ICON Namelist Overview

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Contents

1 ICON Namelists

1.1 Scripts, Namelist files and Programs

Run scripts starting the programs for the grid generation and the models are stored in run/. These scripts write namelist files containing the specified Fortran namelists. Programs are stored in < icon home>/build/<architecture>/bin/.

Table 1: Namelist files

Namelist file	**Purpose**	**Made by script**	**Used by program**
NAMELIST_GRAPH	Generate graphs	create_global_grids.run	grid_command
NAMELIST_GRID	Generate grids	create_global_grids.run	grid_command
NAMELIST_GRIDREF	Gen. nested domains	create_global_grids.run	grid_command
NAMELIST_OCEAN_GRID	Gen. ocean grid	create_ocean_grid.run	grid_command
NAMELIST_TORUS_GRID	Gen. torus grid	create_torus_grid.run	grid_command
NAMELIST_ICON	Run ICON models	exp.<name>.run	control_model

1.2 Namelist parameters

The following subsections tabulate all available Fortran namelist parameters by name, type, default value, unit, description, and scope:

- *Type* refers to the type of the Fortran variable, in which the value is stored: I=INTEGER, L=LOGICAL, R=REAL, C=character string
- *Default* is the preset value, if defined, that is assigned to this parameter within the programs.
- *Unit* shows the unit of the control parameter, where applicable.
- *Description* explains in a few words the purpose of the parameter.
- *Scope* explains under which conditions the namelist parameter has any effect, if its scope is restricted to specific settings of other namelist parameters.

Information on the file, where the namelist is defined and used, is given at the end of each table.

2 Namelist parameters for grid generation

2.1 Namelist parameters defining the atmosphere grid

2.1.1 graph_ini (NAMELIST_GRAPH)

Parameter	Type	Default	Unit	Description	Scope
nroot	I	2		root subdivision of initial edges	
grid_levels	I	4		number of edge bisections following the root subdivision	
lplane	L	.FALSE.		switch for generating a double periodic planar grid. The root level consists of 8 triangles.	

Defined and used in: `src/grid_generator/mo_io_graph.f90`

2.1.2 grid_ini (NAMELIST_GRID)

Parameter	Type	Default	Unit	Description	Scope
nroot	I	2		root subdivision of initial edges	
grid_levels	I	4		number of edge bisections following the root subdivision	
lplane	L	.FALSE.		switch for generating planar grid. The root level consists of 8 triangles.	

Defined and used in: `src/grid_generator/mo_io_grid.f90`

2.1.3 grid_options (NAMELIST_GRID)

Parameter	Type	Default	Unit	Description	Scope
x_rot_angle	R	0.0	deg	Rotation of the icosahedron about the x-axis (connecting the origin and [0°E, 0°N])	
y_rot_angle	R	0.0	deg	Rotation of the icosahedron about the y-axis (connecting the origin and [90°E, 0°N), done after the rotation about the x-axis.	
z_rot_angle	R	0.0	deg	rotation of the icosahedron about the z-axis (connecting the origin and [0°E, 90°N), done after the rotation about the y-axis.	
itype_optimize	I	4		Grid optimization type 0: no optimization 1: Heikes Randall 2: equal area 3: c-grid small circle 4: spring dynamics	
l_c_grid	L	.FALSE.		C-grid constraint on last level	
maxlev_optim	I	100		Maximum grid level where the optimization is applied	i_type_optimize = 1 or 4
beta_spring	R	0.90		tuning factor for target grid length	i_type_optimize = 4

Defined and used in: `src/grid_generator/mo_io_grid.f90`

2.1.4 plane_options (NAMELIST_GRID)

Parameter	Type	Default	Unit	Description	Scope
tria_arc_km	R	10.0	km	length of triangle edge on plane	lplane=.TRUE.

The number of grid points is generated by root level section and further bisections. The double periodic root level consists of 8 triangles. The spatial coordinates are $-1 <= x <= 1$, and $-\sqrt{3}/2 <= y <= \sqrt{3}/2$. Currently the planar option can only be used as an f-plane. Defined and used in: `src/grid_generator/mo_io_grid.f90`

2.1.5 gridref_ini (NAMELIST_GRIDREF)

Parameter	Type	Default	Unit	Description	Scope
grid_root	I	2		root subdivision of initial edges	
start_lev	I	4		number of edge bisections following the root subdivision	
n_dom	I	2		number of logical model domains, including the global one	
n_phys_dom	I	n_dom		number of physical model domains, may be larger than n_dom (in this case, domain merging is applied)	
parent_id	I(n_phys_dom-1)	i		ID of parent domain (first entry refers to first nested domain; needs to be specified only in case of more than one nested domain per grid level)	
logical_id	I(n_phys_dom-1)	i+1		logical grid ID of domain (first entry refers to first nested domain; needs to be specified only in case of domain merging, i.e. n_dom < n_phys_dom)	
l_plot	L	.FALSE.		produces GMT plots showing the locations of the nested domains	
l_circ	L	.TRUE.		Create circular (.T.) or rectangular (.F.) refined domains	
l_rotate	L	.FALSE.		Rotates center point into the equator in case of l_circ = .FALSE.	lcirc=.FALSE.

Parameter	Type	Default	Unit	Description	Scope
write_hierarchy	I	1		0: Output only computational grids 1: Output in addition parent grid of global model domain (required for computing physics on a reduced grid) 2: Output all grids back to level 0 (required for hierarchical search algorithms)	
bdy_indexing_depth	I	max_rlcell (=8)		Number of cell rows along the lateral boundary of a model domain for which the refin_ctrl fields contain the distance from the lateral boundary; needs to be enlarged when lateral boundary nudging is required for one-way nesting	
radius	R(n_dom-1)	30.	deg	radius of nested domain (first entry refers to first nested domain; needs to be specified for each nested domain separately)	lcirc=.TRUE.
hwidth_lon	R(n_dom-1)	20.	deg	zonal half-width of refined domain (first entry refers to first nested domain; needs to be specified for each nested domain separately)	lcirc=.FALSE.
hwidth_lat	R(n_dom-1)	20.	deg	meridional half-width of refined domain (first entry refers to first nested domain; needs to be specified for each nested domain separately)	lcirc=.FALSE.
center_lon	R(n_dom-1)	90.	deg	center longitude of refined domain (first entry refers to first nested domain; needs to be specified for each nested domain separately)	
center_lat	R(n_dom-1)	30.	deg	center latitude of refined domain (first entry refers to first nested domain; needs to be specified for each nested domain separately)	

Defined and used in: `src/grid_generator/mo_gridrefinement.f90`

2.1.6 gridref_metadata (NAMELIST_GRIDREF)

Parameter	Type	Default	Unit	Description	Scope
number_of_grid_used	I(n_dom+1)	0		sets the number of grid used in the netcdf header; the number of entries must be n_dom+1 because the first number refers to the radiation grid	
centre	I	0		centre running the grid generator: 78 - edzw (DWD), 252 - MPIM	
subcentre	I	0		subcentre to be assigned by centre, usually 0	
outname_style	I	1		Output name style 1: Standard: *iconRXBXX_DOMXX.nc* 2: DWD: *icon_grid_XXXX_RXXBXX_X.nc*	

