Supporting Information for "Surface heat fluxes drive a two-phase response in Southern Ocean mode water stratification"

Ciara Pimm[1], Richard G. Williams[1], Dani Jones[2,3], Andrew J. S. Meijers[2]

[1]Department of Earth, Ocean and Ecological Sciences, School of Environmental Sciences, University of Liverpool, Liverpool, UK

[2]British Antarctic Survey, NERC, UKRI, Cambridge, UK

[3]Cooperative Institute for Great Lakes Research, University of Michigan, Ann Arbor, MI, USA

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1. Figures S1 to S6

Introduction The supporting information includes four extra figures to give the reader insight into the details of the adjoint sensitivities of large-scale potential vorticity to different independent variables; surface heat flux, surface freshwater flux, eastward wind stress, and northward wind stress. The fifth figure gives extra information on the initial response to a heat flux perturbation upstream of the South Indian mode water formation region. The sixth figure shows the adjoint sensitivities of large-scale potential vorticity in the Southeast Pacific mode water formation region to surface heat flux.

Figures S1 - S6.

Corresponding author: C. Pimm, Department of Earth, Ocean and Ecological Sciences, School of Environmental Sciences, University of Liverpool, Liverpool, UK. (c.pimm@liverpool.ac.uk)

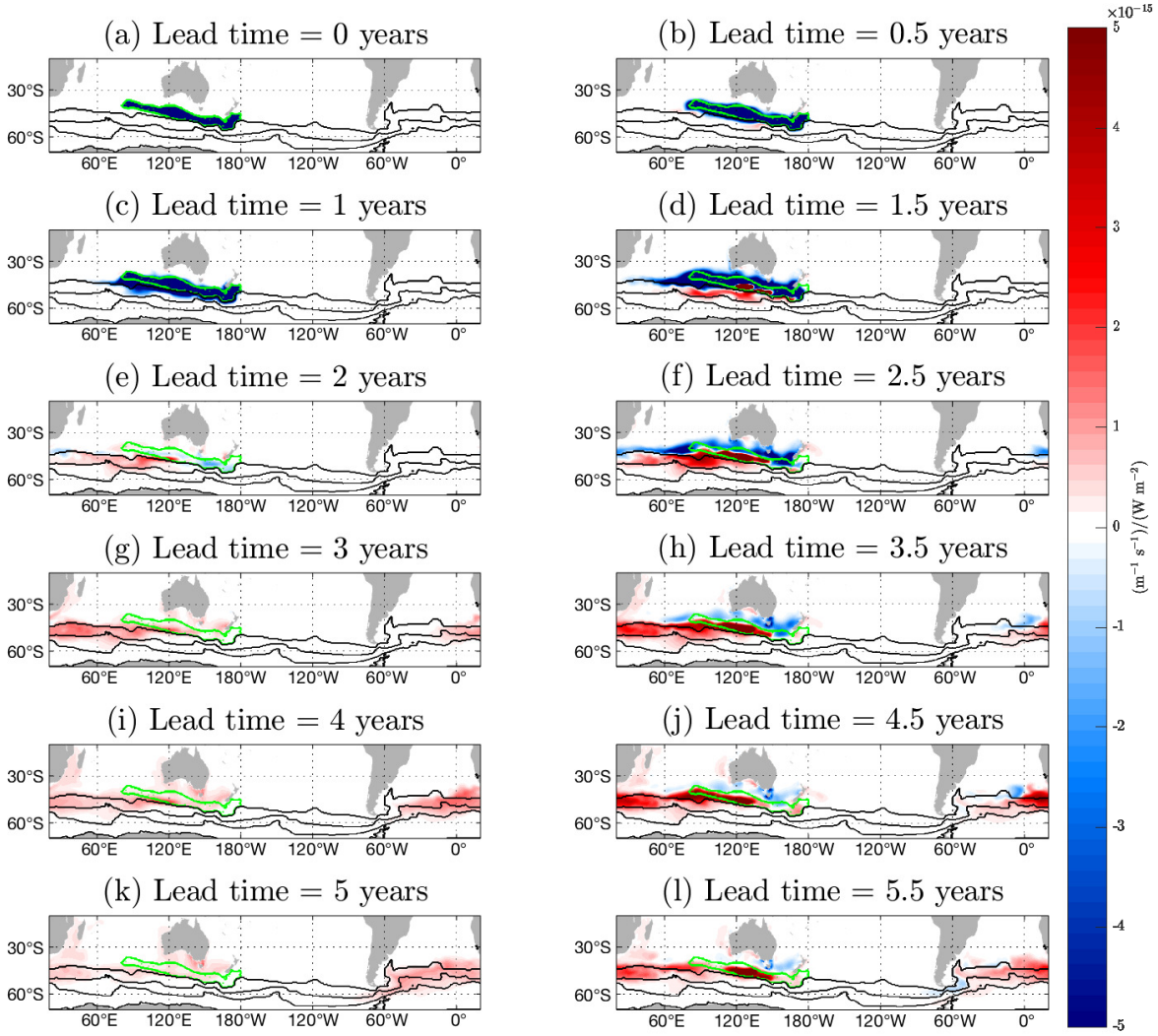


Figure S1. Sensitivity of large-scale PV to surface heat flux ($(m^{-1}\ s^{-1})/(W\ m^{-2})$) at the surface for lead times of 0 - 5.5 years. The South Indian adjoint sensitivity target region (green) and frontal zones of the ACC (black contours, as in Figure 2) are included.

