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! cat_param describes the approach how to calculate turbulence
!           1 = Ellrod + Knox (DVSI + DVT)
cat_param = 1

! nhours describes the length of the interval for which the divergence
!           trend term should be calculated, e.g. 6 hours
nhours = 6.

! DIV_C is a weighting constant to limit the amplitude of the divergence trend term
DIV_C = 0.1

! N2_lim is the limitation threshold for modifying the stability term, mixing will
!           be switched off at the grid box that N2 is below N2_lim
N2_lim = 6.e-4

! t_norm1 & t_norm2 is the time normalization factor to moderate the strength
!           of the whole mixing term
t_norm_1 = 86400
t_norm_2 = 4.e6

! logical switch for performing tracer mixing by CAT
l_tracmix = .TRUE.

!use original Ellrod + Knox index for mixing, else use an index modified with N2
USE_DDVS I = .FALSE.

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Figure S1. Example Fortran90 namelist for the new submodel CAT.

An example of the Fortran90 namelist of the CAT submodel is shown in Figure ???. The namelist including 8 parameters:

- cat_param
 - nhours
 - DIV_C
 - 5 - N2_lim
 - t_norm1
 - t_norm2
 - l_tracmix
 - USE_DDVS I
- 10 The *cat_param* determines the approach of how to calculate turbulence, currently the Ellrod-Knox index is the only option, but it provides the possibility to extend the submodel to other turbulence diagnostics. The *nhours* represents the length of the interval (*h2* and *h1* in equation 1) for which the divergence trend term should be calculated. *DIV_C* is the constant *C* in equation 1 and *N2_lim* is the N_{lim}^2 in equation 2. *t_norm_1* and *t_norm_2* are used to calculate the *t_norm* in equation 4, where the former is the seconds of a day and later is the time scaling factor. *l_tracmix* is a logical switch for enabling the
- 15 tracer mixing by CAT. It could be switched to false as a diagnostic submodel for calculating the turbulence diagnostics. The *USE_DDVS I* could switch between the Ellrod-Knox index and the MoCATI.

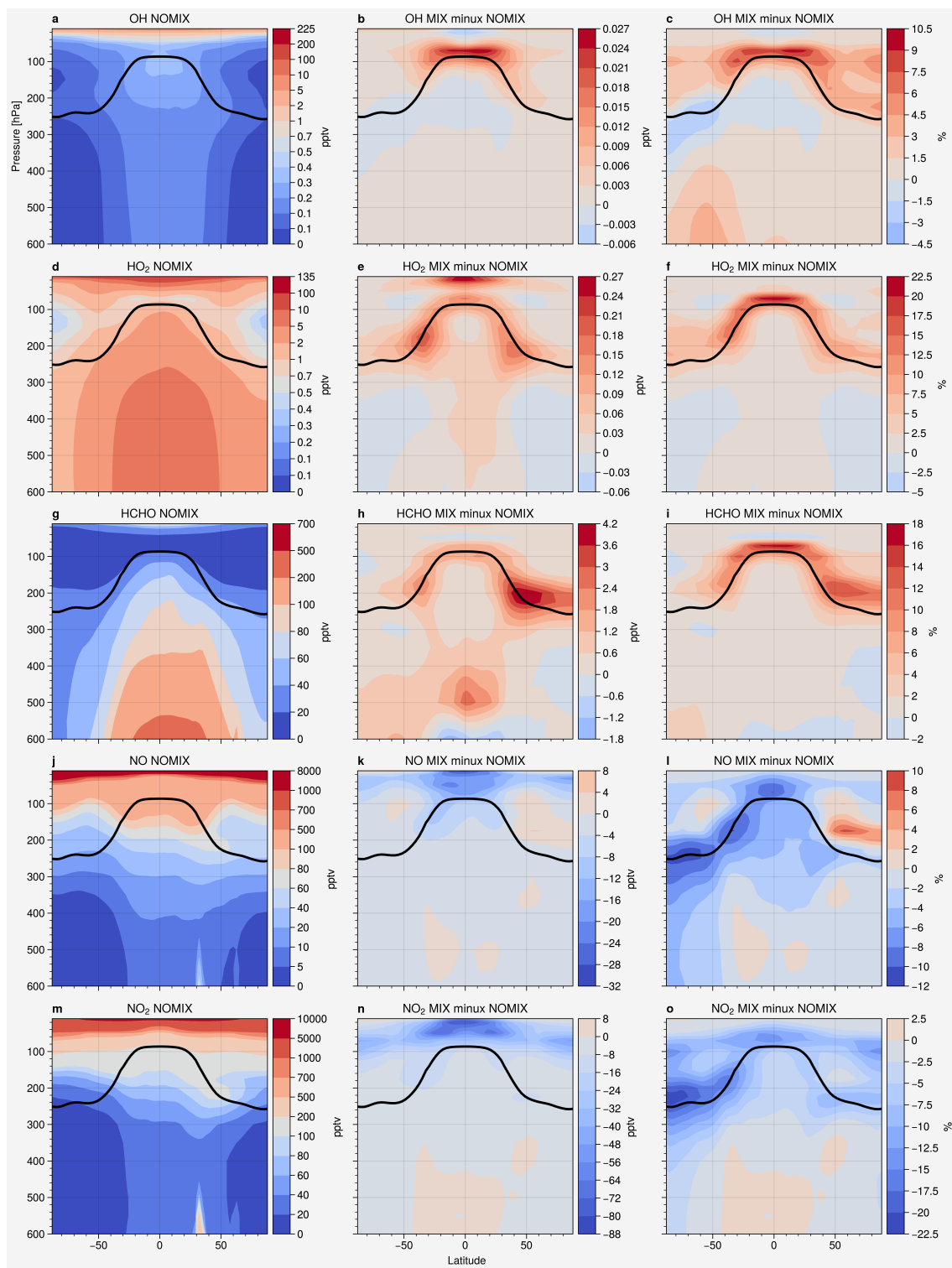


Figure S2. Annual zonal mean OH, HO₂, HCHO, NO, NO₂ (a,d,g,j,m) profile of QCTM-NOMIX, (b,e,h,k,n) difference, (c,f,i,l,o) percentage difference. The black line indicates the tropopause.