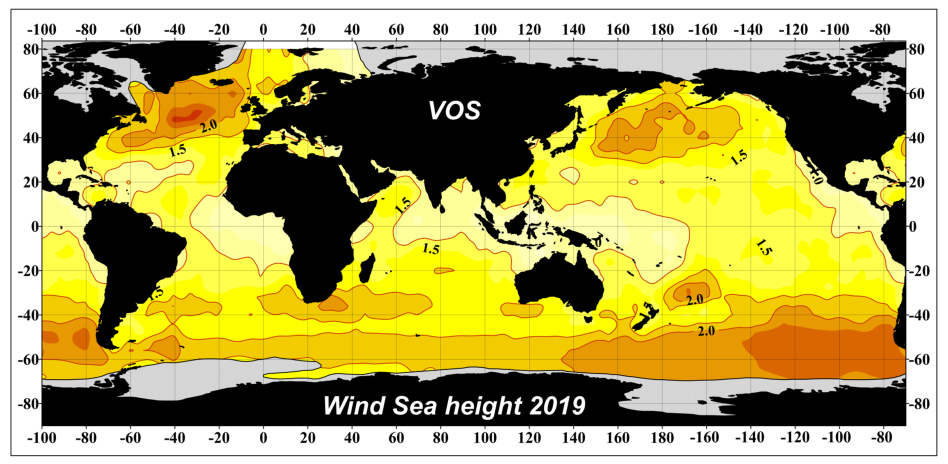


Global SWH are consistent in the NH. VOS SWH is underestimated in the Southern Ocean, same as for CFOSAT

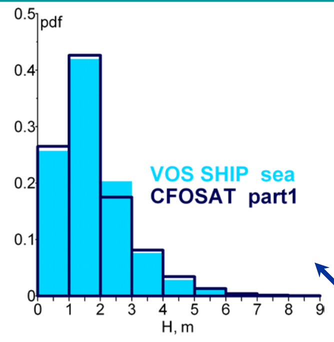


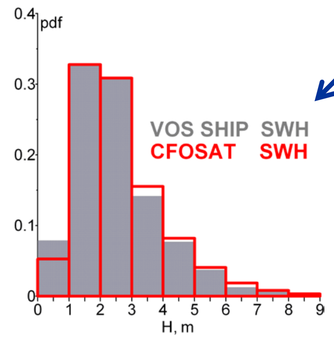


WW3 overestimation of wind sea heights in storminess regions and an underestimation in tropics stem from wave system identification problems in models



VOS vs. CFOSAT, 2020

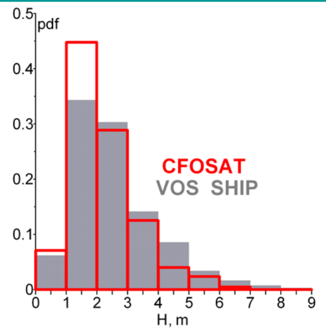


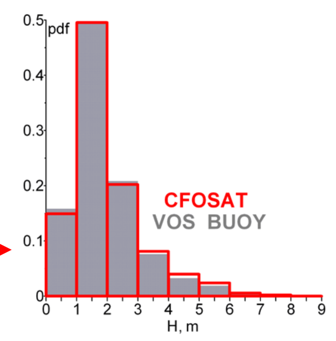


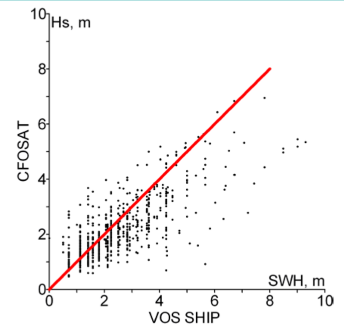
A separate comparison of ship and buoy data in VOS with CFOSAT shows:

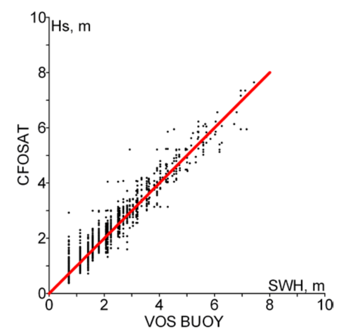
a very close match for distributions of VOS wind sea heights and partitision1 in CFOSAT as well as for SWH

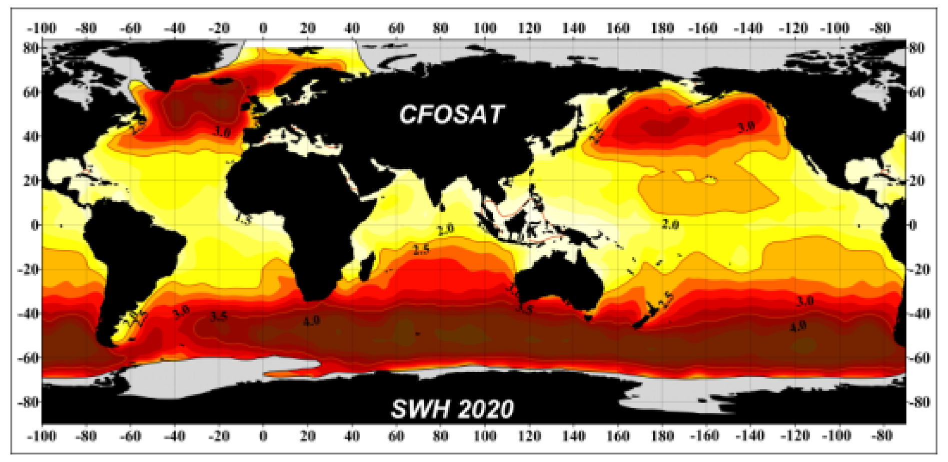
excellent agreement for SWH between buoy data in VOS and CFOSAT within a 50 km radius and time lag <30 min



