

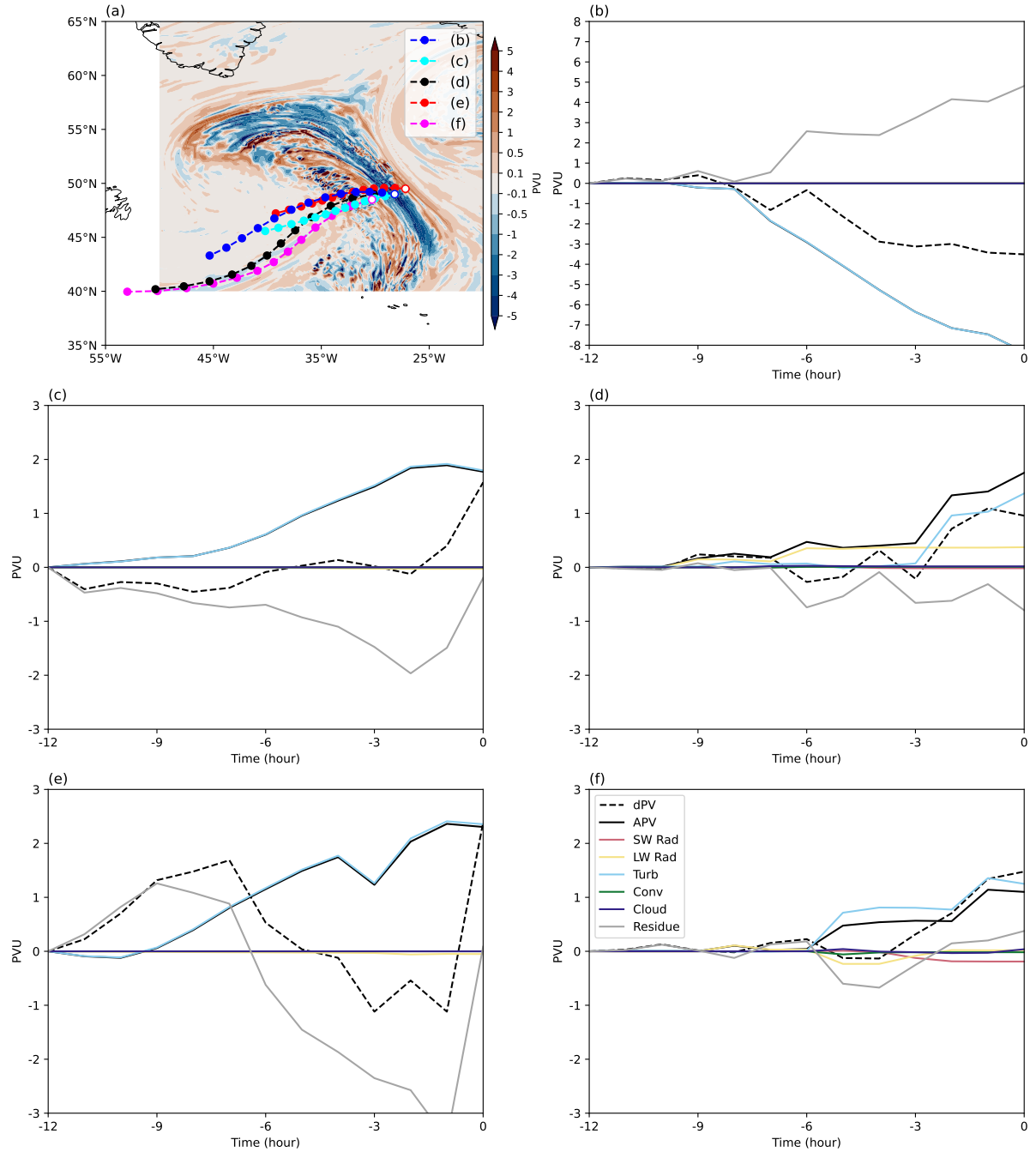


Figure S1. (a) Total APV on 225 hPa at 17 UTC on 25 December 2019 with an accumulation time of 12 h (same field as shown in Fig. 6b but in a larger domain) Five backward trajectories are shown, labelled (b) to (f), and their horizontal positions in the last 12 h are shown by filled circles (white filling at $t = 0$ h). Note that trajectories b-d share the same horizontal position, but are initialised on 225, 200, and 250 hPa, respectively. (b-f) Temporal evolution of change in PV (dPV), total APV (APV) of air parcels along backward trajectory with the corresponding label defined in panel (a). The dPV and APV are defined relative to the PV values of the air parcel at $t = -12$ h. This is different from those defined in the manuscript (and hence an abuse of notation), as it aids interpretations by having the changes now accumulate forward in time. The APV is further partitioned into the contribution from shortwave radiation (SW Rad), longwave radiation (LW Rad), turbulence (Turb), convection (Conv), and cloud microphysics (Cloud). The residue (Residue), which is the difference between dPV and APV, is also shown.