Multi-decadal chlorophyll time series merged from shipborne and satellite data

Mati Kahru, mkahru@ucsd.edu, Ralf Goericke rgoericke@ucsd.edu
Scripps Institution of Oceanography, UCSD, La Jolla, CA 92093-0218

Introduction and Methods

- In order to separate anthropogenic climate change in ocean chlorophyll-a concentration (Chla) from natural variations (due to ENSO, PDO, etc) we need time series that are at least 50 years long (Henson et al. 2010).
- Reliable satellite Chla time series are only about 20 years long and old shipborne samples are too few and inconsistently distributed.
- We propose a method how to normalize old shipborne Chla samples with satellite-derived climatology.
- All *in situ* samples are normalized to the seasonal and spatial mean (climatology) with 4 km spatial and 10 day seasonal resolution by subtracting $\log_{10}$(Chla) of the satellite climatology from $\log_{10}$(Chla) of the *in situ* data. Those individual differences (anomalies) are then pooled as 10-day, monthly and annual averages in characteristic regions.

Datasets

- By combining CalCOFI and CCE-LTER we have a total of 14,370 surface Chla stations from 1973 to 2019.
- For satellite data we use ESA Ocean Colour Climate Change Initiative (OC-CCI) (Sathyendranath et al., 2019, https://esa-oceancolour-cci.org/), the California Current regionally optimized dataset (CalFit) (Kahru et al., 2012, 2015, http://spg-satdata.ucsd.edu/CC4km/) and the California merged 1-km dataset of 1996-2020 (http://spg-satdata.ucsd.edu/ca1km/).

Results

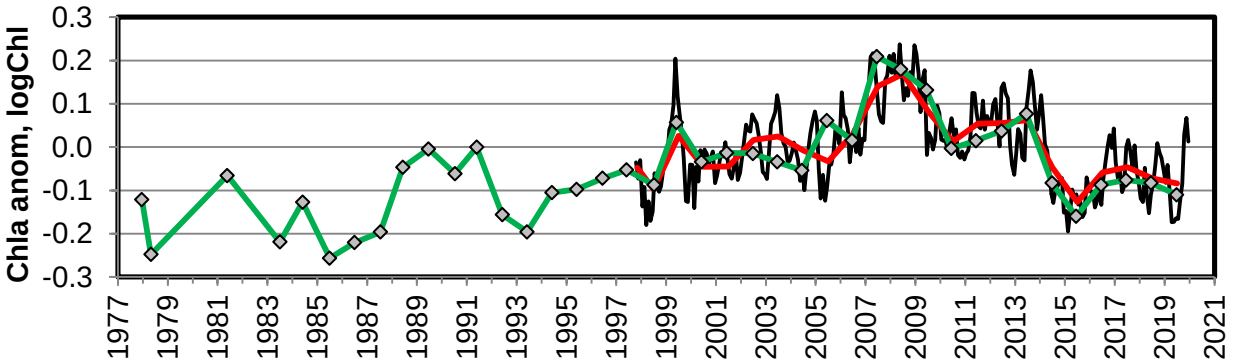

Fig. 1. Time series of Chla anomaly in offshore region of Sothern California (including CalCOFI nominal stations 93.30-80, 93.30-90, 93.30-100, 93.30-110, 90-90, 90-100, 90-110, 86.7-80, 86.7-90, 86.7-100, 86.7-110, 83.3-80, 83.3-90, 83.3-100 and 83.3-110):
In situ annual average (small gray diamonds connected with green line), satellite monthly average (black line), and satellite annual average (red line).