

Figure 6. EEMs fluorescence spectra and PARAFAC analysis. (A) Example EEMs at three locations (S3, S26 and S31) along the transect. Spectral properties of four fluorescent components (C1, C2, C3, and C4) identified by PARAFAC in Raman Units (R.U.) of intensity. Excitation and emission loadings derived from the four-component PARAFAC model using split-half validation technique (bottom right).

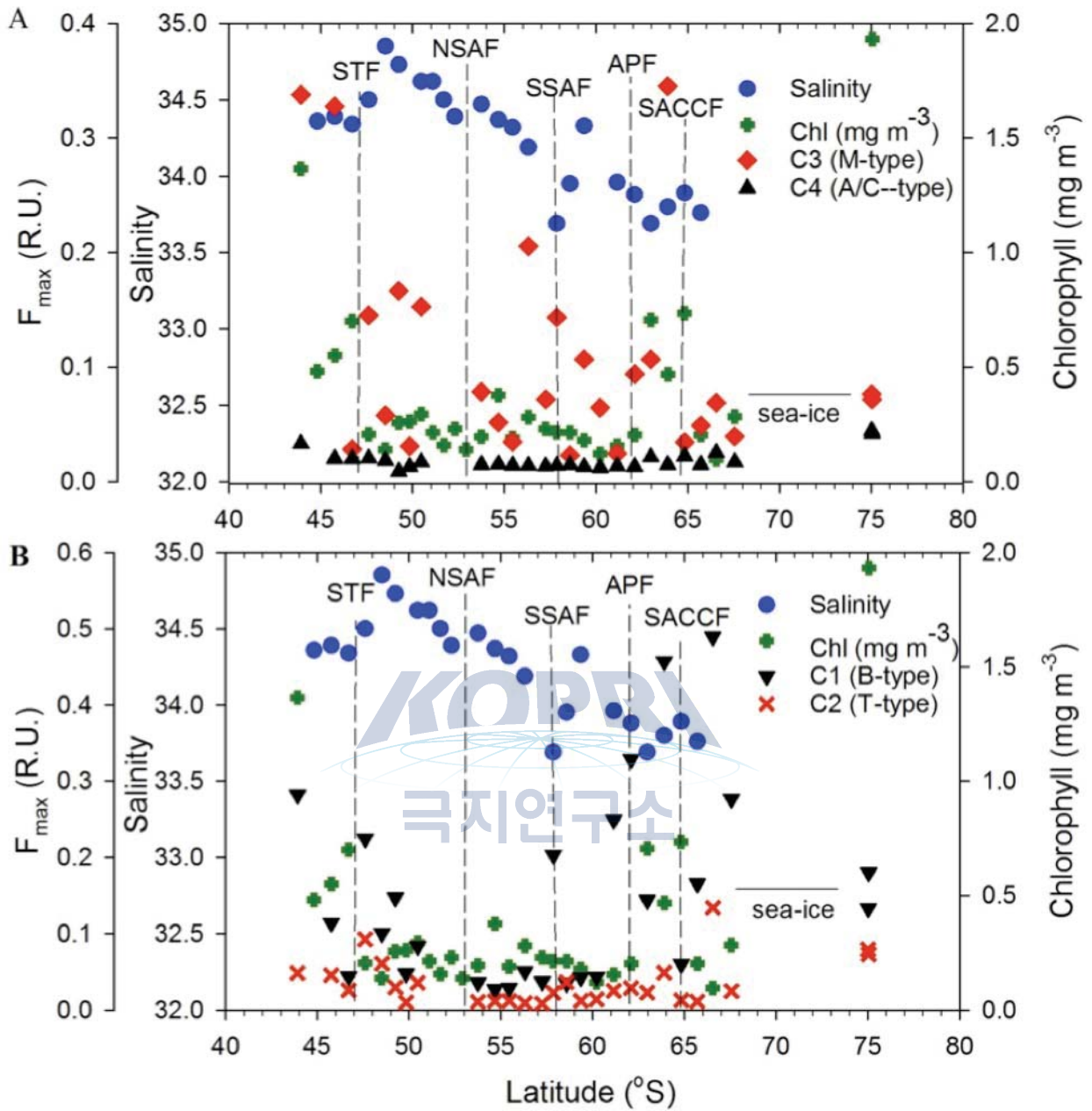


Figure 7. FDOM components. Meridional distribution of the (A) C3 and C4, (B) C1 and C2 FDOM components, sea surface salinity and chlorophyll along the transect. Dashed vertical lines show locations of the Southern Ocean fronts.