2.2 Namelist parameters defining the local grid generation

The ocean grids are created by the script `run/create_ocen_grid.run`

2.2.1 grid_geometry_conditions

Parameter	Type	Default	Unit	Description	Scope
no_of_conditions	I	0		Number of geometric conditions	
patch_shape	I(no_of_conditions)	0		1=rectangle; 2=circle	
patch_center_x	R(no_of_conditions)	0.0	deg	longitude of patch center	
patch_center_y	R(no_of_conditions)	0.0	deg	latitude of patch center	
rectangle_xradious	R(no_of_conditions)	0.0	deg	half meridional extension of a rectangular patch	patch_shape=1
rectangle_yradious	R(no_of_conditions)	0.0	deg	half zonal extension of a rectangular patch	patch_shape=1

Parameter	Type	Default	Unit	Description	Scope
circle_radious	R(no_of_ conditions)	0.0	deg	radius of a circular patch	patch_shape=2

Defined in `mo_grid_conditions.f90`

2.2.2 local_grid_optimization

Parameter	Type	Default	Unit	Description	Scope
use_optimization	L	.FALSE.		Apply, or not, optimization	
use_edge_springs	L	.FALSE.		Use spring dynamics	
prime_ref_length _coeff	R	1.0		Spring length coefficient	
use_adaptive_ spring_length	L	.FALSE.		Use adaptive spring length	
use_local_reference_ length	L	.FALSE.		Use locally adaptive spring length	
local_reference_ length_coeff	R	0.0		Coefficient of local vs global spring length	
use_isotropy_force	L	.FALSE.		Use isotropy force, tends to create symmetric triangles	
isotropy_rotation _coeff	R	0.0		Coefficient of the rotational isotropy force	
isotropy_stretch _coeff	R	0.0		Coefficient of the stretch isotropy force	
optimize_vertex _depth	I	1		For patches the min depth of the vertices that will be optimized. The boundary vertices have depth 0, the next level 1, etc.	

Defined in `mo_local_grid_optimization.f90`

2.2.3 create_ocean_grid

Parameter	Type	Default	Unit	Description	Scope
only_get_sea_ land_mask	L	.false.		.true.:returns the whole grid with a sea-land mask; .false.:returns only the ocean grid	
smooth_ocean_ boundary	L	.true.		.true.:smooths the ocean boundaries so no triabgle has two boundary edges; .false.:no smoothing	
input_file	C			name of the input grid file	
elevation_file	C			name of the file containing cell elevation values for the input_file	no_of_conditions=0
elevation_field	C			name of the field containing the cell elevation values	no_of_conditions=0
min_sea_depth	R	0.0	m (negative)	if cell elevation < min_sea_depth then the cell is consider sea	
set_sea_depth	R	0.0	m (negative)	if not 0, then sea cells are of set_sea_depth elevation	
set_min_sea_depth	R	0.0	m (negative)	if not 0, then sea cells have a maximum of set_min_sea_depth elevation	
edge_elev_ interp_method	I	2		compute edge elevation from cells using: linear interpolation=1; min value = 2	
output_refined_ ocean_file	C			name of the output refined ocean grid file	

Defined in `mo_create_ocean_grid.f90`

2.2.4 torus_grid_parameters

Parameter	Type	Default	Unit	Description	Scope
y_no_of_rows	I		4	number of triangle rows of the torus grid, >=2	
x_no_of_columns	I		8	number of triangle columns of the torus grid, >=2	
edge_length	R	m	1000.0	the triangle edge length	
x_center	R	m	0.0	the x coordinate of the torus center	
y_center	R	m	0.0	the y coordinate of the torus center	
out_file_name	C			the torus grid file name	

Parameter	Type	Default	Unit	Description	Scope
unfolded_torus_ file_name	C			the unfolded torus grid file name (for plotting)	
ascii_filename	C			the unfolded torus grid ascci file name (for plotting)	

Defined in `mo_create_torus_grid.f90`. See the run script `run/create_torus_grid.run`.

3 Namelist parameters defining the ICON model

Namelist parameters for the ICON models are organized in several thematic Fortran namelists controling the experiment, and the properties of dynamics, transport, physics etc.

3.1 coupling_nml

Parameter	Type	Default	Unit	Description	Scope
name	C	blank		short name of the coupling field	
dt_coupling	I	0	s	coupling time step / coupling interval	
dt_model	I	0	s	model time step	
lag	I	0		offset to coupling event in number of model time steps	
l_time_average	L	.FALSE.		.TRUE.: time averaging between two coupling events	
l_time_accumulation	L	.FALSE.		.TRUE.: accumulation of coupling fields in time between two coupling events	
l_diagnostic	L	.FALSE.		.TRUE.: simple diagnostics (min, max, avg) for coupling fields is switched on	
l_activated	L	.FALSE.		.TRUE.: activate the coupling of the respective coupling field	

Defined and used in: `src/namelists/mo_coupling_nml.f90`

3.2 diffusion_nml

Parameter	Type	Default	Unit	Description	Scope
lhdiff_temp	L	.TRUE.		Diffusion on the temperature field	
lhdiff_vn	L	.TRUE.		Diffusion on the horizontal wind field	
lhdiff_w	L	.TRUE.		Diffusion on the vertical wind field	
hdiff_order	I	4 (hydro) 5 (NH)		Order of ∇ operator for diffusion: -1: no diffusion 2: ∇^2 diffusion (not available for NH model on triangles!) 3: Smagorinsky ∇^2 diffusion (includes frictional heating for the hexagonal model if lhdiff_temp=.TRUE.) 4: ∇^4 diffusion 5: Smagorinsky ∇^2 diffusion combined with ∇^4 background diffusion as specified via hdiff_efdt_ratio defaults: 2 for hexagonal model, 4 for hydrostatic triangular model, 5 for nonhydrostatic triangular NH model 24 or 42: ∇2 diffusion from model top to a certain level (cf. k2_pres_max and k2_klev_max below); ∇^4 for the lower levels.	24 and 42 currently allowed only in the hydrostatic atm model (run_nml:iequation = 1 or 2).
itype_vn_diffu	I	1		Reconstruction method used for Smagorinsky diffusion: 1: u/v reconstruction at vertices only 2: u/v reconstruction at cells and vertices	iequations=3, hdiff_order=3 or 5
itype_t_diffu	I	2		Discretization of temperature diffusion: 1: $K_h \nabla^2 T$ 2: $\nabla \cdot (K_h \nabla T)$	iequations=3, hdiff_order=3 or 5
k2_pres_max	R	-99.	Pa	Pressure level above which ∇^2 diffusion is applied.	hdiff_order = 24 or 42, and run_nml:iequation = 1 or 2.

Parameter	Type	Default	Unit	Description	Scope
k2_klev_max	I	0		Index of the vertical level till which (from the model top) ∇^2 diffusion is applied. If a positive value is specified for k2_pres_max, k2_klev_max is reset accordingly during the initialization of a model run.	hdiff_order = 24 or 42, and run_nml:iequation = 1 or 2.
hdiff_efdt_ratio	R	1.0 (hydro) 36.0 (NH)		ratio of e-folding time to time step (or 2* time step when using a 3 time level time stepping scheme) (only for triangles currently; for triangular NH model, values above 30 are recommended when using hdiff_order=5)	
hdiff_w_efdt_ratio	R	15.0		ratio of e-folding time to time step for diffusion on vertical wind speed	iequations=3
hdiff_min_efdt_ratio	R	1.0		minimum value of hdiff_efdt_ratio near model top	iequations=3 .AND. hdiff_order=4
hdiff_tv_ratio	R	1.0		Ratio of diffusion coefficients for temperature and normal wind: $T : v_n$	
hdiff_multfac	R	1.0		Multiplication factor of normalized diffusion coefficient for nested domains	n_dom>1
hdiff_smag_fac	R	0.15 (hydro) 0.015 (NH)		Scaling factor for Smagorinsky diffusion	for triangles only with iequations=3, for hexagons with hdiff_order=3

Defined and used in: `src/namelists/mo_diffusion_nml.f90`

3.3 dynamics_nml

This namelist is relevant if run_nml:ldynamics=.TRUE.

