### Tab. 1 The anomalies of the initial ice day, final ice day, iceing duration, and temperature of Bayuquan, Qinhuangdao, Huludao, and Tanggu Stations

<table>
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Tab. 2: The anomalies of the initial ice day, final ice day, icing duration and temperature of Wentuozi, Zhimaowan, Donggang Stations.
3.2  

$$r = \frac{\sum_{i=1}^{n} (x_i - \bar{x})(y_{i+d} - \bar{y})}{\sqrt{\sum_{i=1}^{n} (x_i - \bar{x})^2 \sum_{i=1}^{n} (y_{i+d} - \bar{y})^2}}, (d = 0,1,2,3,4,5) \quad (1)$$

**Fig. 2** The distribution of the Initial ice day, Final ice day, Icing duration and temperature anomaly

**Fig. 3** Diurnal variation of sea ice area in the Liaodong Bay from 2006 to 2016
Fig. 4 Duration of sea ice in the Liaodong Bay from 2006 to 2016

Tab. 3 Cross-correlation coefficient between sea ice area in Liaodong Bay and daily temperature in Huludao Station

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Tab. 4 Cross-correlation coefficient between sea ice area in Liaodong Bay and daily temperature in Bayuquan Station

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### Tab. 5  Cross-correlation coefficient between ice bounding line in Liaodong Bay and daily temperature in Huludao Station

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### Tab. 6  Cross-correlation coefficient between ice bounding line in Liaodong Bay and daily temperature in Bayuquan Station

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辽东湾每日海冰外缘线距离与葫芦岛海洋站日平均气温时滞相关系数

辽东湾每日海冰外缘线距离与鲅鱼圈海洋站日平均气温时滞相关系数

3.3 1980-1983

82%

1980-1988

98%

1988-1998
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<td><strong>Tab.7</strong> Correlation between Atmospheric circulation index (Dec, Jan, and Feb) and monthly maximum sea ice area</td>
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| 24,1,8 | -0.42, -0.36, 0.29 |
| 16,7,15 | -0.51, 0.46, -0.44 |
| 2,1,19 | -0.35, -0.34, 0.33 |
| 1,6,20 | -0.69, 0.67, 0.64 |
| 18,1,19 | -0.66, -0.65, 0.65 |
| 6,20,19 | 0.71, 0.70, 0.69 |
| 18,19,7 | 0.71, 0.66, 0.64 |
| 15,9,21 | 0.77, -0.65, -0.65 |
| 15,9,3 | 0.75, -0.64, 0.63 |
| 15,16,21 | 0.65, 0.62, -0.59 |
| 15,9,21 | 0.72, -0.70, -0.63 |
| 15,16,3 | 0.66, 0.65, 0.59 |
| 15,4,3 | 0.67, 0.60, 0.59 |
| 21,12,13 | 0.63, -0.62, -0.62 |
| 0,1,12 | -0.65, -0.57, -0.55 |
| 1,18,9 | 0.41, -0.25, 0.24 |
| 1,14,20 | -0.70, -0.64, 0.63 |
| 5,3,20 | 0.50, -0.31, 0.27 |
| 5,17,18 | -0.52, -0.42, -0.37 |
| 15,22,0 | 0.40, -0.33, 0.33 |
| 1,5,17 | -0.71, 0.62, 0.60 |
| 22,18,0 | -0.34, 0.30, 0.26 |
| 1,2,17 | -0.67, -0.58, 0.57 |
### 3.4 Correlation between monthly maximum sea ice area and Arctic ice concentration

![Map showing correlation between monthly maximum sea ice area and Arctic ice concentration.](image)

**Fig. 5** Correlation between monthly maximum sea ice area and Arctic ice concentration

(a) current month (b) 1 to 5 months ahead (Significant at 95% level)
4

(1) 2005—2016

(2) 2010

(3) 2011

(4) 2015


SEA ICE IN THE LIAODONG BAY: STATISTICAL ANALYSIS BASED ON SATELLITE OBSERVATIONS

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Abstract Using the monitoring data of sea ice and the observation of air temperature from 2006 to 2016 in six marine stations in the Liaodong Bay along the northern Bohai Sea, the final ice day and the icing duration are used to better characterize the icing severity in the Liaodong Bay, North Bohai Sea. In most years, the final ice day and the icing duration are negatively correlated with the icing severity. Based on the sea ice area and outer edge distance data, the variation of icing severity in the 11 years was analyzed. The results show that the sea ice area in the Liaodong Bay was obviously influenced by the regional temperature, and a significant negative correlation was observed between the two variables. The inter-annual variation of sea ice in the Liaodong Bay is not only affected by regional climate, but also by the Pacific subtropical high, the Polar vortex, the East Asian Trough, Eurasian circulation index, and other climatic factors. The Pacific Subtropical High Northern Boundary Position Index, the Polar Vortex Area Index, the East Asian Trough Intensity Index, and the Eurasian Zonal Circulation Index are the most important influential factors, and these factors can be used as the predictive factors to the sea ice in the Liaodong Bay. In addition, the Arctic sea ice concentration can provide a reference for the prediction of sea ice in the Liaodong Bay.

Key words Liaodong Bay; icing severity; regional temperature; climatic factors; Arctic sea ice