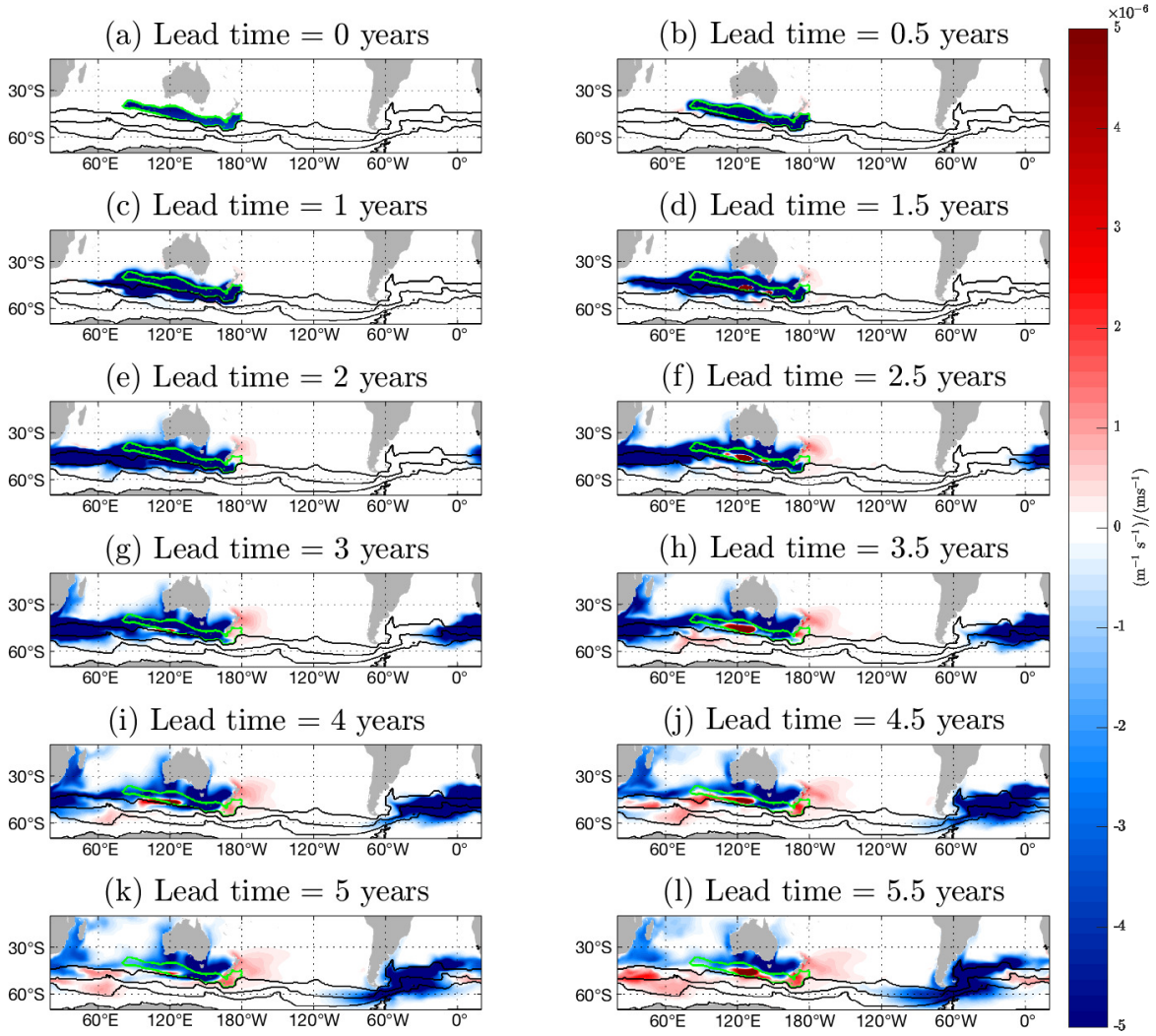


Figure S2. Sensitivity of large-scale PV to surface freshwater flux $((\mathrm{m}^{-1}\ \mathrm{s}^{-1})/(\mathrm{m}\ \mathrm{s}^{-1}))$ at the surface for lead times of 0 - 5.5 years. The South Indian adjoint sensitivity target region (green) and frontal zones of the ACC (black contours, as in Figure 2) are included.

