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Supplement of

Diabatic processes modulating the vertical structure of the jet stream above the cold front of an extratropical cyclone: sensitivity to deep convection schemes

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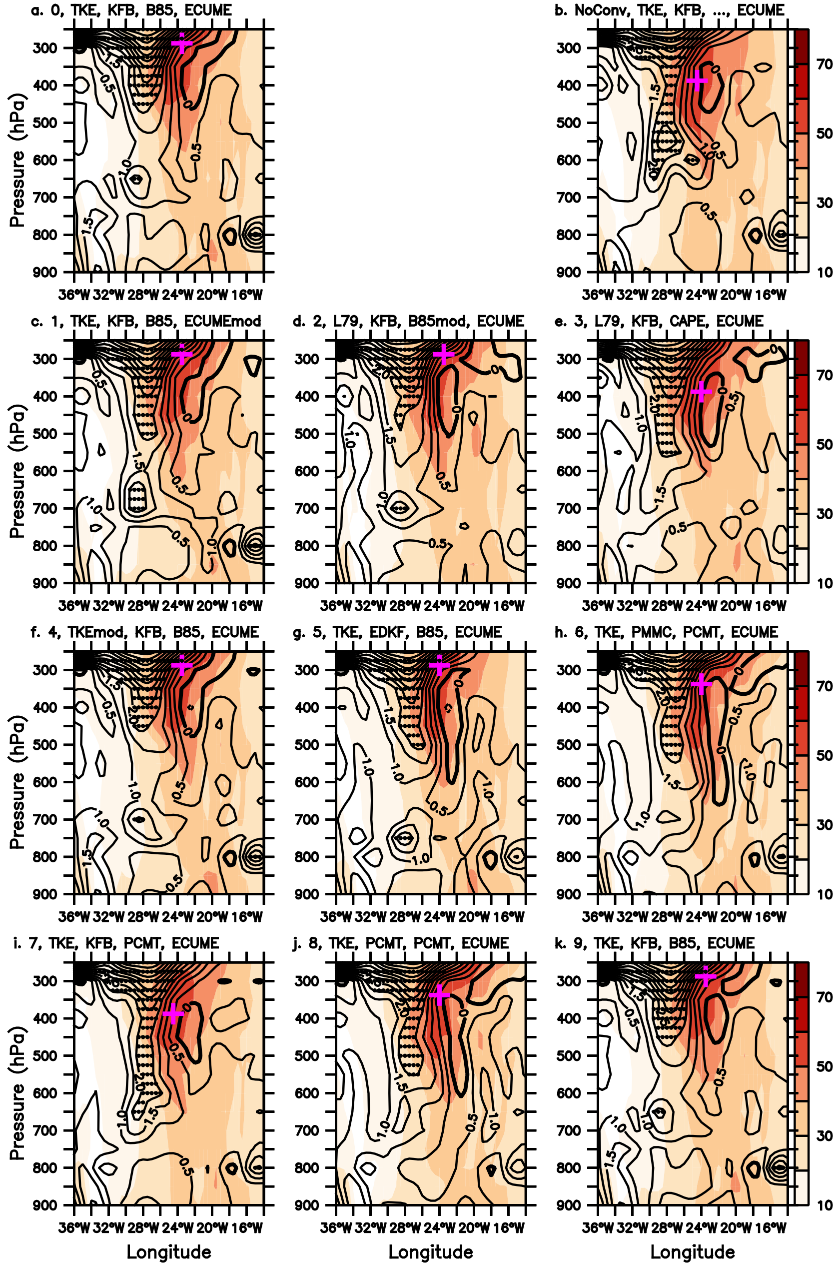

Figure S 1. Vertical cross section at 58° N (grey line in fig. 1) of the zonal wind (shadings, pink crosses localize wind speed maximum) and Potential Vorticity (black contours with hatched areas for values superior to 2PVU) at 15 UTC, 2 October 2016 for the NoConv and the 10 PEARP members starting with the same initial conditions but differing from four main physics package: turbulence, shallow convection, deep convection and surface fluxes and whose schemes are indicated in that order in the subtitle of each panel. Turbulence schemes can be TKE (Turbulent Kinetic Energy scheme of Cuxart et al. 2000), L79 (Louis, 1979), or TKEmod (slightly modified version of TKE in which horizontal advection is ignored). Shallow convection can be KFB (Kain and Fritsch, 1993; Bechtold et al., 2001), PCMT, PMMC (Pergaud et al. 2009) or EDKF (eddy diffusivity and Kain-Fritsch scheme). Deep convection schemes can be B85, PCMT, CAPE (B85 where the closure is based on the CAPE), B85mod (B85 in which deep convection is only triggered if cloud top exceeds 3000 m. The surface oceanic fluxes are based on Belamari et al. (2005)'s scheme (ECUME) and an alternative in which evaporative fluxes are enhanced (ECUMEmod). Members 0 and 9 are characterized by the same parametrization set-up, but member 9 differs in the modelling of orographic waves. See Ponzano et al. (2020) for more details on the setup of the different members.

