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Supplement of

The implementation of a MiXed Layer model (MXL, v1.0) for the dynamics of the atmospheric boundary layer in the Modular Earth Submodel System (MESSy)

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1 Introduction

This document describes the namelist *mxl.nml* that is used to set initial and boundary conditions for MXL/MESSy. It is divided into different parts: the `CTRL` namelist is used to set the geographical location at which the model is run, `IC_MXL` to initialize the ABL and land surface dynamics, `INIT_CHEM` to initialize species mixing ratios and `EMIS_SIMPLE` to specify simplified emissions.

2 Namelist example

```
! -*- f90 -*-

&CTRL ! DOMINO
lon  = 357.                    ! longitude (degrees North)
lat  = 37.1,                   ! latitude (degrees East)
l_verbose = T                  ! switch for writing input to screen ('F','T')
/

&IC_MXL ! DOMINO
hbl_ic          = 500.         ! initial boundary layer height (m)
psurf           = 100000.      ! surface pressure (Pa)
thetam_ic       = 287.         ! initial mixed layer potential temperature (K)
dtheta_ic       = 1.5          ! initial potential temperature jump (K)
gammatheta      = 0.006        ! potential temperature lapse rate in
                                 free troposphere (K m-1)
lgamma          = F            ! switch for second lapse rate ('F','T')
hcrit           = 0            ! critical height for second lapse rate (m)
gammath2        = 0.           ! second lapse rate (K m-1)
advtheta        = 0.0          ! advection of temperature (K s-1)
qm_ic           = 5.3          ! initial mixed layer specific humidity (g kg-1)
dq_ic           = -0.8         ! initial specific humidity jump (g kg-1)
gammaq          = -1.2E-3      ! specific humidity lapse rate in
                                 free tropopshere (g kg-1 m-1)
advq            = 0.0          ! advection of moisture (g kg-1 s-1)
beta            = 0.20         ! ratio between surface and entrainment buoyancy flux (-)
omega           = 5e-6         ! subsidence rate (s-1)
wthetasmax      = 0.22         ! maximum kinematic surface heat flux (K m s-1)
f_wthetas       = 'SINE'       ! surface heat flux function
                                 ('CONST','SINE','COSINE','NOFLUX')
starttime_wths = 0             ! start time heat flux after start model run (s)
stoptime_wths  = 0             ! stop time heat flux after start model run (s)
wqsmax          = 0.03         ! maximum surface moisture flux (g kg-1 s-1)
f_wqs           = 'SINE'       ! surface moisture flux function
                                 ('CONST','SINE','COSINE','NOFLUX')
starttime_wqs  = 0             ! start time moisture flux after start model run (s)
stoptime_wqs   = 0             ! stop time moisture flux after start model run (s)
starttime_adv  = 0             ! start time advection after start model run (s)
stoptime_adv   = 0             ! stop time advection after start model run (s)
um_ic           = 0.7          ! initial wind velocity in x-direction (m s-1)
vm_ic           = 0.7          ! initial wind velocity in y-direction (m s-1)
ug              = 0.           ! geostrophic wind velocity in x-direction (m s-1)
vg              = 0.           ! geostrophic wind velocity in y-direction (m s-1)
uws_ic          = 0.           ! initial surface momentum flux in x-direction (m2 s-2)
vws_ic          = 0.           ! initial surface momentum flux in y-direction (m2 s-2)
gammau          = 0.           ! wind velocity lapse rate x-direction (m s-1 m-1)
gammav          = 0.           ! wind velocity lapse rate y-direction (m s-1 m-1)
```

```
z0             = 0.6          ! roughness length (m)
l_ustconst     = F            ! switch for constant ustar ('F','T')
l_surfacelayer = F            ! switch for interactive surface layer ('F','T')
z0m            = 0.05         ! roughness length for momentum (m)
z0h            = 0.01         ! roughness length for heat and moisture (m)
l_radiation    = T            ! switch for radiation calculation ('F','T')
Cc             = 0.0          ! cloud cover (-)
salbedo        = 0.13         ! surface albedo (-)
l_landsurface  = F            ! switch for interactive land surface ('F','T')
Tsurf          = 287.2        ! surface temperature (K)
wwilt          = 0.314        ! volumetric soil moisture at wilting point (m3 m-3)
w2             = 0.43         ! volumetric soil moisture layer 1 (top) (m3 m-3)
w1             = 0.43         ! volumetric soil moisture layer 2 (m3 m-3)
wfc            = 0.491        ! volumetric soil moisture at field capacity (m3 m-3)
wsat           = 0.6          ! saturated volumetric water content (m3 m-3)
CLa            = 0.083        ! Clapp-Hornberger retention curve parameter (-)
CLb            = 11.4         ! Clapp-Hornberger retention curve parameter (-)
CLc            = 12.0         ! Clapp-Hornberger retention curve parameter (-)
C1sat          = 0.342        ! coefficient force term moisture (-)
C2ref          = 0.3          ! coefficient restore term moisture (-)
gD             = 0.0          ! correction factor for vapor pressure deficit (-)
rsmin          = 110          ! minimum resistance transpiration (s m-1)
rssoilmin      = 50           ! minimum resistance soil evaporation (s m-1)
LAI            = 2            ! leaf area index of the vegetated fraction (-)
cveg           = 1.0          ! vegetation fraction (-)
Tsoil1         = 287.2        ! soil temperature layer 1 (top) (K)
Tsoil2         = 285.0        ! soil temperature layer 2 (K)
Wl             = 0e-4         ! equivalent water layer depth for wet vegetation (m)
Lambda         = 6            ! thermal diffusivity of the skin layer (W m-2 K-1)
CGsat          = 3.6e-6       ! saturated soil conductivity for heat (K m-2 J-1)
/

&INIT_CHEM
! ---------------------------------------------------------------------------
!  tracer, BL mixing ratio (ppb), FT mixing ratio (ppb)
! ---------------------------------------------------------------------------
INIT_TRAC(1) = 'O3', 30, 41.
INIT_TRAC(2) = 'NO', 0.008, 0.
INIT_TRAC(3) = 'NO2', 0.65, 0.
INIT_TRAC(4) = 'O2', 2.E8, 2.E8
INIT_TRAC(5) = 'N2', 8.E8, 8.E8
INIT_TRAC(6) = 'CO', 105, 105
INIT_TRAC(7) = 'CH4', 1724, 1724
INIT_TRAC(8) = 'CO2', 390e3, 390e3
INIT_TRAC(9) = 'H2O2', 0.1, 0.1
/

&EMIS_SIMPLE
l_emis_simple  = T            ! switch for simple emissions ('F','T')
starttime_emis = 0            ! start time emission after start model run (s)
stoptime_emis  = 0            ! stop time emission after start model run (s)
! ------------------------------------------------------------
!  tracer name, emission function (NOEMIS,CONST,SINE,COSINE),
!  maximum emission (ppb m s-1)
! ------------------------------------------------------------
EMIS(1) = 'NO',     'CONST',  0.015
EMIS(2) = 'NO2',    'CONST', -0.0007
```

```
EMIS(3) = 'C5H8',   'SINE',   0.015
/
```