Introduction

This supporting material contains supplementary figures S1 to S3 which are referenced in the main manuscript.
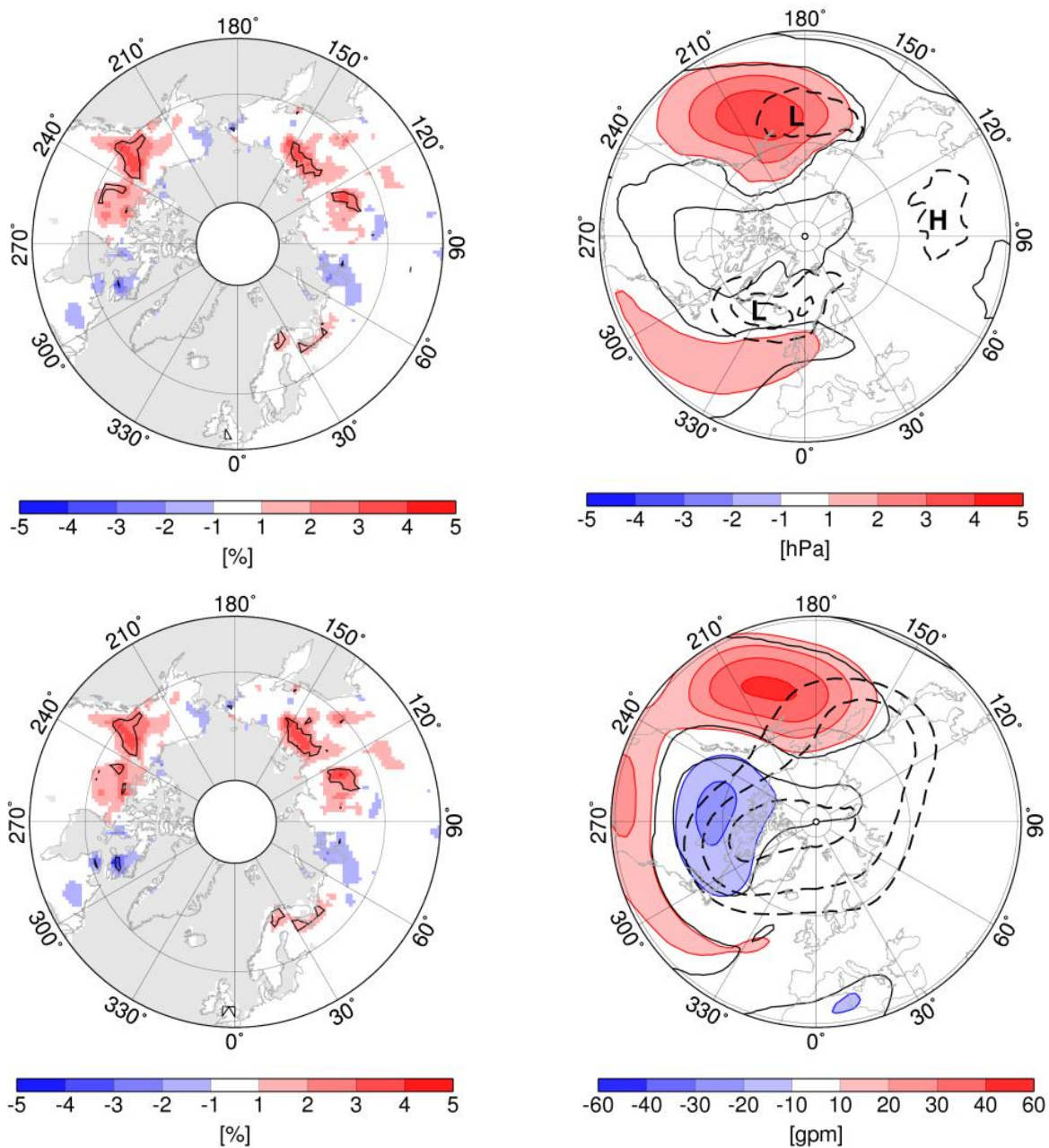
Figure S1. First pair of coupled patterns obtained by the maximum covariance analysis (MCA) of simulated October snow cover with simulated sea-level pressure (upper row) and GPH500 fields (lower row) in winter (DJF mean) from 1979-2012. All data are from the ensemble mean of three ECHAM6-AMIP simulations from 1979-2008. Column 1 