Parameter	Type	Default	Unit	Description	Scope
iequations	I	1		Equations and prognostic variables. Use positive indices for the atmosphere and negative indices for the ocean. 0: shallow water model 1: hydrostatic atmosphere, T	

Parameter	Type	Default	Unit	Description	Scope
				2: hydrostatic atm., θ·dp 3: non-hydrostatic atmosphere -1: hydrostatic ocean	
idiv_method	I	1		Method for divergence computation: 1: Standard Gaussian integral. Hydrostatic atm. model: for unaveraged normal components, Non-hydrostatic atm. model: for averaged normal components 2: bilinear averaging of divergence	
divavg_cntrwgt	R	0.5		Weight of central cell for divergence averaging	idiv_method= 2
sw_ref_height	R	0.9* 2.94e4/g	m	Reference height of shallow water model used for linearization in the semi-implicit time stepping scheme	
lcoriolis	L	.TRUE.		Coriolis force	

Defined and used in: `src/namelists/mo_dynamics_nml.f90`

3.4 echam_conv_nml

Parameter	Type	Default	Unit	Description	Scope
iconv	I	1		Choice of cumulus convection scheme. 1: Nordeng scheme 2: Tiedtke scheme 3: hybrid scheme	iforcing = 2 .AND. lconv = .TRUE.
ncvmicro	I	0		Choice of convective microphysics scheme.	iforcing = 2 .AND. lconv = .TRUE.
lmfpen	L	.TRUE.		Switch on penetrative convection.	iforcing = 2 .AND. lconv = .TRUE.
lmfmid	L	.TRUE.		Switch on midlevel convection.	iforcing = 2 .AND. lconv = .TRUE.
lmfdd	L	.TRUE.		Switch on cumulus downdraft.	iforcing = 2 .AND. lconv = .TRUE.

Parameter	Type	Default	Unit	Description	Scope
lmfdudv	L	.TRUE.		Switch on cumulus friction.	iforcing = 2 .AND. lconv = .TRUE.
cmftau	R	10800.		Characteristic convective adjustment time scale.	iforcing = 2 .AND. lconv = .TRUE.
cmfctop	R	0.3		Fractional convective mass flux (valid range [0,1]) across the top of cloud	iforcing = 2 .AND. lconv = .TRUE.
cprcon	R	1.0e-4		Coefficient for determining conversion from cloud water to rain.	iforcing = 2 .AND. lconv = .TRUE.
cminbuoy	R	0.025		Minimum excess buoyancy.	iforcing = 2 .AND. lconv = .TRUE.
entrpen	R	1.0e-4		Entrainment rate for penetrative convection.	iforcing = 2 .AND. lconv = .TRUE.
dlev	R	3.e4	Pa	Critical thickness necessary for the onset of convective precipitation.	iforcing = 2 .AND. lconv = .TRUE.

Defined and used in: `src/namelists/mo_echam_conv_nml.f90`

3.5 echam_phy_nml

Parameter	Type	Default	Unit	Description	Scope
lrad	L	.TRUE.		Switch on radiation.	iforcing = 2
lvdiff	L	.TRUE.		Switch on turbulent mixing (i.e. vertical diffusion).	iforcing = 2
lconv	L	.TRUE.		Switch on cumulus convection.	iforcing = 2
lcond	L	.TRUE.		Switch on large scale condensation.	iforcing = 2
icover	I	1		1 = diagnostic Sunquist cloud cover scheme, 2 = prognostic Tompkins cloud cover scheme.	iforcing = 2 Note: icover = .TRUE. runs, but has not been evaluated (yet) in ICON.
lgw_hines	L	.FALSE.		.TRUE. for atmospheric gravity wave drag by the Hines scheme	iforcing = 2
lssodrag	L	.FALSE.		.TRUE. for subgrid scale orographic drag	iforcing = 2 Not implemeted yet
llandsurf	L	.FALSE.		.TRUE. for surface exchanges	iforcing = 2 Not implemeted yet
lice	L	.FALSE.		.TRUE. for sea-ice temperature calculation	iforcing = 2 Not implemeted yet
lmeltpond	L	.FALSE.		.TRUE. for calculation of meltponds	iforcing = 2 Not implemeted yet
lhd	L	.FALSE.		.TRUE. for hydrologic discharge model	iforcing = 2 Not implemeted yet
lmlo	L	.FALSE.		.TRUE. for mixed layer ocean	iforcing = 2 Not implemeted yet
dt_rad	R	3600.	s	time interval of full radiation computation	run_nml/iforcing = iecham

Defined and used in: `src/namelists/mo_echam_phy_nml.f90`

3.6 gribout_nml

Parameter	Type	Default	Unit	Description	Scope
backgroundProcess	I	0		Background process - GRIB2 code table backgroundProcess.table	filetype=2
generatingCenter	I	-1		Output generating center. If this key is not set, center information is taken from the grid file DWD: 78 MPIMET: 98 ECMWF: 98	filetype=2
generatingProcess Identifier	I(n_dom)	1		generating Process Ident- ifier - GRIB2 code table generatingProcessIdentifier.table	filetype=2
generatingSubcenter	I	-1		Output generating Subcenter. If this key is not set, subcenter information is taken from the grid file DWD: 255 MPIMET: 232 ECMWF: 0	filetype=2
lspecialdate_invar	L	.FALSE.		SPecial reference date for invariant and climatological fields .TRUE.: set special reference date 0001-01-01, 00:00 .FASLE.: no special reference date	filetype = 2
ldate_grib_act	L	.TRUE.		GRIB creation date .TRUE.: add creation date .FALSE.: add dummy date	filetype=2
lgribout_24bit	L	.FALSE.		If TRUE, write thermodynamic fields ρ, θ_v, T, p with 24bit precision instead of 16bit	filetype=2
localDefinitionNumber	I	254		local Definition Number - GRIB2 code table grib2LocalSectionNumber.78.table	filetype=2
localNumberOfExperi-ment	I	1		local Number of Experiment	filetype=2
numberOfForecastsIn-Ensemble	I	-1		Local definiton for ensemble products, (only set if value changed from default)	filetype=2
perturbationNumber	I	-1		Local definiton for ensemble products, (only set if value changed from default)	filetype=2

Parameter	Type	Default	Unit	Description	Scope
preset	C	"none"		Setting this different to "none" enables a couple of defaults for the other `gribout_nml` namelist parameters. If, additionally, the user tries to set any of these other parameters to a conflicting value, an error message is thrown. Possible values are "none", "deterministic", "ensemble".	filetype=2
productionStatusOfProcessedData	I	1		Production status of data - GRIB2 code table 1.3	filetype=2
significanceOfReferenceTime	I	1		Significance of reference time - GRIB2 code table 1.2	filetype=2
typeOfEnsembleForecast	I	-1		Local definiton for ensemble products (only set if value changed from default)	filetype=2
typeOfGeneratingProcess	I	2		Type of generating process - GRIB2 code table 4.3	filetype=2
typeOfProcessedData	I	1		Type of data - GRIB2 code table 1.4	filetype=2

Defined and used in: `src/namelists/mo_gribout_nml.f90`

3.7 grid_nml

Parameter	Type	Default	Unit	Description	Scope
cell_type	I	3		Cell type: not used	
lplane	L	.FALSE.		planar option	
is_plane_torus	L	.FALSE.		f-plane approximation on triangular grid	
corio_lat	R	0.0	deg	Center of the f-plane is located at this geographical latitude	lplane=.TRUE. and is_plane_torus=.TRUE.
grid_angular _velocity	R	Earth's	rad/s	The angular velocity in rad per sec.	
l_limited_area	L	.FALSE.			
grid_rescale_factor	R	1.0		The geometry and the timestep will be multiplied by this factor. The angular velocity will be divided by this factor.	

