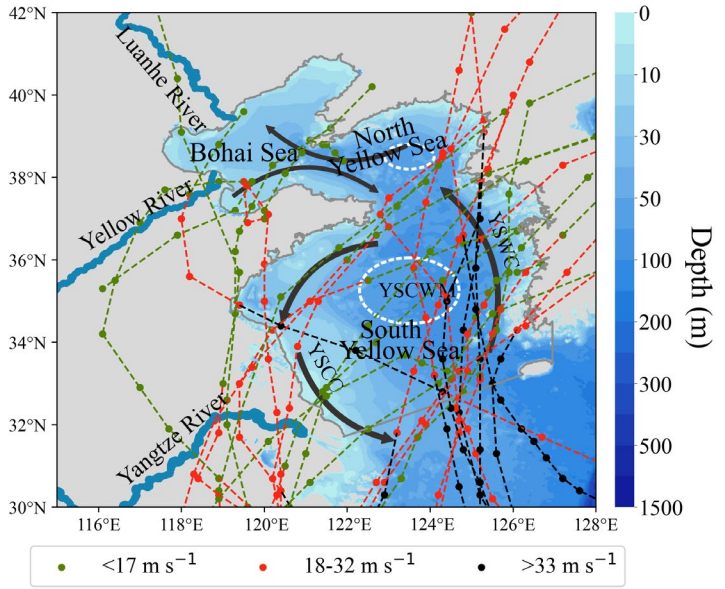
Impacts of Typhoon Events on the Dynamics of Chlorophyll-a and Particulate Organic Carbon in the Yellow Bohai Sea

Xiaowen Wang, Xiujun Wang*
College of Global Change and Earth System Science, Beijing Normal University, China

Introduction

Mid-latitude marginal seas experience increasing number of typhoon events in recent years, with implications for biogeochemical processes. The Yellow-Bohai Sea (YBS) is a semi-enclosed shallow marginal sea, which has had 1-2 typhoon events each year during the recent decade. However, little is known about the impacts of typhoon on carbon cycle in the YBS.