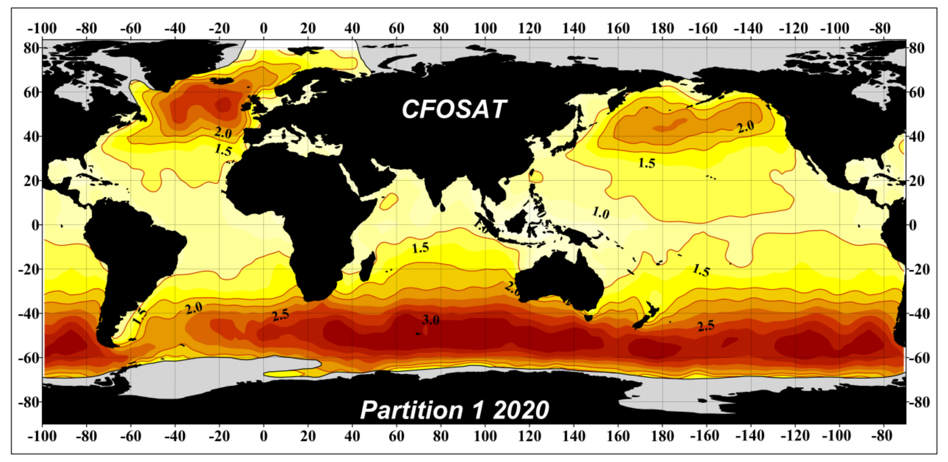


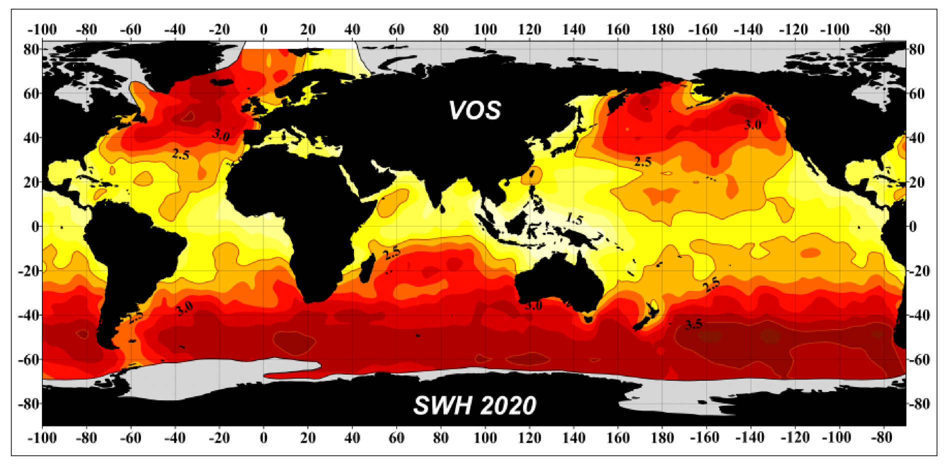




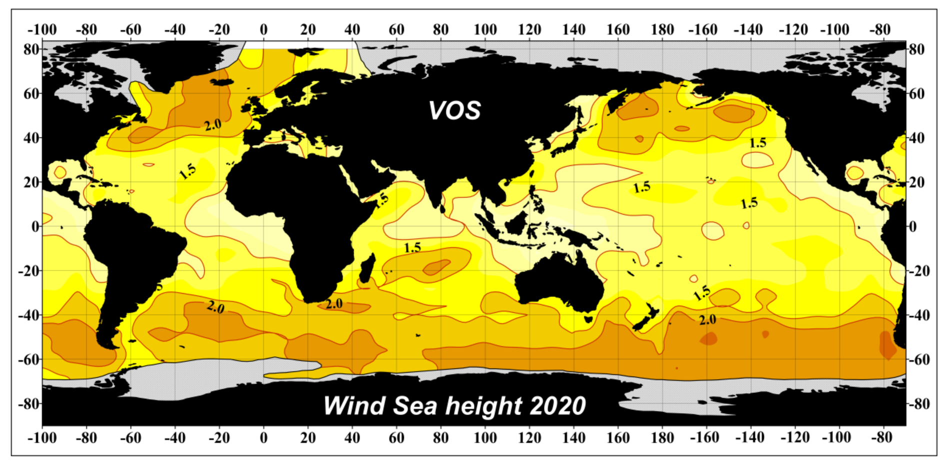


Annual maps of VOS and CFOSAT SWH also show consistency, with an expected smoother pattern for CFOSAT





Global maps of VOS wind sea heights and CFOSAT partition 1 also look promising for further analysis of wave partitioning in altimetry and visual observations



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