

1 **Supplementary materials**

2 One table (Table S1) and three figures, i.e., Fig. S1, Fig. S2 and Fig. S3, are included in the
3 supplementary materials.

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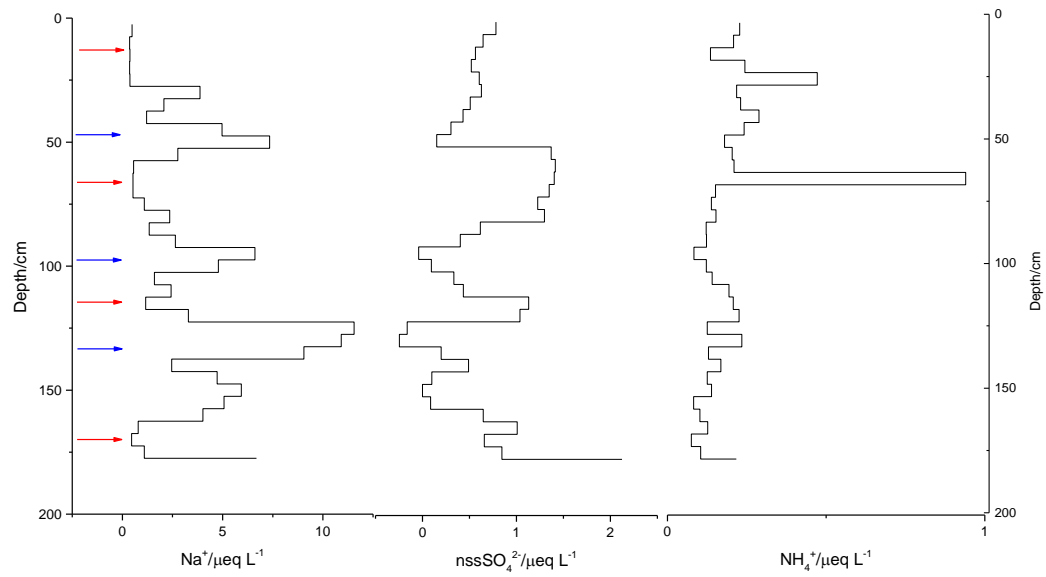
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6 **Table S1** The p values of independent samples t test between ion concentrations in 2015 and in the
7 other observation years. A p-value less than 0.05 (<0.05) is statistically significant.

Ions	2011	2012	2016	2019
Cl ⁻	0.000	0.000	0.002	0.023
Na ⁺	0.001	0.002	0.012	0.054
K ⁺	0.000	0.000	0.000	0.000
Mg ²⁺	0.118	0.065	0.148	0.260
SO ₄ ²⁻	0.000	0.000	0.000	0.000
Ca ²⁺	0.057	0.002	0.729	0.008

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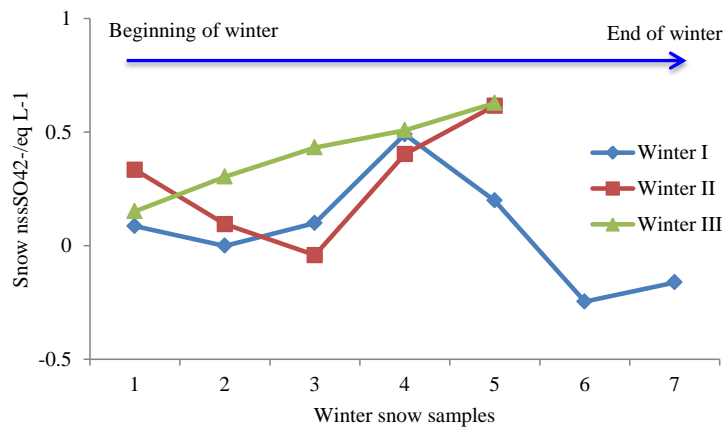


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12 **Figure S1** Profiles of ions in the coastal snow pit (P1) on the Chinese inland Antarctic traverse. Red
13 and blue arrows represent the middle of the identified summer and winter seasons, respectively (see the
14 main text).