displays the snow-cover anomaly maps (in [%]) as heterogeneous regression maps. Column 2 displays the corresponding anomaly maps for the atmospheric variables as homogeneous regression maps. Thin black contours show the significance of the regressions at the 95% level. Dashed contours show the simulated climatological mean (1980-2008) atmospheric fields of SLP and GPH500 respectively. All data have been linearly detrended before calculating the MCA.
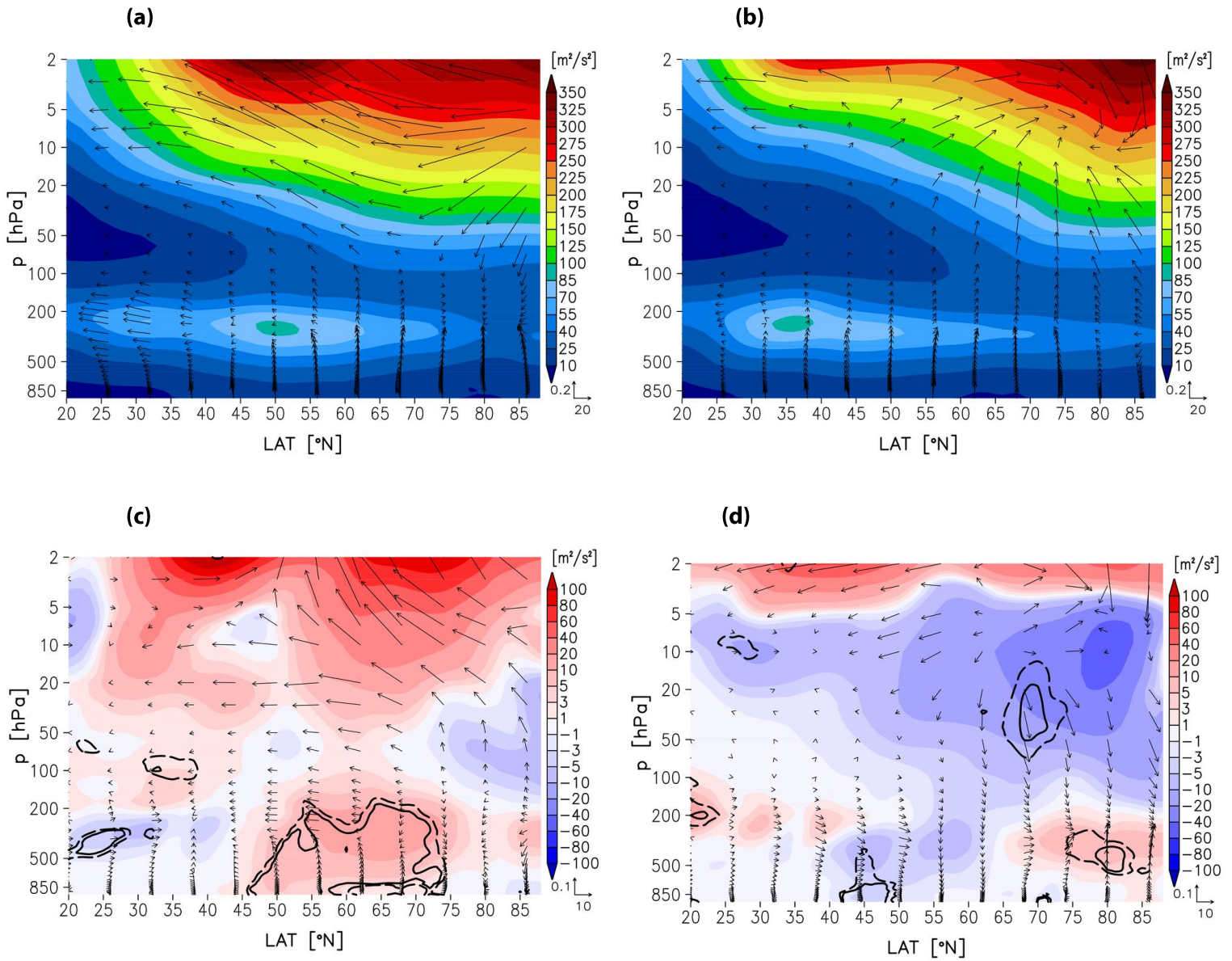
(a)