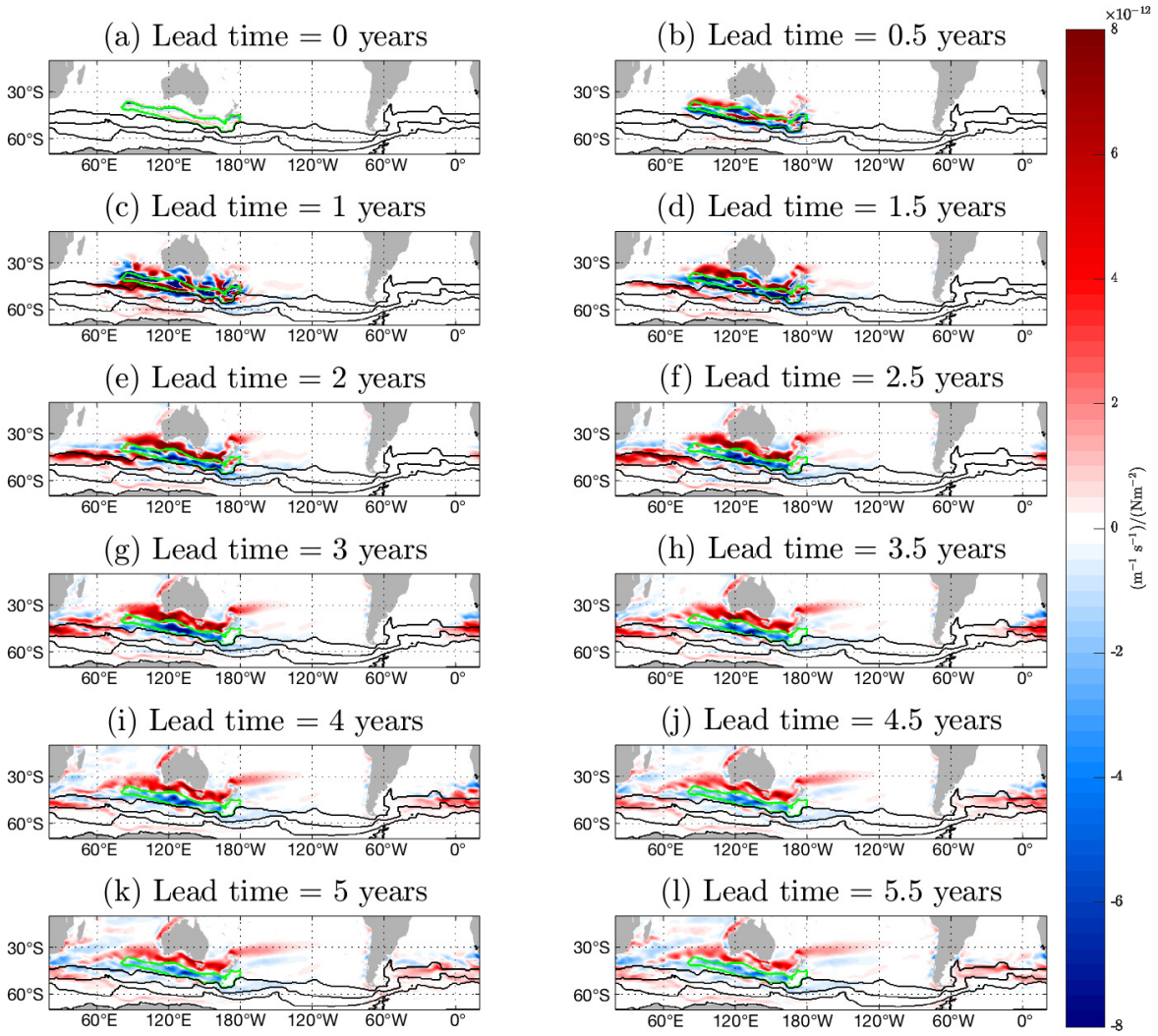


Figure S3. Sensitivity of large-scale PV to eastward wind stress $((\mathrm{m}^{-1}\ \mathrm{s}^{-1})/(\mathrm{N}\ \mathrm{m}^{-2}))$ at the surface for lead times of 0 - 5.5 years. The South Indian adjoint sensitivity target region (green) and frontal zones of the ACC (black contours, as in Figure 2) are included.

