



Consistent past half-century trends in the atmosphere, the sea ice and the ocean at high southern latitudes

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Simulations performed with the climate model LOVECLIM, aided with a simple data assimilation technique that forces a close matching of simulated and observed surface temperature variations, are able to reasonably reproduce the observed changes in the lower atmosphere, sea ice and ocean during the second half of the 20th century. Although the simulated ice area slightly increases over the period 1980-2000, in agreement with observations, it decreases by 0.5 million square kilometers between early 1960s and early 1980s. No direct and reliable sea ice observations are available to firmly confirm this simulated decrease, but it is consistent with the data used to constrain model evolution as well as with additional independent data in both the atmosphere and the ocean. The simulated reduction of the ice area between the early 1960s and early 1980s is similar to the one simulated over that period as a response to the increase in greenhouse gas concentrations in the atmosphere while the increase in ice area over the last decades of the 20th century is likely due to changes in atmospheric circulation. However, the exact contribution of external forcing and internal variability in the recent changes cannot be precisely estimated from our results. Our simulations also reproduce the observed oceanic subsurface warming north of the continental shelf of the Ross Sea and the salinity decrease on the Ross Sea continental shelf. Parts of those changes are likely related to the response of the system to the external forcing. Modifications in the wind pattern, influencing the ice production/melting rates, also play a role in the simulated surface salinity decrease