STORMS AND THE FORMATION OF HIGH SALINITY SHELF WATER IN THE BARRIER POLYNYA, EAST ANTARCTICA

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Background:
- High Salinity Shelf Water (HSSW) originates at coastal polynas around Antarctica due to intense sea-ice production
- Salt is ejected in the upper ocean and form HSSW
- HSSW is an important precursor of Antarctic Bottom Water (AABW) and therefore has great climate importance

Objective:
- Understand the impact of low pressure systems in the HSSW formation in polynas of the East Antarctica region

Methods:
- Pan-Antarctica domain of the Regional Ocean Modelling System (ROMS) with 4-km horiz. resolution (WAOM v1.0, Richter et al. 2020)
- Forced with prescribed surface heat and salt fluxes estimated from sea-ice products (Tamura et al 2011) and ERA-interim winds (Dee et al. 2011)
- Two storm events were analyses in the vicinity of the Barrier Polynya (dot green, Fig. 1)

Results:
Storm 1-5 August 2007
- Low-pressure system north of the Barrier Polynya (Fig. 3)
- Winds weaken locally and increase air temperature (Fig. 2)
- The upper-10m of the ocean warms, no clear changes in ocean salinity (Fig. 4)

Storm 8-11 August 2007
- Larger low-pressure system (Fig. 3)
- Strengthen offshore winds and decreasing air temperature at the polynya (Fig. 2)
- Ocean hydrography changes indicate overturning: cooling (top-15m) and warming (15-30m)
- Increase salinity suggests HSSW formation (Fig. 5)

Conclusions:
- The upper-ocean hydrography at the Barrier Polynya is sensitive to atmospheric forcing
- Two low-pressure systems with offshore winds caused different response in the ocean properties
- A strong storm (8-11 August) induces offshore winds, enhances sea-ice production and salt input in the upper-ocean >>> High Salinity Shelf Water formation is likely to increase
- A somewhat weaker/smaller storm causes air temperature to rise and the upper-ocean to warm: no effect for High Salinity Shelf Water production

Next steps:
- Extend analyses to other polynas in the East Antarctica and to other storm events
- Quantify the importance of low-pressure systems to the production of HSSW
- Comparison between 10, 4 and 2km WAOM solutions to identify the impact of resolved dynamics (eddies, tides) and topography

References: