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Seasonal and long-term variability of the characteristics surface frontal zones of the Barents and Kara seas

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One of the most important phenomena in the Arctic seas, in which all cascades of the scale of variability of oceanological processes are observed, are climatic and seasonal frontal zones. However, despite the climate changes noted by many researchers, so far, the ideas about the long-term dynamics and characteristics of the surface layer in the frontal zones in the Arctic region are fragmentary.

In our work, we considered seasonal and long-term variability of the Polar Frontal Zone (PFZ), the River Plumes Frontal Zone (RPFZ) and the Marginal Ice Zone (MIZ) in the Barents and Kara Seas. The authors evaluated their relationship with eddies structures and atmospheric oscillations. We used satellite data of temperature, salinity and sea level for the period from 2002 to 2020, which we processed using cluster analysis. To isolate the manifestations of eddies structures on the surface, we used radar images of the Envisat ASAR and Sentinel-1A/B. To analyze the relationship between the characteristics of the frontal zones and atmospheric oscillations, we used correlation analysis.

We have shown that the intensity of interannual and seasonal estimates of the SST gradient and the area of the PFZ and RPFZ in the first decade was an order of magnitude higher than in the period from 2011 to 2020. We observe the opposite pattern for the characteristics of the MIZ – in the second decade, the magnitude of the estimates of the SST gradient and area increases. We observe the maximum number of eddies structures in PFZ and RPFZ against the background of a general weakening of the SST gradients. We assume that this is due to the development of intense baroclinic instability in the frontal zones. In our opinion, the intensity of winter meridional transport over Northern Europe affects the growth of summer SST gradients and a decrease in the area of the PFZ and a decrease in SST in the RPFZ. The magnitude of the winter Arctic zonal transfer may increase the characteristics of SST in the RPFZ region. The value of the average seasonal gradient of the SST of the climatic surface PFZ is lower than that of the seasonal RPFZ and MIZ.

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