Parameter	Type	Default	Unit	Description	Scope
lfeedback	L(n_dom)	.TRUE.		Specifies if feedback to parent grid is performed. Setting lfeedback(1)=.false. turns off feedback for all nested domains; to turn off feedback for selected nested domains, set lfeedback(1)=.true. and set ".false." for the desired model domains	n_dom>1
ifeedback_type	I	2		1: incremental feedback 2: relaxation-based feedback Note: vertical nesting requires option 2 to run numerically stable over longer time periods	n_dom>1
start_time	R(n_dom)	0.	s	Time when a nested domain starts to be active (namelist entry is ignored for the global domain)	n_dom>1
end_time	R(n_dom)	1.E30	s	Time when a nested domain terminates (namelist entry is ignored for the global domain)	n_dom>1
patch_weight	R(n_dom)	0.		If patch_weight is set to a value > 0 for any of the first level child patches, processor splitting will be performed, i.e. every of the first level child patches gets a subset of the total number or processors corresponding to its patch_weight. A value of 0. corresponds to exactly 1 processor for this patch, regardless of the total number of processors. For the root patch and higher level childs, patch_weight is not used. However, patch_weight must be set to 0 for these patches to avoid confusion.	n_dom>1
lredgrid_phys	L	.FALSE.		If set to .true. is calculated on a reduced grid (= one grid level higher)	
dynamics_grid_ filename	C			Array of the grid filenames to be used by the dycore. May contain the keyword `<path>` which will be substituted by `model_base_dir`.	
dynamics_parent_ grid_id	I			Array of the indexes of the parent grid filenames, as described by the dynamics_grid_filename array. Indexes start at 1, an index of 0 indicates no parent.	

Parameter	Type	Default	Unit	Description	Scope
radiation_grid_filename	C			Array of the grid filenames to be used for the radiation model. Filled only if the radiation grid is different from the dycore grid. May contain the keyword `<path>` which will be substituted by `model_base_dir`.	
dynamics_radiation_grid_link	I			Array of the indexes linking the dycore grids, as described by the dynamics_grid_filename array, and the radiation_grid_filename array. It provides the link index of the radiation_grid_filename, for each entry of the dynamics_grid_filename array. Indexes start at 1, an index of 0 indicates that the radiation grid is the same as the dycore grid. Only needs to be filled when the radiation_grid_filename is defined.	
create_vgrid	L	.FALSE.		.TRUE.: Write vertical grid files containing (`vct_a`, `vct_b`, `z_ifc`, and `z_ifv`.	
vertical_grid_filename	C (n_dom)			Array of filenames. These files contain the vertical grid definition (`vct_a`, `vct_b`, `z_ifc`.	

Defined and used in: `src/namelists/mo_grid_nml.f90`

3.8 gridref_nml

Parameter	Type	Default	Unit	Description	Scope
grf_intmethod_c	I	2		Interpolation method for grid refinement (cell-based dynamical variables): 1: parent-to-child copying 2: gradient-based interpolation	n_dom>1
grf_intmethod_ct	I	2		Interpolation method for grid refinement (cell-based tracer variables): 1: parent-to-child copying 2: gradient-based interpolation	n_dom>1

Parameter	Type	Default	Unit	Description	Scope
grf_intmethod_e	I	6		Interpolation method for grid refinement (edge-based variables): 1: inverse-distance weighting (IDW) 2: RBF interpolation 3: combination gradient-based / IDW 4: combination gradient-based / RBF 5/6: same as 3/4, respectively, but direct interpolation of mass fluxes along nest interface edges	n_dom>1
grf_velfbk	I	1		Method of velocity feedback: 1: average of child edges 1 and 2 2: 2nd-order method using RBF interpolation	n_dom>1
grf_scalfbk	I	2		Feedback method for dynamical scalar variables (T, p_{sfc}): 1: area-weighted averaging 2: bilinear interpolation	n_dom>1
grf_tracfbk	I	2		Feedback method for tracer variables: 1: area-weighted averaging 2: bilinear interpolation	n_dom>1
grf_idw_exp_e12	R	1.2		exponent of generalized IDW function for child edges 1/2	n_dom>1
grf_idw_exp_e34	R	1.7		exponent of generalized IDW function for child edges 3/4	n_dom>1
rbf_vec_kern_grf_e	I	1		RBF kernel for grid refinement (edges): 1: Gaussian 2: $1/(1+r^2)$ 3: inverse multiquadric	n_dom>1
rbf_scale_grf_e	R	0.5		RBF scale factor for grid refinement (edges)	n_dom>1
denom_diffu_t	R	135		Deniminator for lateral boundary diffusion of temperature	n_dom>1
denom_diffu_v	R	200		Deniminator for lateral boundary diffusion of velocity	n_dom>1
l_mass_consvcorr	L	.FALSE.		.TRUE.: Apply mass conservation correction in feedback routine	n_dom>1

Parameter	Type	Default	Unit	Description	Scope
l_density_nudging	L	.FALSE.		.TRUE.: Apply density nudging near lateral nest boundary if grf_intmethod_e ≤ 4	n_dom>1 .AND. lfeedback = .TRUE.
fbk_relax_timescale	R	10800		Relaxation time scale for feedback	n_dom>1 .AND. lfeedback = .TRUE. .AND. ifeedback_type = 2

Defined and used in: `src/namelists/mo_gridref_nml.f90`

3.9 gw_hines_nml (Scope: lgw_hines = .TRUE. in echam_phy_nml)

Parameter	Type	Default	Unit	Description	Scope
lheatcal	L	.FALSE.		.TRUE.: compute drag, heating rate and diffusion coefficient from the dissipation of gravity waves .FALSE.: compute drag only	
emiss_lev	I	10		Index of model level, counted from the surface, from which the gravity wave spectra are emitted	
rmscon	R	1.0	m/s	Root mean square gravity wave wind at the emission level	
kstar	R	5.0e-5	1/m	Typical gravity wave horizontal wavenumber	
m_min	R	0.0	1/m	Minimum bound in vertical wavenumber	
lrmscon_lat	L	.FALSE.		.TRUE.: use latitude dependent rms wind - |latitude| >= lat_rmscon: use rmscon - |latitude| <= lat_rmscon_eq: use rmscon_eq - lat_rmscon_eq < |latitude| < lat_rmscon: use linear interpolation between rmscon_eq and rmscon .FALSE.: use globally constant rms wind rmscon	
lat_rmscon_eq	R	5.0	deg N	rmscon_eq is used equatorward of this latitude	lrmscon_lat = .TRUE.
lat_rmscon	R	10.0	deg N	rmscon is used polward of this latitude	lrmscon_lat = .TRUE.
rmscon_eq	R	1.2	m/s	is used equatorward of latitude lat_rmscon_eq	lrmscon_lat = .TRUE.

Defined and used in: `src/namelists/mo_gw_hines_nml.f90`

3.10 ha_dyn_nml

This namelist is relevant if run_nml:ldynamics=.TRUE. and dynamics_nml:iequations=IHS_ATM_TEMP or IHS_ATM_THETA.