Regional setting

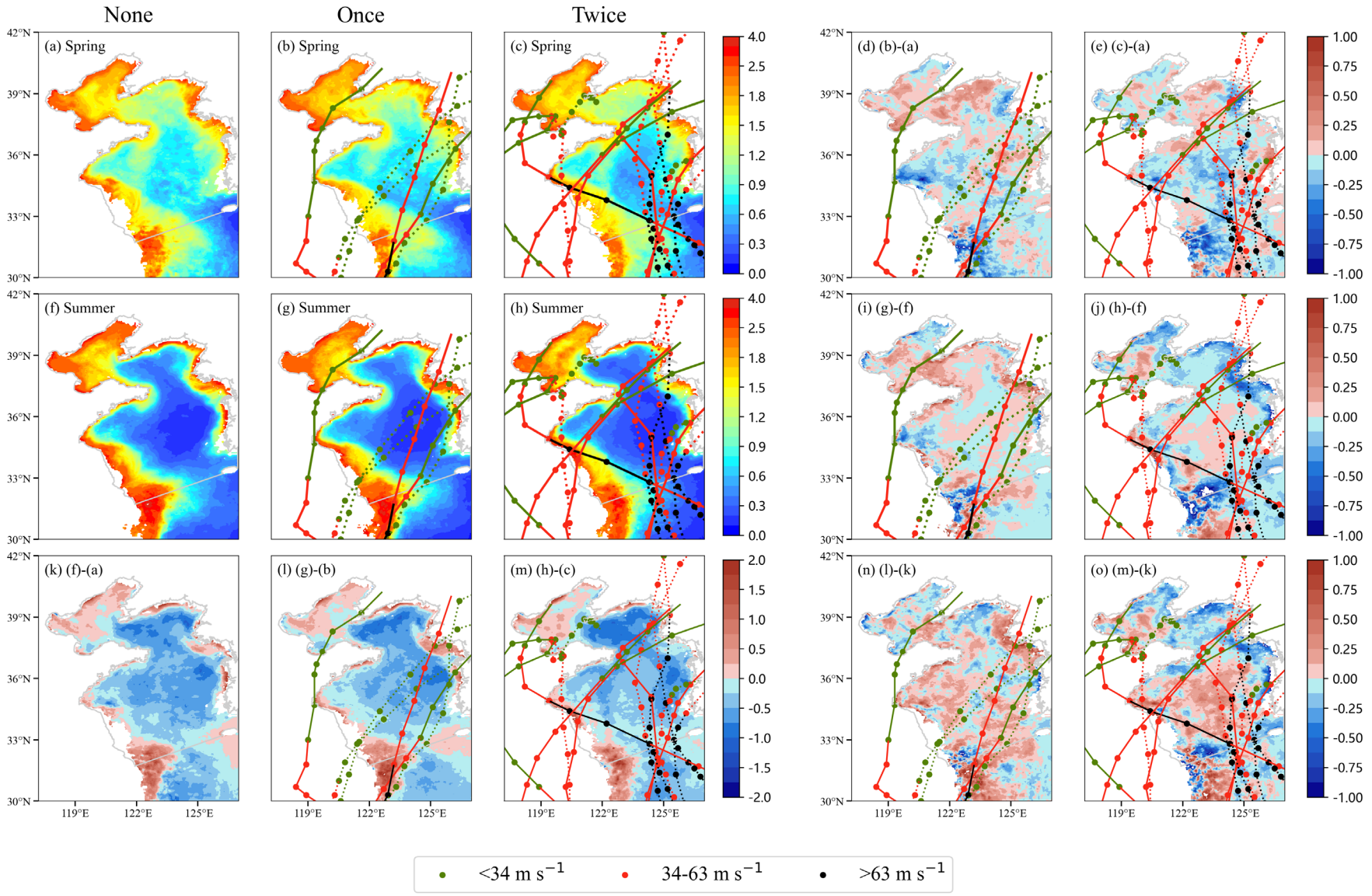


Bathymetry of the YBS, the Yellow Sea Coastal Current (YSCC), the Yellow Sea Warm Current (YSWC), the Yellow Sea Cold Water Mass (YSCWM), and main inflow rivers, with intensity and tracks of typhoons.

Data sources and analyses

- Wind speed and rainfall are from ERA5, particulate organic carbon and surface reflectance from MODIS.
- Typhoon-data are from Japanese National Institute of Informatics. There were 12 years with typhoon events in summer: one typhoon in 2004, 2005, 2007, 2008, 2009 and 2015, two typhoons in 2011, 2012, 2014, 2018, 2019 and 2020.
- Means of Chl-a and POC in spring and summer were calculated for the years with zero, one and two typhoon events, and their seasonal changes were compared between typhoon years and normal years.

