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Imprint of the ocean mesoscale activity on air-sea-ice interactions in a regional coupled model of the Adélie Land sector

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The mesoscale activity of the ocean – eddies and fronts with dimensions ranging from 1 to 100 km which populate the Southern Ocean – is thought to modulate air-sea interactions due to its imprint on the sea surface conditions. However, very little is known about the effects of the mesoscale activity on the exchanges between the ocean and the atmosphere of polar regions. The smaller deformation radius and the seasonal sea ice coverage suggest that air-sea interactions at the mesoscale could be very different at high latitude. In this study, we examine how mesoscale ocean eddies affect the state of the atmosphere and the air-sea interactions in polar regions. We use a regional, eddy resolving ocean-sea ice-atmosphere coupled model (NEMO-LIM 1/24° and MAR at 10 km) of the Southern Ocean off the Adélie Land sector, in East Antarctica. We describe the imprint of the eddies on the near surface atmosphere with specific attention to the effect of the sea ice. The role of feedbacks between the air, sea and ice is further investigated. A series of experiments is carried out where the signature of the mesoscale variability on the sea surface is filtered out before the exchange with the atmosphere model. We use these experiments to explore the role of the modulation of air-sea-ice interactions by the ocean mesoscale activity in the evolution of the ocean, sea ice and atmosphere near the Marginal Ice Zone on daily to seasonal time scales. This study advances our understanding of the poorly explored role of the eddies on air-sea interactions in the polar regions.