Parameter	Type	Default	Unit	Description	Scope
itime_scheme	I	4		Time integration scheme: 11: pure advection (no dynamics) 12: 2 time level semi implicit (not yet implemented) 13: 3 time level explicit 14: 3 time level with semi implicit correction 15: standard 4th-order Runge-Kutta method (4-stage) 16: SSPRK(5,4) scheme (5-stage)	
ileapfrog_startup	I	1		How to integrate the first time step when the leapfrog scheme is chosen. 1 = Euler forward; 2 = a series of sub-steps.	itime_scheme= 13 or 14
asselin_coeff	R	0.1		Asselin filter coefficient	itime_scheme= 13 or 14
si_2tls	R	0.6		weight of time step n+1. Valid range: [0,1]	itime_scheme=12
si_expl_scheme	I	2		scheme for the explicit part used in the 2 time level semi-implicit time stepping scheme. 1 = Euler forward; 2 = Adams-Bashforth 2nd order	itime_scheme=12
si_cmin	R	30.0	m/s	semi implicit correction is done for eigenmodes with speeds larger than si_cmin	itime_scheme=14 and lsi_3d=.FALSE.
si_coeff	R	1.0		weight of the semi implicit correction	itime_scheme=14
si_offctr	R	0.7			itime_scheme=14
si_rtol	R	1.0e-3		relative tolerance for GMRES solver	itime_scheme=14
lsi_3d	L	.FALSE.		3D GMRES solver or decomposistion into 2D problems	lshallow_water=.FALSE. and itime_scheme=14
ldry_dycore	L	.TRUE.		Assume dry atmosphere	iequations∈{1,2}
lref_temp	L	.FALSE.		Set a background temperature profile as base state when computing the pressure gradient force	iequations∈{1,2}

3.11 initicon_nml

Parameter	Type	Default	Unit	Description	Scope
init_mode	I	1		1: start from DWD analysis 2: start from IFS analysis 3: combined mode: IFS atm + GME soil 4: start from COSMO-DE forecast	
dt_iau	R	10800	s	Time interval during which an incremental analysis update (IAU) is performed	init_mode=5
type_iau_wgt	I	1		Weighting function for performing IAU 1: Top-Hat 2: SIN2	init_mode=5
nlevsoil_in	I	4		number of soil levels of input data	init_mode=2
zpbl1	R	500.0	m	bottom height (AGL) of layer used for gradient computation	
zpbl2	R	1000.0	m	top height (AGL) of layer used for gradient computation	
l_sst_in	L	.TRUE.		Logical switch. If true, the surface temperature of the water sea points is initialized with the SST provided in the ifs2icon file. If false, it is initialized with the skin temperature. If the SST is not provided in the ifs2icon file,l_sst_in is reset to false.	init_mode=2
lread_ana	L	.TRUE.		If .FALSE., ICON is started from first guess only. Analysis field is not required, and skipped if provided.	init_mode=1,3
l_coarse2fine_mode	L(max_dom)	.FALSE.		If true, apply corrections for coarse-to-fine mesh interpolation to wind and temperature	
ifs2icon_filename	C			Filename of IFS2ICON input file, default "`<path>ifs2icon_R<nroot>B<jlev>_DOM<idom>.nc`". May contain the keywords `<path>` which will be substituted by `model_base_dir`, as well as `nroot`, `jlev`, and `idom` defining the current patch.	init_mode=2

Parameter	Type	Default	Unit	Description	Scope
dwdfg_filename	C			Filename of DWD first-guess input file, default "<path>dwdFG_R<nroot>B<jlev>_DOM <idom>.nc". May contain the keywords <path> which will be substituted by model_base_dir, as well as nroot, jlev, and idom defining the current patch.	init_mode=1,3
dwdana_filename	C			Filename of DWD analysis input file, default "<path>dwdana_R<nroot>B<jlev>_DOM <idom>.nc". May contain the keywords <path> which will be substituted by model_base_dir, as well as nroot, jlev, and idom defining the current patch.	init_mode=1
filetype	I	-1 (undef.)		One of CDI's FILETYPE_XXX constants. Possible values: 2 (=FILETYPE_GRB2), 4 (=FILETYPE_NC2). If this parameter has not been set, we try to determine the file type by its extension "*.grb*" or ".nc".	
ana_varlist	C			List of mandatory analysis fields that must be present in the analysis file. If these fields cannot be found in the analysis file, the model aborts. For all other analysis fields, the FG-fields will serve as fallback position.	init_mode=1
ana_varnames_map_file	C			Dictionary file which maps internal variable names onto GRIB2 shortnames or NetCDF var names. This is a text file with two columns separated by whitespace, where left column: ICON variable name, right column: GRIB short name.	

Defined and used in: src/namelists/mo_initicon_nml.f90

3.12 interpol_nml

Parameter	Type	Default	Unit	Description	Scope
l_intp_c2l	L	.TRUE.		If .TRUE. directly interpolate scalar variables from cell centers to lon-lat points, otherwise do gradient interpolation and reconstruction.	
l_mono_c2l	L	.TRUE.		Monotonicity can be enforced by demanding that the interpolated value is not higher or lower than the stencil point values.	
llsq_high_consv	L	.TRUE.		conservative (T) or non-conservative (F) least-squares reconstruction for high order transport	
lsq_high_ord	I	3		polynomial order for high order reconstruction 1: linear 2: quadratic 30: cubic (no 3^{rd} order cross deriv.) 3: cubic	ihadv_tracer=4
llsq_lin_consv	L	.FALSE.		conservative (T) or non-conservative (F) least-squares reconstruction for 2nd order (linear) transport	
nudge_efold_width	R	2.5		e-folding width (in units of cell rows) for lateral boundary nudging coefficient	
nudge_max_coeff	R	0.02		Maximum relaxation coefficient for lateral boundary nudging	
nudge_zone_width	I	8		Total width (in units of cell rows) for lateral boundary nudging zone. If <0 the patch boundary_depth_index is used.	
rbf_dim_c2l	I	10		stencil size for direct lon-lat interpolation: $4 =$ nearest neighbor, $13 =$ vertex stencil, $10 =$ edge stencil.	
rbf_scale_mode_ll	I	2		Specifies, how the RBF shape parameter is determined for lon-lat interpolation. 1 : lookup table based on grid level (default) 2 : determine automatically. So far, this routine only estimates the smallest value for the shape parameter for which the Cholesky is likely to succeed in floating point arithmetic.	
rbf_vec_kern_c	I	1		Kernel type for reconstruction at cell centres:	

Parameter	Type	Default	Unit	Description	Scope
				1: Gaussian 3: inverse multiquadric	
rbf_vec_kern_e	I	3		Kernel type for reconstruction at edges: 1: Gaussian 3: inverse multiquadric	
rbf_vec_kern_ll	I	1		Kernel type for reconstruction at lon-lat-points: 1: Gaussian 3: inverse multiquadric	
rbf_vec_kern_v	I	1		Kernel type for reconstruction at vertices: 1: Gaussian 3: inverse multiquadric	
rbf_vec_scale_c	R(n_dom)	resolution-dependent		Scale factor for RBF reconstruction at cell centres	
rbf_vec_scale_e	R(n_dom)	resolution-dependent		Scale factor for RBF reconstruction at edges	
rbf_vec_scale_v	R(n_dom)	resolution-dependent		Scale factor for RBF reconstruction at vertices	