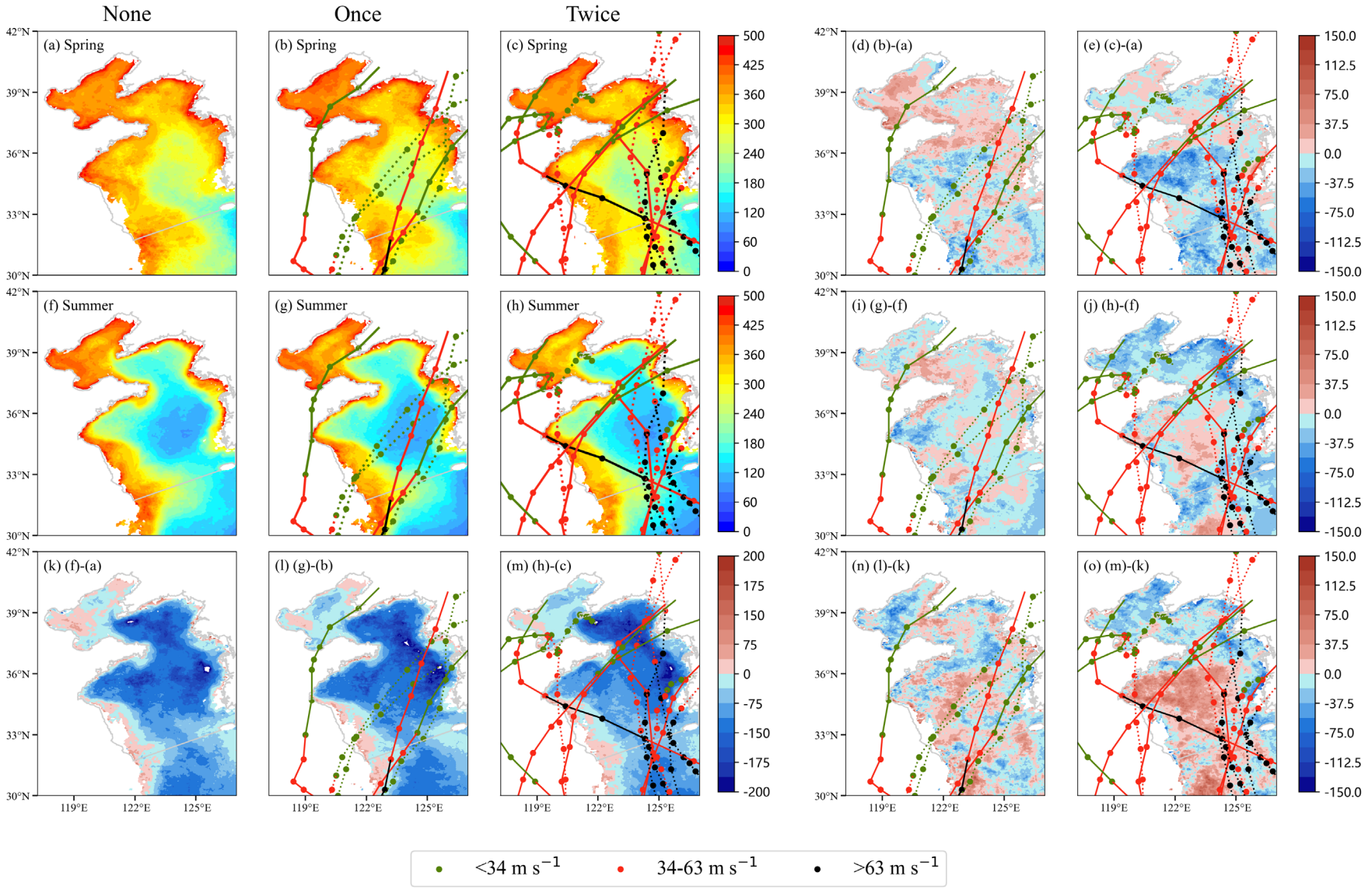
Results



Mean Chl-a (mg m^{-3}) in spring and summer with zero, one and two typhoons in each year during 2003-2020

- Chl-a showed an increase in summer of typhoon years in the Bohai Sea (BS), mainly in the western sections
- An increase in Chl-a was observed in the western Yellow Sea (YS) in the years with one typhoon
- There was a significant increase in Chl-a in the upper layer of YSCWM in the years with two typhoon events