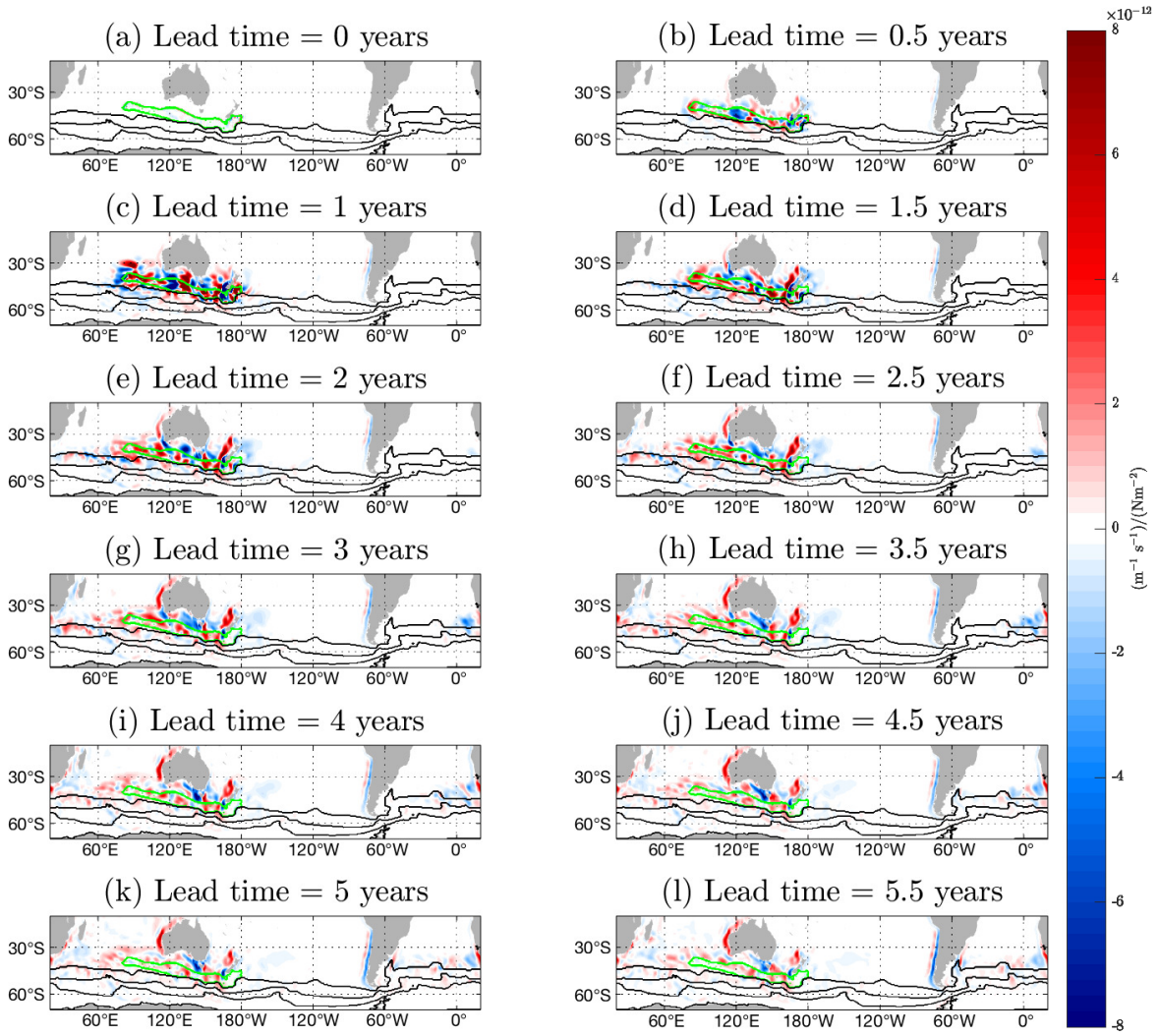


Figure S4. Sensitivity of large-scale PV to northward wind stress $((\mathrm{m}^{-1}\ \mathrm{s}^{-1})/(\mathrm{N}\ \mathrm{m}^{-2}))$ at the surface for lead times of 0 - 5.5 years. The South Indian adjoint sensitivity target region (green) and frontal zones of the ACC (black contours, as in Figure 2) are included.

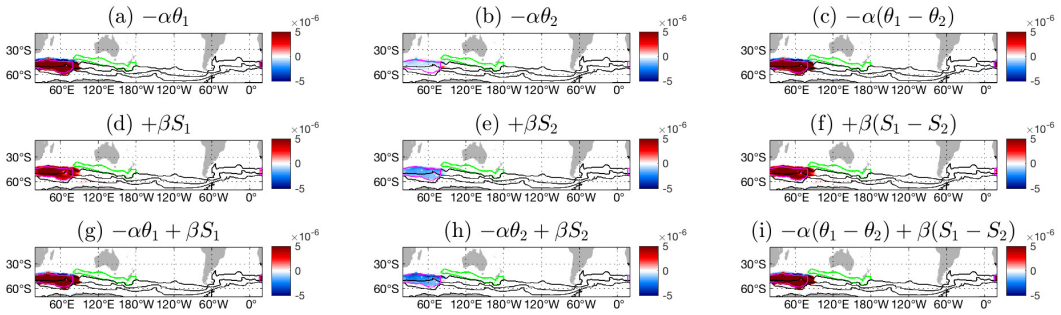


Figure S5. Upstream cooling perturbation experiment minus control experiment after 3 months for each of the component parts of large-scale PV. (a) Upper depth thermal component, (b) lower depth thermal component, (c) upper depth minus lower depth thermal component, (d) upper depth haline component, (e) lower depth haline component, (f) upper depth minus lower depth haline component, (g) upper depth density component, (h) lower depth density component, and (i) upper depth minus lower depth density component. Together with sea surface height contours (-0.25, -1, -1.5 m, black) defining the fronts of the ACC, the South Indian adjoint sensitivity target region (green contour), and the region where the 100 Wm^{-2} heat flux perturbation is imposed for 3 months in winter (magenta contour).