Defined and used in: `src/namelists/mo_interpol_nml.f90`

3.13 io_nml

Parameter	Type	Default	Unit	Description	Scope
lkeep_in_sync	L	.FALSE.		Sync output stream with file on disk after each timestep	
dt_diag	R	86400.		diagnostic integral output interval	
dt_checkpoint	R	2592000	s	Time interval for writing restart files. Note that if the value of dt_checkpoint resulting from model default or user's specification is longer than time_nml:dt_restart, it will be reset (by the model) to dt_restart so that at least one restart file is generated during the restart cycle.	`output /= "none"` (`run_nml`)

Parameter	Type	Default	Unit	Description	Scope
inextra_2d	I	0		Number of extra 2D Fields for diagnostic/debugging output.	iequations = 3 (to be done for 1, 2)
inextra_3d	I	0		Number of extra 3D Fields for diagnostic/debugging output.	iequations = 3 (to be done for 1, 2)
lflux_avg	L	.TRUE.		if .FALSE. the output fluxes are accumulated from the beginning of the run if .TRUE. the output fluxes are average values from the beginning of the run, except of TOT_PREC that would be accumulated	iequations=3 iforcing=3
itype_pres_msl	I	1		Specifies method for computation of mean sea level pressure (and geopotential at pressure levels below the surface). 1: GME-type extrapolation, 2: stepwise analytical integration, 3: current IFS method, 4: IFS method with consistency correction	
itype_rh	I	1		Specifies method for computation of relative humidity 1: WMO-type: water only (e_s=e_s_water), 2: IFS-type: mixed phase (water and ice), 3: IFS-type with clipping (rh $\leq$ 100)	

Parameter	Type	Default	Unit	Description	Scope
output_nml_dict	C	' '		File containing the mapping of variable names to the internal ICON names. May contain the keyword `<path>` which will be substituted by `model_base_dir`. The format of this file: One mapping per line, first the name as given in the `ml_varlist`, `hl_varlist`, `pl_varlist` or `il_varlist` of the `output_nml` namelists, then the internal ICON name, separated by an arbitrary number of blanks. The line may also start and end with an arbitrary number of blanks. Empty lines or lines starting with # are treated as comments. Names not covered by the mapping are used as they are.	`output_nml` namelists
netcdf_dict	C	' '		File containing the mapping from internal names to names written to NetCDF. May contain the keyword `<path>` which will be substituted by `model_base_dir`. The format of this file: One mapping per line, first the name written to NetCDF, then the internal name, separated by an arbitrary number of blanks (*inverse to the definition of* output_nml_dict). The line may also start and end with an arbitrary number of blanks. Empty lines or lines starting with # are treated as comments. Names not covered by the mapping are output as they are. Note that the specification of output variables, e. g. in `ml_varlist`, is independent from this renaming, see the namelist parameter `varnames_map_file` for this.	`output_nml` namelists, NetCDF output

Parameter	Type	Default	Unit	Description	Scope
lzaxis_reference	L	.TRUE.		FALSE: use vertical axis ZAXIS_HYBRID for 3D atmospheric fields TRUE: use vertical axis ZAXIS_REFERENCE for 3D atmospheric fields	will be removed after some testing phase

Defined and used in: `src/namelists/mo_io_nml.f90`

3.14 les_nml (parameters for LES turbulence scheme; valid for inwp_turb=5)

Parameter	Type	Default	Unit	Description	Scope
sst	R	300	K	sea surface temperature for idealized LES simulations	nh_test_name=CBL, RICO isrfc_type=5,4
shflx	R	-999	Km/s	Kinematic sensible heat flux at surface	isrfc_type = 2
lhflx	R	-999	m/s	Kinematic latent heat flux at surface	isrfc_type = 2
isrfc_type	I	1		surface type 1 = TERRA land physics 2 = fixed surface fluxes 3 = fixed buoyancy fluxes 4 = RICO test case 5 = fixed SST	
ufric	R	-999	m/s	friction velocity for idealized LES simulations	
is_dry_cbl	L	.FALSE.		switch for dry convective boundary layer simulations	
karman_constant	R	0.4		von Karman constant	
smag_constant	R	0.12		Smagorinsky constant	
turb_prandtl	R	0.333333		turbulent Prandtl number	
bflux	R	-999	m^2/s^3	buoyancy flux for idealized LES simulations (Stevens 2007)	isrfc_type=3
tran_coeff	R	-999	m/s	transfer coefficient near surface for idealized LES simulation (Stevens 2007)	isrfc_type=3

Parameter	Type	Default	Unit	Description	Scope
vert_scheme_type	I	2		type of time integration scheme in vertical diffusion 1 = explicit 2 = fully implicit	
sampl_freq_sec	R	60	s	sampling frequency in seconds for statistical (1D and 0D) output	
avg_interval_sec	R	900	s	(time) averaging interval in seconds for 1D statistical output	
expname	C	ICOLES		expname to name the statistical output file	
ldiag_les_out	L	.TRUE.		Control for the statistical output in LES mode	

Defined and used in: `src/namelists/mo_les_nml.f90`

3.15 limarea_nml (Scope: l_limited_area=1 in grid_nml)

Parameter	Type	Default	Unit	Description	Scope
itype_latbc	I	0		Type of lateral boundary nudging. Nudge from 0: the initial data, 1: IFS data analysis/forecast (if `init_mode`=4, we take COSMO-DE data), 2: ICON output data (with the identical 3d grid)	
dtime_latbc	R	10800.0	s	Time difference between two consecutive boundary data.	itype_latbc ≥ 1
nlev_latbc	I	0	s	Number of vertical levels in boundary data.	itype_latbc ≥ 1
latbc_filename	C			Filename of boundary data input file, default: "`prepiconR<nroot>B<jlev>_<y><m><d><h>.nc`". `<y>`, `<m>`, `<d>`, and `<h>` will be automatically replaced during the run-time. In case the time span between two consecutive boundary data is less than 1 hour, one can use `<min>` and `<sec>`. These files must be located in the `latbc_path` directory.	itype_latbc ≥ 1
latbc_path	C			Absolute path to boundary data.	itype_latbc ≥ 1

Defined and used in: `src/namelists/mo_limarea_nml.f90`

3.16 lnd_nml

Parameter	Type	Default	Unit	Description	Scope
nlev_snow	I	2		number of snow layers for `lmulti_snow=.true.`	lmulti_snow=.true.
ntiles	I	1		number of tiles	
lsnowtile	L	.FALSE.		.TRUE.: consider snow-covered and snow-free tiles separately	ntiles>1
frlnd_thrhld	R	0.05		fraction threshold for creating a land grid point	ntiles>1
frlake_thrhld	R	0.05		fraction threshold for creating a lake grid point	ntiles>1
frsea_thrhld	R	0.05		fraction threshold for creating a sea grid point	ntiles>1
frlndtile_thrhld	R	0.05		fraction threshold for retaining the respective tile for a grid point	ntiles>1
lmulti_snow	L	.TRUE.		.TRUE. for use of multi-layer snow model	
max_toplaydepth	R	0.25	m	maximum depth of uppermost snow layer	lmulti_snow=.TRUE.
idiag_snowfrac	I	1		Type of snow-fraction diagnosis: 1 = based on SWE only 2–4 = more advanced experimental methods	
itype_lndtbl	I	1		Table values used for associating surface parameters to land-cover classes: 1 = defaults from extpar (GLC2000 and GLOBCOVER2009) 2 = Tuned version based on IFS values for globcover classes (GLOBCOVER2009 only) 3 = even more tuned version (EXPERIMENTAL!!, GLOBCOVER2009 only)	
itype_root	I	2		root density distribution: 1 = constant 2 = exponential	
lseaice	L	.TRUE.		.TRUE. for use of sea-ice model	
llake	L	.TRUE.		.TRUE. for use of lake model	