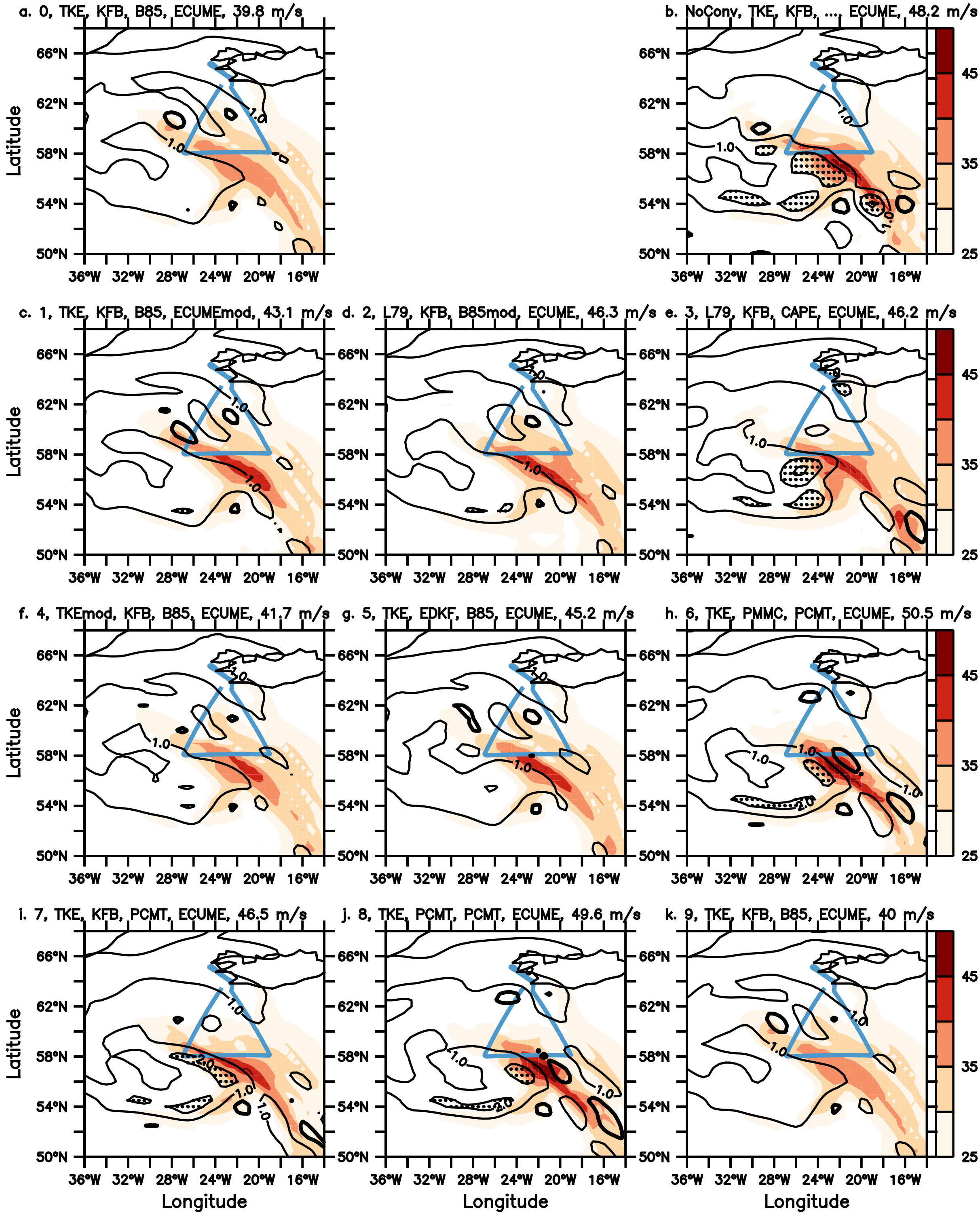

Figure S 2. Wind (shadings) and Potential Vorticity (black contours with hatched areas for values superior to 2 PVU) at 600 hPa at 15 UTC, 2 October 2016 for the NoConv and the 10 PEARP members starting with the same initial conditions. The Flight F7 of the SAFIRE Falcon appears in blue line.