2. Analysis of bio-optical data obtained during the austral summer of 2015 along the New Zealand sector of the Southern Ocean and in the Ross Sea (manuscript in preparation)

During the 2015 austral summer, seawater samples were collected along the Araon transect as well as CTD stations in the Ross Sea (Figure 8-left) and processed in the laboratory. Measurements of CDOM spectral absorption, particulate (total, phytoplankton and non-algal) absorption coefficients, and EEMs fluorescence were then obtained on a spectrophotometer and a spectrofluorometer. DOC concentrations at these stations were also measured. These field bio-optical data were examined in conjunction with the physical properties in the Ross Sea (Figure 8 –right)

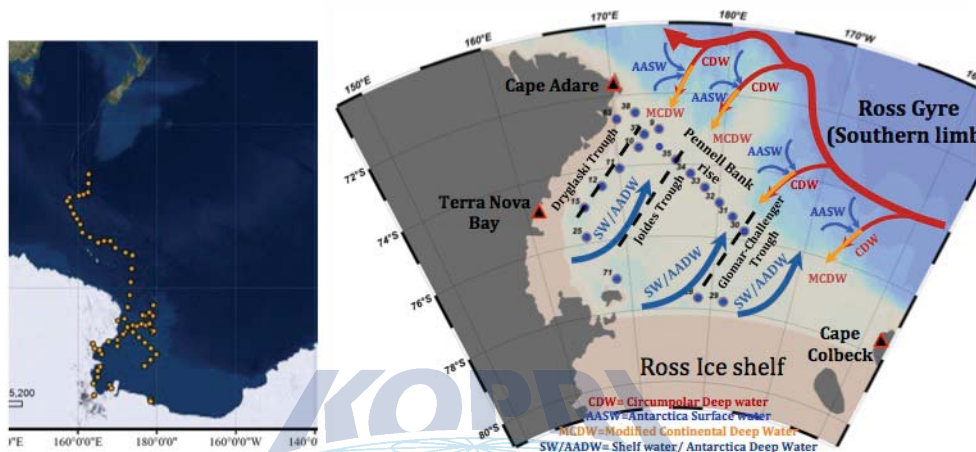


Figure 8. (Left) Sampling stations during the 2015 Araon cruise to the Southern Ocean. (Right) Location of sampling stations in the Ross Sea and physical regime corresponding to different water masses in the study area.

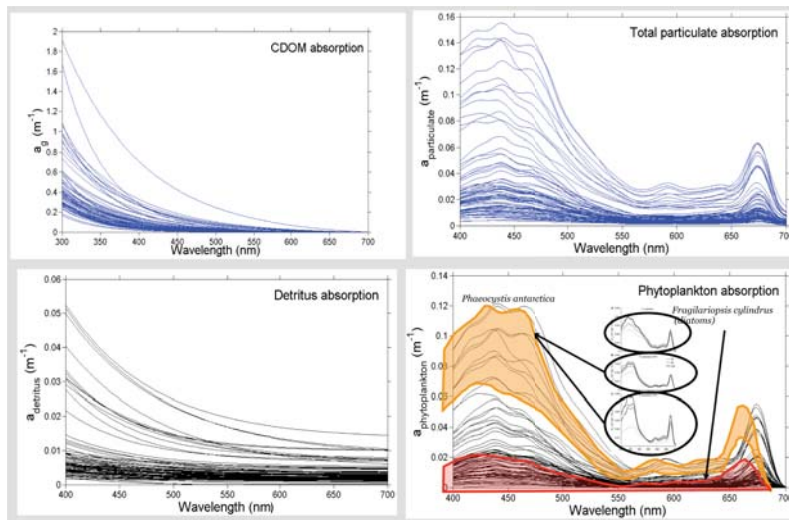


Figure 9. CDOM and particulate spectral absorption coefficients (total, non-algal, and phytoplankton) for all stations (at various depths – e.g., surface, mid-depth) in the Ross Sea.