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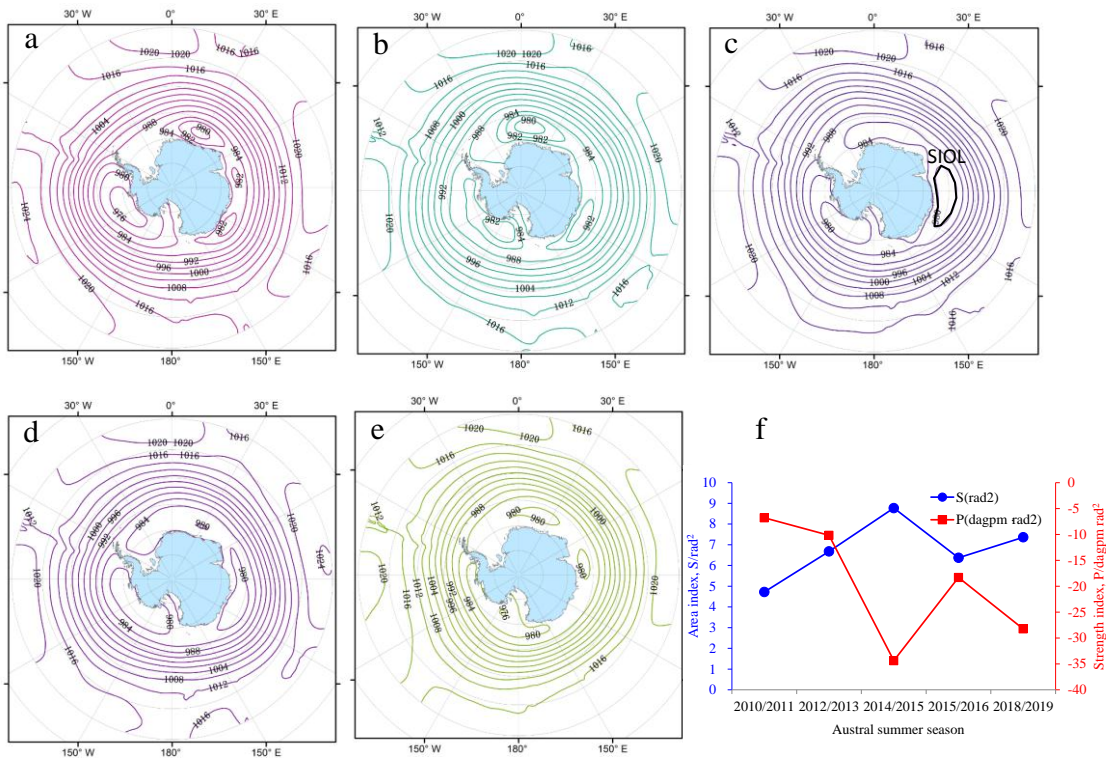
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18 **Figure S2** Non sea salt SO₄²⁻ concentrations in the three winters identified in the coastal snow pit (P1).

19 The first and last snow samples in individual winters correspond to the beginning and end of the austral

20 wintertime, respectively.

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24 **Figure S3** Climatological mean sea level pressure distribution over the southern ocean in the austral
 25 summers of 2010/2011 (a), 2012/2013(b), 2014/2015 (c), 2015/2016 (d), and 2018/2019 (e), derived
 26 from ERA-interim reanalysis, with a spatial resolution of 0.5 °. For a quantification of the strength of
 27 the Southern Indian Ocean low (SIOL), the circulation indices of a closed pressure system, i.e., the area
 28 area index (S) and strength index (P), were calculated over the domain 55°S-65°S, 60°E-90°E (Xiao et al.,
 29 2004; Wang et al., 2007). The results are shown in panel (f), with the higher S and lower P values
 30 corresponding to stronger Southern Indian Ocean Low (SIOL).

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33 **References**

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35 Wang, P., Lu, C., Guan, Z., Li, S., Yao, J., Yan, L., 2007. Definition and Calculation of Three Circulation
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37 Xiao, C., Mayewski, P.A., Qin, D., Li, Z., Zhang, M., Yan, Y., 2004. Sea level pressure variability over the
38 southern Indian Ocean inferred from a glaciochemical record in Princess Elizabeth Land, east
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