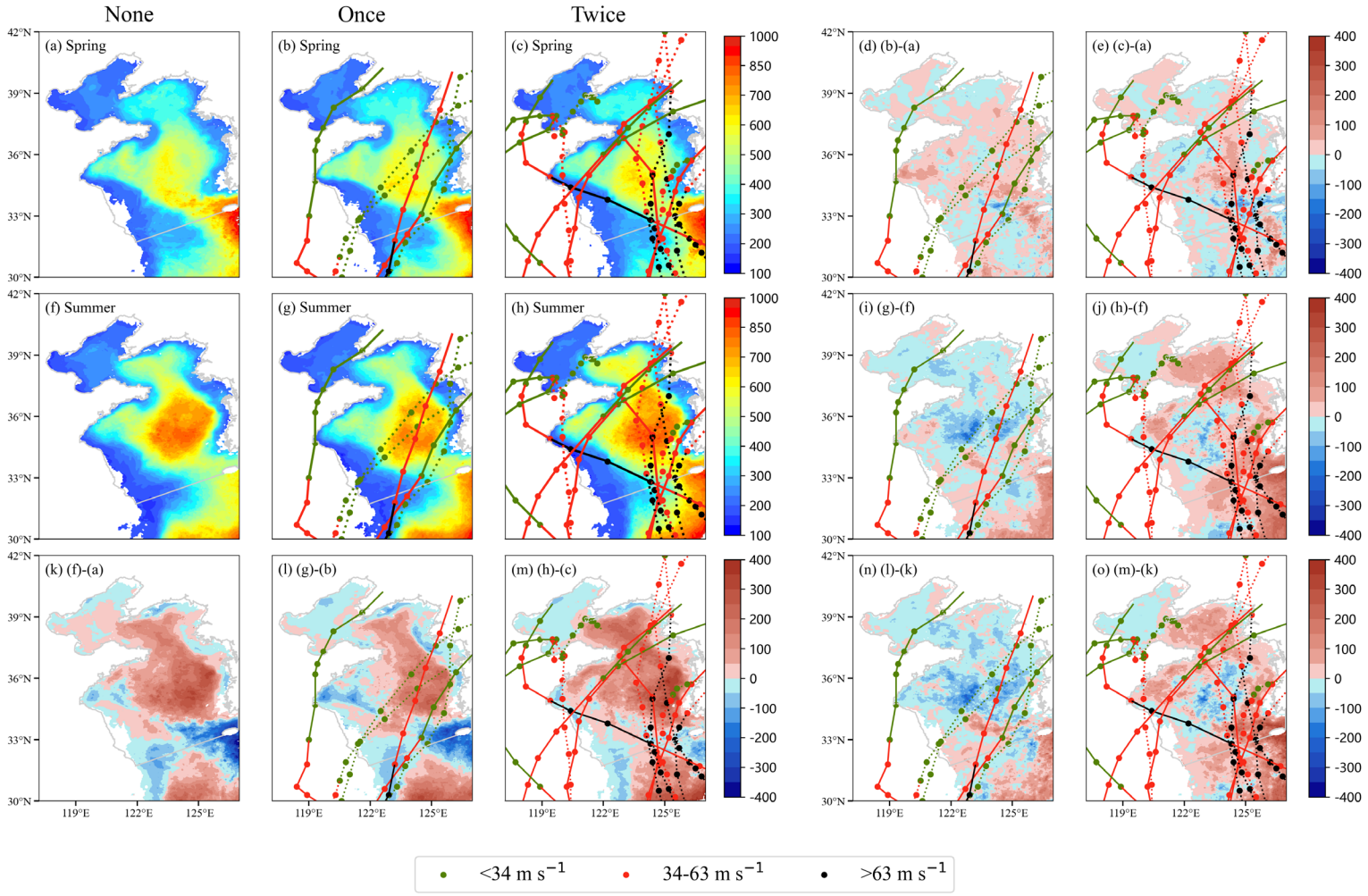
Results



Mean POC (mg m^{-3}) in spring and summer with zero, one and two typhoons in each year during 2003-2020

- POC revealed a reduction in summer of typhoon years in the BS
- An increase of POC was observed in nearly half area of the YS in typhoon years
- There was a significant increase of POC in the years with two typhoon events in the South Yellow Sea (SYS), especially in the upper layer of YSCWM

Discussion and Summary



Mean ratio of POC:Chl-a in spring and summer with zero, one and two typhoons in each year.

- POC revealed an increase in some coastal regions and western/central SYS and a decrease in the BS and some sections of the North Yellow Sea (NYS)
- Decreased POC:Chl-a ratio in the central SYS indicated main contribution of phytoplankton growth to the increase of POC
- Elevated POC:Chl-a ratio in coastal regions suggested large contributions (to POC increase) from sediment resuspension and terrestrial runoff
- Sedimentary/terrigenous POC could be transported from nearshore to offshore regions
- Stronger currents transported high-POC water into low-POC regions, responsible for the decrease of POC in the BS and some parts of NYS

Knowledge gaps and future directions

Knowledge gaps:

- Lack of field measurements in nutrients, Chl-a and POC;
- Lack of calibration/validation of remote sensing products of Chl and POC for coastal water/Case II water;
- Lack of integrative and systematic observations in both physical and biogeochemical parameters;
- Lack of observation-based model development

Future directions:

- Regular field measurements for phytoplankton biomass and community construction, Chl, POC and nutrients in representative sections in marginal seas;
- More accurate remote sensing algorithms for inversion of Chl and POC concentration in Case II waters;
- Systematic observations for current, temperature, salinity, together with biogeochemical parameters;
- Process-orientated model development and model-data synthetical studies

Contact: Xiujun Wendy Wang (xwang@bnu.edu.cn)