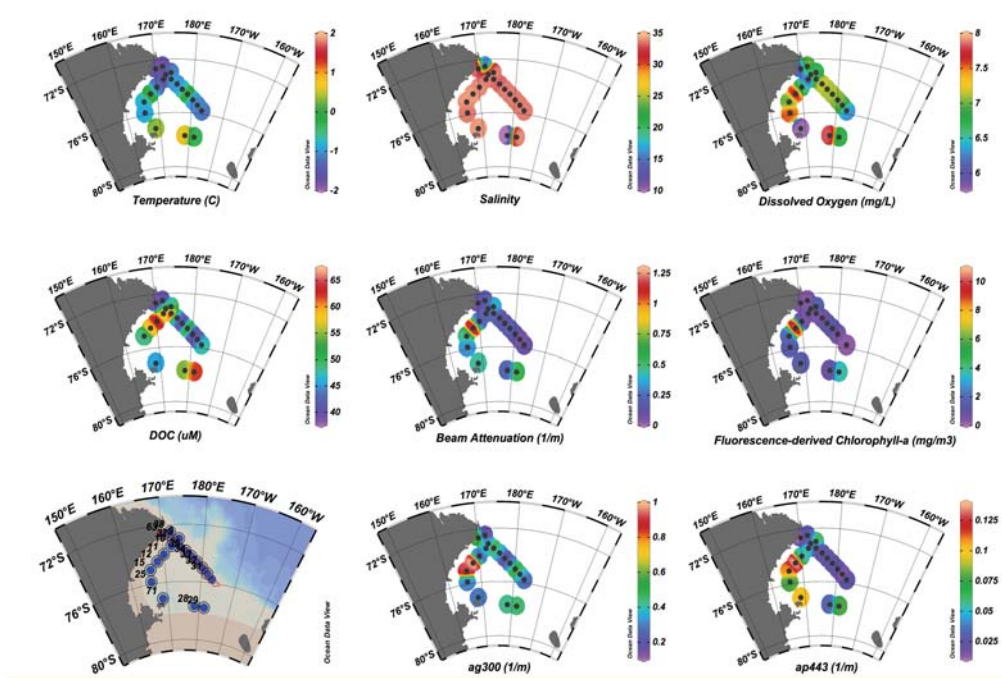


Figure 10. Surface hydrographic (temperature, salinity), and bio-optical (DOC, chlorophyll, absorption coefficients of CDOM, and particulate matter) properties along two transects in the Ross Sea.

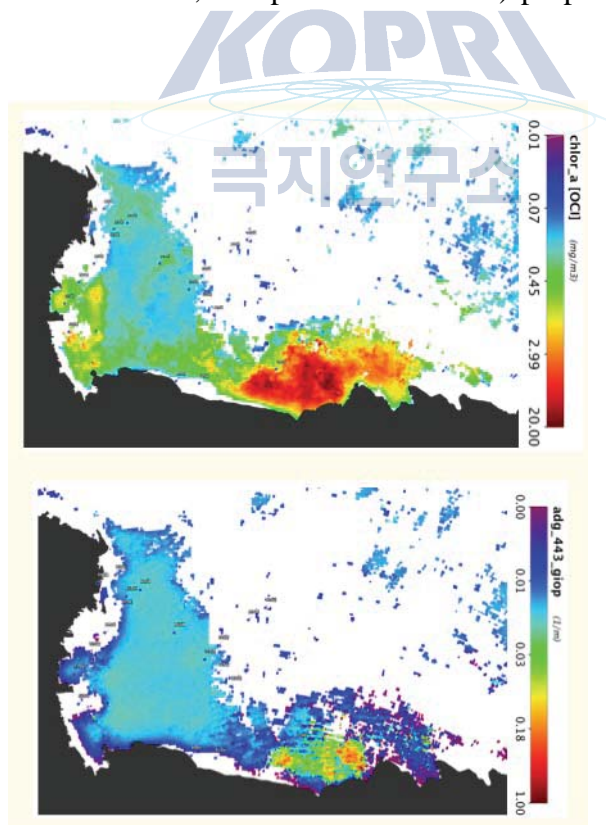


Figure 11. Satellite-derived (MODIS/Aqua) estimates of surface chlorophyll ( $\text{mg m}^{-3}$ ) and cdm (CDOM + nonalgal particulate matter) absorption coefficient at 443 nm averaged for the sampling period during austral summer (January 2015) in the Ross Sea.

## Summary results

Surface optical properties along the ARAON transect in the New Zealand sector of the Southern Ocean during 2014 cruise showed variability associated with different water masses. Both CDOM absorption and particulate matter absorption (indicative of CDOM, phytoplankton and non-algal matter concentrations) were generally higher off New Zealand coast and in the Terra Nova Bay, Ross Sea. However, along most of the transect that spanned the different water masses, CDOM and particulate absorption were very low, often close to the instrument detection limit. Satellite remote sensing data provided additional insights into the water masses present along the New Zealand Southern Ocean transect. Sea surface salinity from the new Aquarius satellite sensor provided important information on the frontal pattern (e.g., Subtropical Front (STF) which influenced the CDOM and chlorophyll distribution and further added to the understanding of the in situ bio-optical data. PARAFAC modeling of the fluorescence excitation-emission matrix (EEM) data revealed the presence of four fluorescence components in the CDOM pool of the Southern Ocean also common in the global ocean. Results of this study were presented at conferences and a paper has been published (D'Sa and Kim 2017-see reference list). Further, during the 2016 project year, a large number of seawater samples obtained during the Araon cruise to the Southern Ocean and the Ross Sea have been processed and analyzed in conjunction with hydrographic data. Work on a manuscript for submission to a peer-review journal has been initiated.

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주 의

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