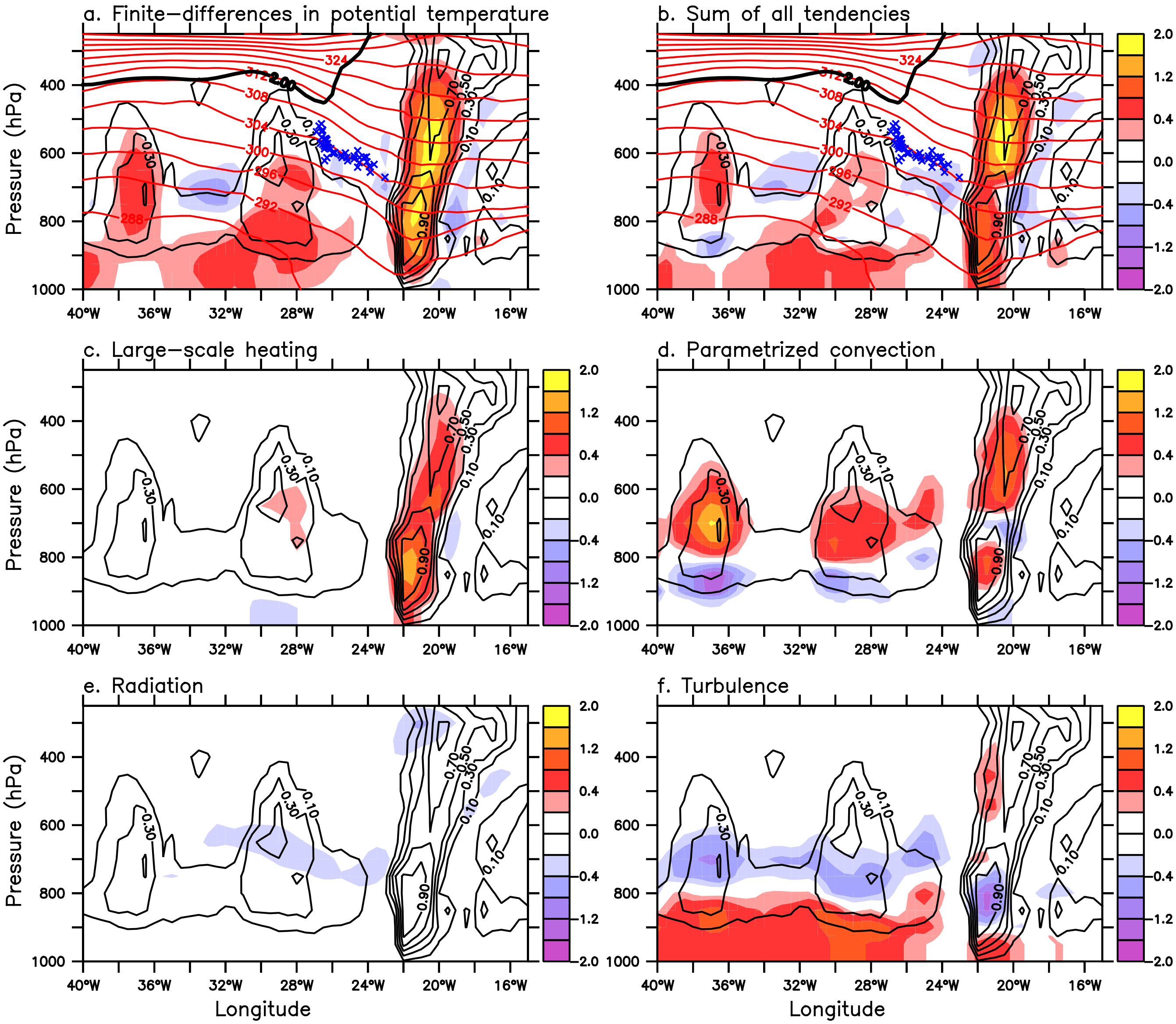

Figure S 3. Vertical cross sections of heating averaged between 45°N and 49°N (shading; units: K h^{-1}), PV (2 PVU isoline in bold black contour), potential temperature (red contours) and WCB positions (blue crosses) at 03 UTC 2 October with B85. (a) heating computed with finite differences in time and space as in the whole paper and (b) resulting from the sum of all diabatic tendencies issued from model outputs. Panel (b) is the sum of (c) large-scale cloud (resolved) sensible and latent heating, (d) parametrized convection sensible and latent heating, (e) radiative heating and (f) turbulence heating. The thin black contours represent the cloud fraction.

