



Supplement of

The response of sea ice and high-salinity shelf water in the Ross Ice Shelf Polynya to cyclonic atmosphere circulations

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Figure S1. (a-j) Spatial distributions of 12 h average sea level pressure (colored shading) and 10-m
wind vectors (black arrow) in the Ross Sea and surrounding regions over 18–22 September 2014.



Figure S2. (a–j) Spatial distributions of 12 h average wind vectors and sea ice production (colored
shading) in the Ross Ice Shelf Polynya over 18–22 September 2014.



Figure S3. Time series of (a) HSSW volume variability and (b) averaged HSSW salinity over the RISP region shown in Fig. 2a from 00:00 on September 18 to 12:00 on September 24 2014. The gray shading represents the time of the SYNO2 event.

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Figure S4. (a–t) Vertical sections of the momentum equation terms (Eq. (2)) along S1 at four selected time moments during the SYNO1 event (indicated by the magenta triangles in Figs. 8a and 8b): (a, f, k and p) local acceleration, (b, g, l and q) Coriolis acceleration, (c, h, m and r) pressure gradient, (d, i, n and s) nonlinear advection and (e, j, o and t) eddy viscosity in the across-ice-shelf momentum budget.



Figure S5. (a–t) Vertical sections of the momentum equation terms (Eq. (1)) along S3 at four selected time moments during the SYNO1 event (indicated by the magenta triangles in Figs. 8a and 18b): (a, f, k and p) local acceleration, (b, g, l and q) Coriolis acceleration, (c, h, m and r) pressure gradient force, (d, i, n and s) nonlinear advection and (e, j, o and t) eddy viscosity in the along-ice-shelf momentum budget.



Figure S6. Spatial pattern of zonal components (U) for ocean currents at the depth of (a, d, g and j) 50 m, (b, e, h and k) 300 m and (c, f, i and l) 500 m at four selected time points (06:00 am on June 21, 12:00 am on June 22, 12:00 on June 23 and 06:00 on June 24). The black lines are the S1, S2, and S3 sections defined in Fig. 1b.

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Figure S7. Spatial pattern of meridional components (V) for ocean currents at the depth of (a, d, g and j) 50 m, (b, e, h and k) 300 m and (c, f, i and l) 500 m at four selected time points (06:00 am on June 21, 12:00 am on June 22, 12:00 on June 23 and 06:00 on June 24). The black lines are the S1, S2, and S3 sections defined in Fig. 1b.



45 Figure S8. Vertical sections of cross-transect velocity for barotropic geostrophic flow on (a, d, g and j)
46 S1, (b, e, h and k) S2 and (c, f, i and l) S3 at four selected time moments (indicated by the magenta
47 triangles in Figs. 11(a) and 11(b)) over MESO. Positive values denote eastward currents for S1 and
48 northward currents for S2 and S3.



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Figure S9. Vertical sections of cross-transect velocity for baroclinic geostrophic flow on (a, d, g and j) S1, (b, e, h and k) S2 and (c, f, i and l) S3 at four selected time moments (indicated by the magenta triangles in Figs. 11(a) and 11(b)) over MESO. Positive values denote eastward currents for S1 and northward currents for S2 and S3.

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Figure S10. Vertical sections of cross-transect velocity for barotropic geostrophic flow on (a, d, g and j) S1, (b, e, h and k) S2 and (c, f, i and l) S3 at four selected time moments (indicated by the magenta triangles in Figs. 7(a) and 7(b)) over SYNO1. Positive values denote eastward currents for S1 and northward currents for S2 and S3.



Figure S11. Vertical sections of cross-transect velocity for baroclinic geostrophic flow on (a, d, g and j) S1, (b, e, h and k) S2 and (c, f, i and l) S3 at four selected time moments (indicated by the magenta triangles in Figs. 7(a) and 7(b)) over SYNO1. Positive values denote eastward currents for S1 and northward currents for S2 and S3.