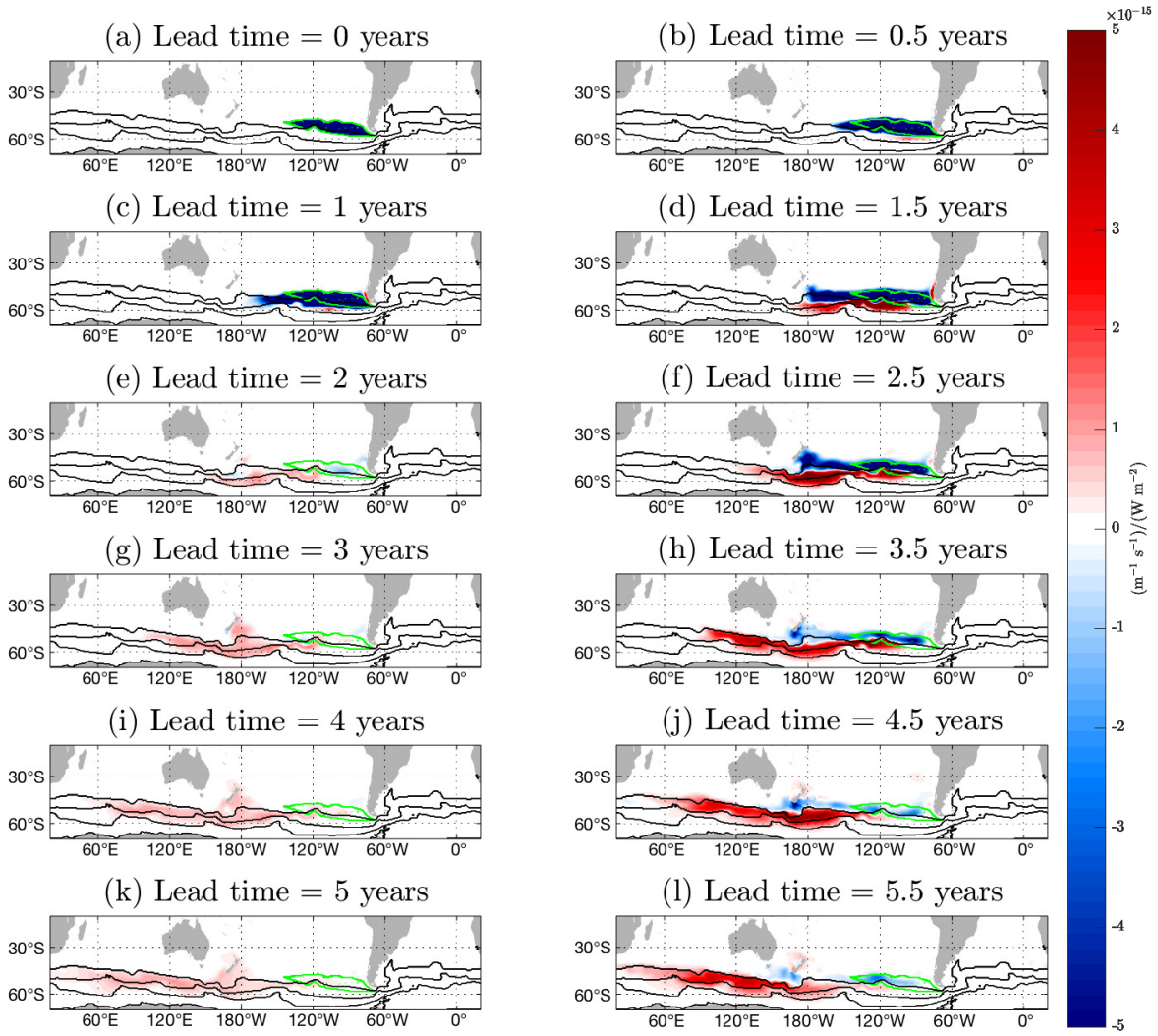


Figure S6. Sensitivity of large-scale PV to surface heat flux ($(m^{-1}\ s^{-1})/(W\ m^{-2})$) at the surface for lead times of 0 - 5.5 years. The Southeast Pacific adjoint sensitivity target region (green) and frontal zones of the ACC (black contours, as in Fig. 1) are included.