Parameter	Type	Default	Unit	Description	Scope
sstice_mode	I	1		1: SST and sea ice fraction are read from the analysis and kept constant. The sea ice fraction can be modified by the seaice model. 2: SST and sea ice fraction are updated daily, based on climatological monthly means 3: SST and sea ice fraction are updated daily, based on actual monthly means 4: SST and sea ice fraction are updated daily, based on actual daily means, not yet implemented	iequations=3 iforcing=3
sst_td_filename	C			Filename of SST input files for time dependent SST. Default is "<path>SST_<year>_<month>_<gridfile>". May contain the keyword <path> which will be substituted by model_base_dir	sstice_mode=2,3
ci_td_filename	C			Filename of sea ice fraction input files for time dependent sea ice fraction. Default is "<path>CI_<year>_<month>_<gridfile>". May contain the keyword <path> which will be substituted by model_base_dir	sstice_mode=2,3

Defined and used in: `src/namelists/mo_lnd_nwp_nml.f90`

3.17 ls_forcing_nml (parameters for large-scale forcing; valid for torus geometry)

Parameter	Type	Default	Unit	Description	Scope
is_ls_forcing	L	.FALSE.		switch for enabling large-scale (LS) forcing on torus grid	is_plane_torus=.TRUE.
is_subsidence_moment	L	.FALSE.		switch for enabling LS vertical advection due to subsidence for momentum equations	is_plane_torus=.TRUE.
is_subsidence_heat	L	.FALSE.		switch for enabling LS vertical advection due to subsidence for thermal equations	is_plane_torus=.TRUE.
is_advection	L	.FALSE.		switch for enabling LS horizontal advection (currently only for thermal equations)	is_plane_torus=.TRUE.

Parameter	Type	Default	Unit	Description	Scope
is_geowind	L	.FALSE.		switch for enabling geostrophic wind	is_plane_torus=.TRUE.
is_rad_forcing	L	.FALSE.		switch for enabling radiative forcing	is_plane_torus=.TRUE. inwp_rad=.FALSE.
is_geowind	L	.FALSE.		switch for enabling geostrophic wind	is_plane_torus=.TRUE.
is_theta	L	.FALSE.		switch to indicate that the prescribed radiative forcing is for potential temperature	is_plane_torus=.TRUE. is_rad_forcing=.TRUE.

Defined and used in: `src/namelists/mo_ls_forcing_nml.f90`

3.18 master_model_nml (repeated for each model)

Parameter	Type	Default	Unit	Description	Scope
model_name	C			Character string for naming this component.	
model_namelist_filename	C			File name containing the model namelists.	
model_type	I	0		Identifies which component to run. atmosphere=1, ocean=2, radiation=3, dummy_model=99	
model_min_rank	I	0		Start MPI rank for this model.	
model_max_rank	I	-1		End MPI rank for this model.	
model_inc_rank	I	0		Stride of MPI ranks.	
model_restart_info_filename	C	restart.info		Name (including full path) of the restart info file for this model	

3.19 master_nml

Parameter	Type	Default	Unit	Description	Scope
l_restart	L	.FALSE.		If .TRUE.: Current experiment is started from a restart.	
model_base_dir	C	' '		General path which may be used in file names of other name lists: If a file name contains the keyword `"<path>"`, then this `model_base_dir` will be substituted.	

3.20 meteogram_output_nml

Parameter	Type	Default	Unit	Description	Scope
lmeteogram_enabled	L(n_dom)	.FALSE.		Flag. True, if meteogram of output variables is desired.	
zprefix	C(n_dom)	"METEOGRAM_"		string with file name prefix for output file	
ldistributed	L(n_dom)	.TRUE.		Flag. Separate files for each PE.	
n0_mtgrm	I(n_dom)	1		initial time step for meteogram output	
ninc_mtgrm	I(n_dom)	1		output interval (in time steps)	
stationlist_tot		53.633, 9.983, 'Hamburg'		list of meteogram stations (triples with lat, lon, name string)	

Defined and used in: `src/namelists/mo_mtgrm_nml.f90`

3.21 nh_pzlev_nml

Parameter	Type	Default	Unit	Description	Scope
nzlev	I	10		number of height levels	iequations=3
nplev	I	10		number of pressure levels	iequations=3
nilev	I	3		number of isentropes	iequations=3
zlevels	R	10000, 9000, ..., 1000, 0	m	array of height levels	iequations=3 level ordering from TOA to bottom
plevels	R	100000, 90000, 80000, ..., 10000	Pa	array of pressure levels	iequations=3 level ordering from TOA to bottom

Parameter	Type	Default	Unit	Description	Scope
ilevels	R	340, 320, 300	K	array of isentropic levels	iequations=3 level ordering from TOA to bottom

Defined and used in: `src/namelists/mo_nh_pzlev_nml.f90`

3.22 nonhydrostatic_nml (relevant if run_nml:iequations=3)

Parameter	Type	Default	Unit	Description	Scope
itime_scheme	I	4		Options for predictor-corrector time-stepping scheme: 4: Contravariant vertical velocity is computed in the predictor step only, velocity tendencies are computed in the corrector step only (most efficient option) 5: Contravariant vertical velocity is computed in both substeps (beneficial for numerical stability in very-high resolution setups with extremely steep slops, otherwise no significant impact) 6: As 5, but velocity tendencies are also computed in both substeps (no apparent benefit, but more expensive)	iequations=3
rayleigh_type	I	2		Type of Rayleigh damping 1: CLASSICAL (requires velocity reference state!) 2: Klemp (2008) type	
rayleigh_coeff	R(n_dom)	0.05		Rayleigh damping coefficient $1/\tau_0$ (Klemp, Dudhia, Hassiotis: MWR136, pp.3987-4004); higher values are recommended for R2B6 or finer resolution	
damp_height	R(n_dom)	45000	m	Height at which Rayleigh damping of vertical wind starts (needs to be adjusted to model top height; the damping layer should have a depth of at least 20 km when the model top is above the stratopause)	

Parameter	Type	Default	Unit	Description	Scope
htop_moist_proc	R	22500.0	m	Height above which moist physics and advection of cloud and precipitation variables are turned off	
hbot_qvsubstep	R	22500.0	m	Height above which QV is advected with substepping scheme (must be at least as large as htop_moist_proc)	ihadv_tracer=22, 32, 42 or 52
vwind_offctr	R	0.15		Off-centering in vertical wind solver. Higher values may be needed for R2B5 or coarser grids when the model top is above 50 km.	
rhotheta_offctr	R	-0.1		Off-centering of density and potential temperature at interface level (may be set to 0.0 for R2B6 or finer grids)	
veladv_offctr	R	0.25		Off-centering of velocity advection in corrector step	
ivctype	I	2		Type of vertical coordinate: 1: Gal-Chen hybrid 2: SLEVE (uses sleve_nml)	
iadv_rcf	I	5		reduced calling frequency (rcf) for transport/diffusion/physics 1: no rcf (every dynamics-step) n>1: transport every n-th step Setting odd values (besides 1) requires l_nest_rcf = .TRUE.	
lhdiff_rcf	L	.TRUE.		.TRUE.: Compute diffusion only at advection time steps (in this case, divergence damping is applied in the dynamical core)	
lextra_diffu	L	.TRUE.		.TRUE.: Apply additional momentum diffusion at grid points close to the stability limit for vertical advection (becomes effective extremely rarely in practice; this is mostly an emergency fix for pathological cases with very large orographic gravity waves)	
lbackward_integr	L	.FALSE.		.TRUE.: Integrate backward in time (preparation for testing a digital filter initialization)	
divdamp_fac	R	0.0025		Scaling factor for divergence damping	lhdiff_rcf = .TRUE.

