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

2 Namelist example

\begin{verbatim}
! -*- 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)
gammatheta2 = 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)
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)
v = 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)
\end{verbatim}
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)
stop_time_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
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