(b)

(c)

(d)

Figure S2. (a) Climatology of zonally averaged (over the Atlantic Ocean sector from -60°E to 30°E) magnitude of the planetary-scale wave EP flux vector for winter (DJF) based on ERA-Interim data from 1979-1012 (in [m2/s2], contours). Vectors indicate the vertical and meridional components of the EP flux vector. (b) As (a) but for zonally averaged over the Pacific Ocean sector from 150°E to 240°E. (c) Differences of zonally averaged (over the Atlantic Ocean sector from 60°W to 30°E) magnitude of the planetary-scale wave EP flux vector for winter (DJF) based on ERA-Interim between low (2001-2012) and high (1979-2000) ice phases for winter (DJF) based on ERA-Interim data. (d) As (c) but for zonal averages over the Pacific Ocean sector from 150°E to 240°E. Statistical significance with a 90% (95%) confidence level is delineated by dashed (solid) black contour.

(a)

(b)

(c)

(d)

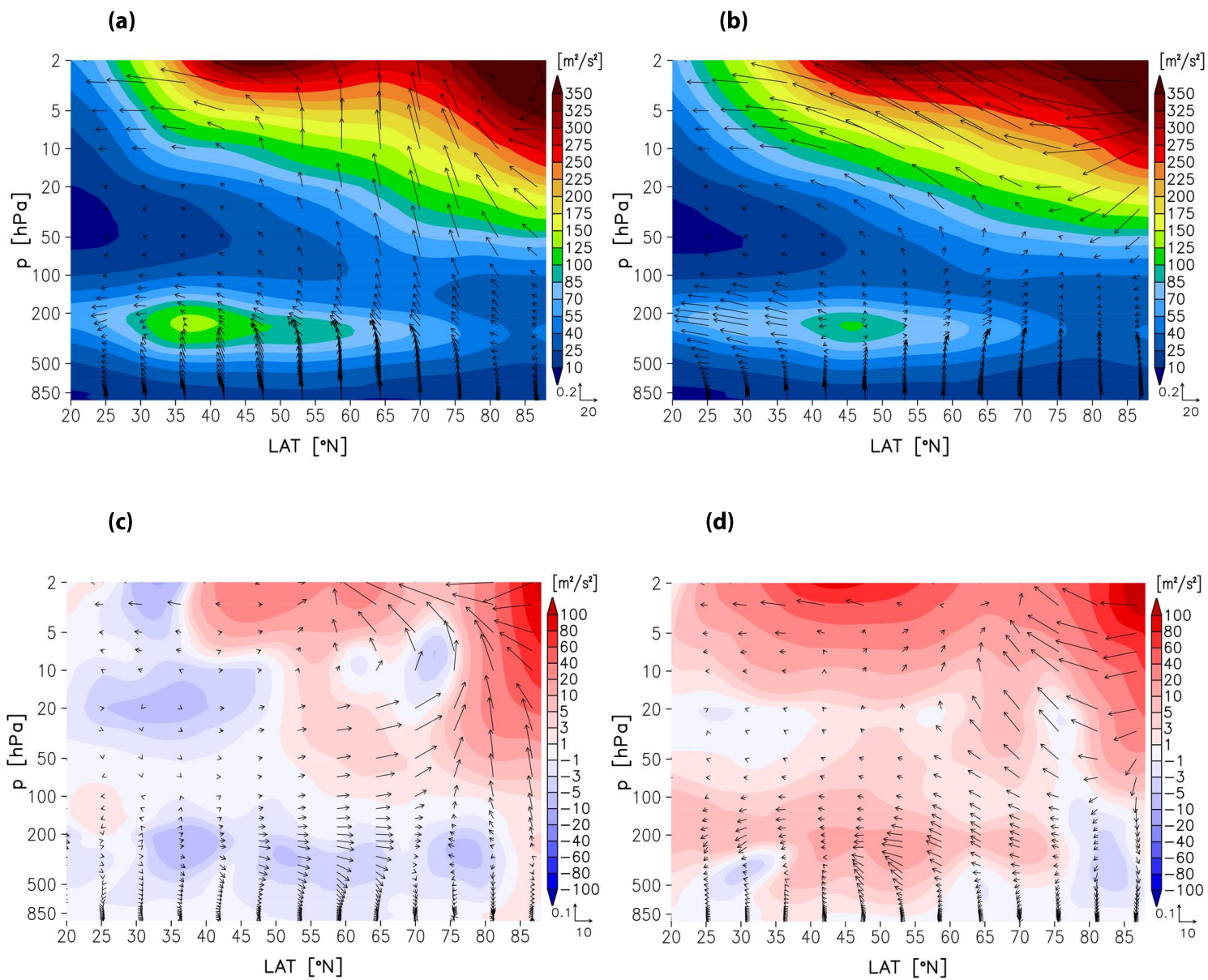**Figure S3.** As Fig. S2, but based on the ensemble mean data from three ECHAM6-AMIP runs from 1979-2008.