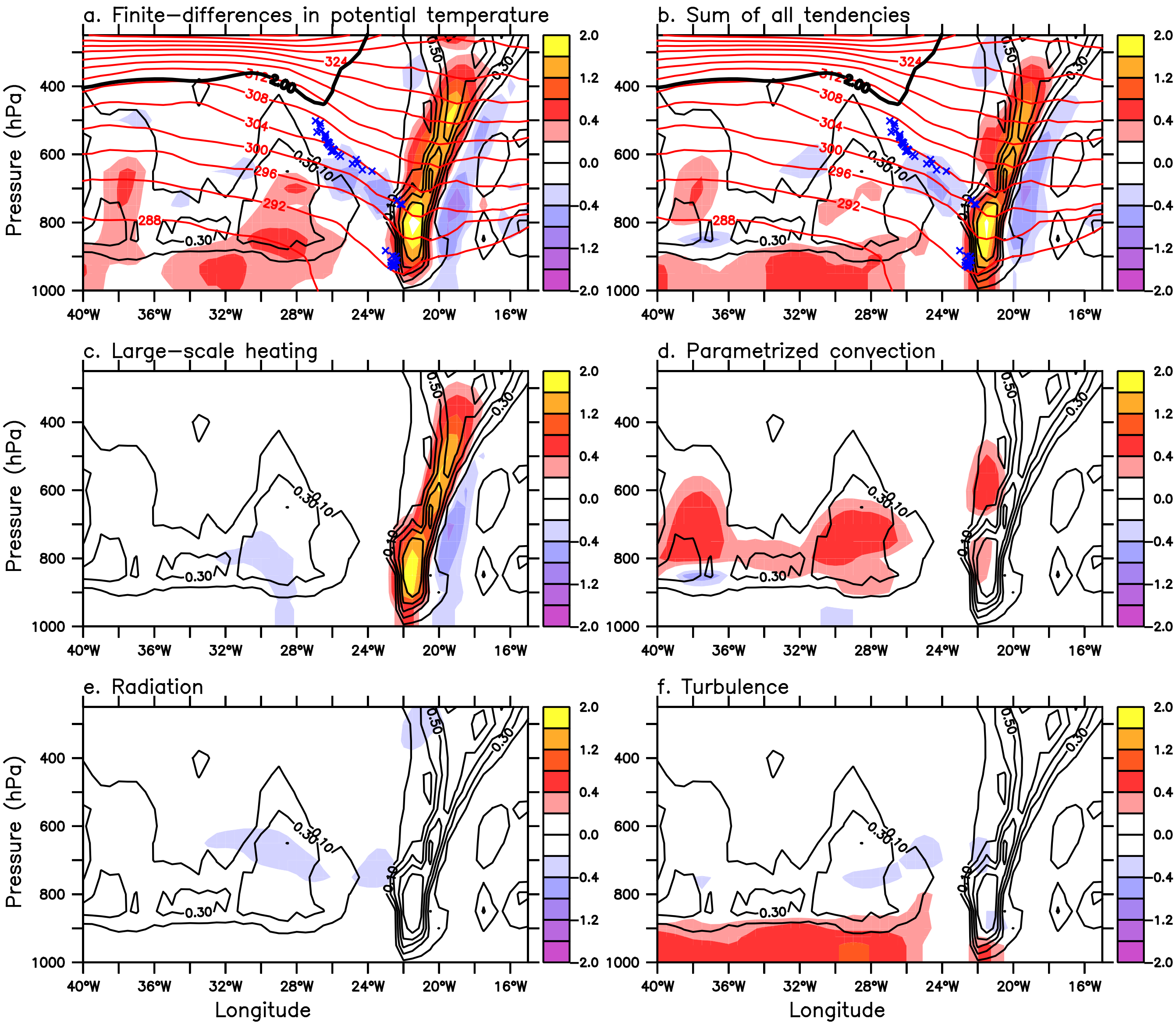

Figure S 4. Same as Figure S3 but for PCMT simulation

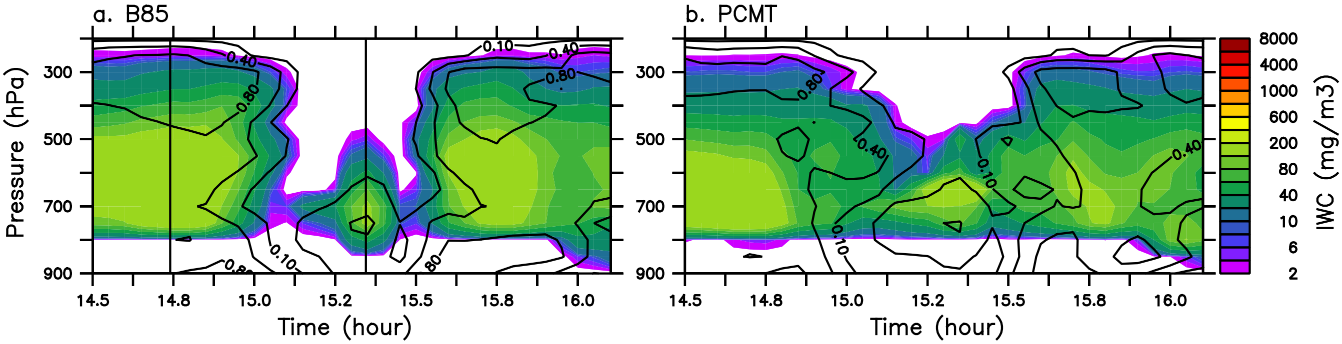

Figure S 5. Same as Figure 10c,d but divided by cloud fraction (cloud ice