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Structure and variability of the Antarctic coastal easterly winds

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The belt of climatological easterly (westward) winds that lies to the south of the circumpolar trough of low pressure surrounding Antarctica has received less attention than the westerlies to the north of the trough, yet it plays a crucial role in atmosphere-ocean-cryosphere interactions in the near-coastal region. The westward-directed wind stress associated with the easterly winds drives a coastal westward ocean current and a westward transport of sea ice around the continent. Easterly winds also inhibit the flow of warm water masses from intermediate depths onto the continental shelves, thus protecting coastal ice shelves from enhanced basal melt. We use the ECMWF ERA-Interim reanalysis to study the mean structure and variability of the coastal easterly winds. The surface component of the easterlies generally extends no more than 200 km to the north of the coast. The easterlies are quite shallow (~ 1-2 km) and are relatively weak (generally < 3 m s^{-1} at the surface in the annual mean) over the ocean but become both deeper (~ 2-3 km) and stronger (~ 7 m s^{-1}) over the steep coastal slopes of the continent. While persistent katabatic flow down these slopes is a source of easterly momentum (through the action of the Coriolis force), the primary driver of the easterlies appears to be the large-scale baroclinicity of the flow, which is enhanced in the coastal region where isentropes are forced to follow the steep coastal orography. Variability of the easterlies on monthly and longer timescales is related to variations in the strength and latitude of the circumpolar trough. On shorter (synoptic) timescales, large variations in the strength of the easterlies at coastal locations are forced by cyclones that move south from the circumpolar trough and decay in the coastal region.