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*Supplement of*

**Description and 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 the simple emission functions.

## 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)
l_gamma     = 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 troposphere (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)
wtheta_max  = 0.22   ! maximum kinematic surface heat flux (K m s-1)
f_wtheta    = 'SINE' ! surface heat flux function
                    ! ('CONST','SINE','COSINE','NOFLUX','INTERACT')
starttime_wths = 0   ! start time heat flux after start model run (s)
stoptime_wths = 0   ! stop time heat flux after start model run (s)
wqsm_max     = 0.03  ! maximum surface moisture flux (g kg-1 s-1)
f_wqs        = 'SINE' ! surface moisture flux function
                    ! ('CONST','SINE','COSINE','NOFLUX','INTERACT')
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)
```

```

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)
w1             = 0.43        ! volumetric soil moisture layer 2 (m3 m-3)
w2             = 0.43        ! volumetric soil moisture layer 1 (top) (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 (-)
Cl1sat         = 0.342       ! coefficient force term moisture (-)
C2ref          = 0.3         ! coefficient restore term moisture (-)
gD             = 0.0         ! correction factor for vapor pressure deficit (Pa-1)
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

```