water/3D cloud fraction + snow/2D cloud fraction)

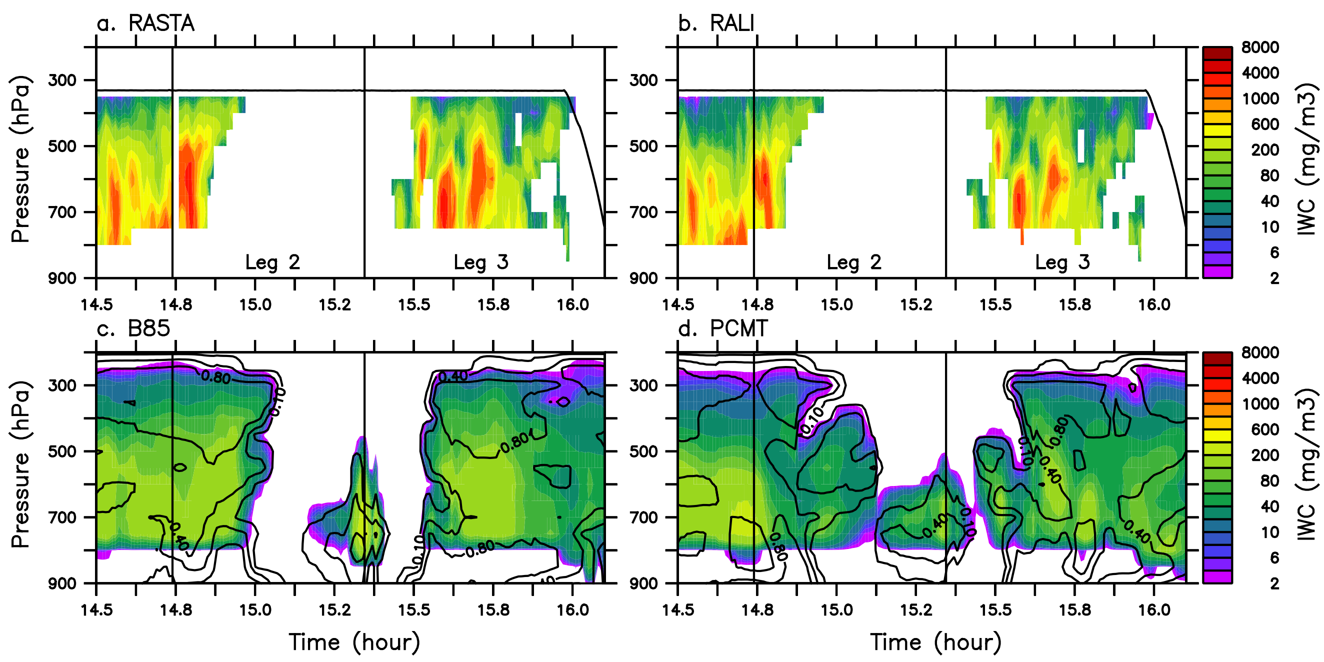

Figure S 6. Same as Figure 10 but with model outputs and radar observation interpolated over a $0.1^\circ \times 0.1^\circ$ grid