Parameter	Type	Default	Unit	Description	Scope
divdamp_order	I	4		Order of divergence damping: 2 = second-order divergence damping 4 = fourth-order divergence damping 24 = combined second-order and fourth-order divergence damping and enhanced vertical wind off-centering during the initial spinup phase (does not allow checkpointing/restarting ealier than 2.5 hours of integration)	lhdiff_rcf = .TRUE.
divdamp_type	I	3		Type of divergence damping: 2 = divergence damping acting on 2D divergence 3 = divergence damping acting on 3D divergence	lhdiff_rcf = .TRUE.
l_nest_rcf	L	.TRUE.		Synchronize interpolation/feedback calls with advection (transport) time steps. l_nest_rcf is automatically reset to .FALSE. if iadv_rcf=1	
l_masscorr_nest	L	.FALSE.		.TRUE.: Apply mass conservation correction also in nested domain	
iadv_rhotheta	I	2		Advection method for rho and rhotheta: 1: simple second-order upwind-biased scheme 2: 2nd order Miura horizontal 3: 3rd order Miura horizontal (not recommended)	
lvadv_tke	L	.FALSE.		.TRUE.: Apply simple first-order upwind vertical advection of TKE	
igradp_method	I	3		Discretization of horizontal pressure gradient: 1: conventional discretization with metric correction term 2: Taylor-expansion-based reconstruction of pressure (advantageous at very high resolution) 3: Similar discretization as option 2, but uses hydrostatic approximation for downward extrapolation over steep slopes 4: Cubic/quadratic polynomial interpolation for pressure reconstruction 5: Same as 4, but hydrostatic approximation for downward extrapolation over steep slopes	

Parameter	Type	Default	Unit	Description	Scope
l_zdiffu_t	L	.TRUE.		.TRUE.: Compute Smagorinsky temperature diffusion truly horizontally over steep slopes	hdiff_order=3/5 .AND. lhdiff_temp = .true.
thslp_zdiffu	R	0.025		Slope threshold above which truly horizontal temperature diffusion is activated	hdiff_order=3/5 .AND. lhdiff_temp=.true. .AND. l_zdiffu_t=.true.
thhgtd_zdiffu	R	200	m	Threshold of height difference between neighboring grid points above which truly horizontal temperature diffusion is activated (alternative criterion to thslp_zdiffu)	hdiff_order=3/5 .AND. lhdiff_temp=.true. .AND. l_zdiffu_t=.true.
exner_expol	R	1./3.		Temporal extrapolation (fraction of dt) of Exner function for computation of horizontal pressure gradient. This damps horizontally propagating sound waves. For R2B5 or coarser grids, values between 1/2 and 2/3 are recommended.	
l_open_ubc	L	.FALSE.		.TRUE.: Use open upper boundary condition (rather than w=0) to allow vertical motions related to diabatic heating to extend beyond the model top	

Defined and used in: `src/namelists/mo_nonhydrostatic_nml.f90`

3.23 nwp_phy_nml

The switches for the physics schemes and the time steps can be set for each model domain individually. If only one value is specified, it is copied to all child domains, implying that the same set of parameterizations and time steps is used in all domains. If the number of values given in the namelist is larger than 1 but less than the number of model domains, then the settings from the highest domain ID are used for the remaining model domains. If the time steps are not an integer multiple of the advective time step (dtime*iadv_rcf), then the time step of the respective physics parameterization is automatically rounded to the next higher integer multiple of the advective time step.

Parameter	Type	Default	Unit	Description	Scope
inwp_gscp	I (max_ dom)	1		cloud microphysics and precipitation 0: none 1: hydci (COSMO-EU microphysics) 9: Kessler scheme	run_nml/iforcing = inwp

Parameter	Type	Default	Unit	Description	Scope
qi0	R	0.0	kg/kg	cloud ice threshold for autoconversion	inwp_gscp=1
qc0	R	0.0	kg/kg	cloud water threshold for autoconversion	inwp_gscp=1
mu_rain	R	0.0	1	shape parameter for gamma distribution for rain	inwp_gscp>0
inwp_convection	I (max_ dom)	1		convection 0: none 1: Tiedtke/Bechtold convection	run_nml/iforcing = inwp
inwp_cldcover	I (max_ dom)	1		cloud cover scheme for radiation 0: no clouds (only QV) 1: diagnostic cloud cover (by Martin Koehler) 2: prognostic total water variance (not yet started) 3: clouds from COSMO SGS cloud scheme 4: clouds as in turbulence (turbdiff) 5: grid scale clouds	run_nml/iforcing = inwp
inwp_radiation	I (max_ dom)	1		radiation 0: none 1: RRTM radiation 2: Ritter-Geleyn radiation	run_nml/iforcing = inwp
inwp_satad	I	1		saturation adjustment 0: none 1:	run_nml/iforcing = inwp
inwp_turb	I (max_ dom)	1		vertical diffusion and transfer 0: none 1: COSMO diffusion and transfer 2: GME turbulence scheme (to be implemented) 3: EDMF-DUALM (work in progress) 5: Classical Smagorinsky diffusion	run_nml/iforcing = inwp
inwp_sso	I (max_ dom)	1		subgrid scale orographic drag 0: none 1: (COSMO) Lott and Miller scheme	run_nml/iforcing = inwp
inwp_gwd	I (max_ dom)	1		non-orographic gravity wave drag 0: none 1:Orr-Ern-Bechtold-scheme(IFS)	run_nml/iforcing = inwp

Parameter	Type	Default	Unit	Description	Scope
inwp_surface	I (max_dom)	1		surface scheme 0: none 1: TERRA	run_nml/iforcing = inwp
ustart_raylfric	R	160.0	m/s	wind speed at which extra Rayleigh friction starts	inwp_gwd > 0
efdt_min_raylfric	R	10800.	s	minimum e-folding time of Rayleigh friction (effective for u > ustart_raylfric + 90 m/s)	inwp_gwd > 0
latm_above_top	L (max_dom)	.FALSE.		.TRUE.: take into account atmosphere above model top for radiation computation	inwp_radiation > 0
itype_z0	I	2		Type of roughness length data used for turbulence scheme: 1 = including contribution from sub-scale orography 2 = land-cover-related roughness only	inwp_turb > 0
dt_conv	R (max_dom)	600.	s	time interval of convection call currently each subdomain has the same value	run_nml/iforcing = inwp
dt_rad	R (max_dom)	1800.	s	time interval of radiation call currently each subdomain has the same value	run_nml/iforcing = inwp
dt_sso	R (max_dom)	1200.	s	time interval of sso call currently each subdomain has the same value	run_nml/iforcing = inwp
dt_gwd	R (max_dom)	1200.	s	time interval of gwd call currently each subdomain has the same value	run_nml/iforcing = inwp
lrtm_filename	C(:)	"rrtmg_lw.nc"		NetCDF file containing longwave absorption coefficients and other data for RRTMG_LW k-distribution model.	
cldopt_filename	C(:)	"ECHAM6_CldOptProps.nc"		NetCDF file with RRTM Cloud Optical Properties for ECHAM6.	

Defined and used in: `src/namelists/mo_atm_phy_nwp_nml.f90`

3.24 ocean_physics_nml

Parameter	Type	Default	Unit	Description	Scope
i_sea_ice	I	1		0: No sea ice, 1: Include sea ice	

Parameter	Type	Default	Unit	Description	Scope
				.FALSE.: compute drag only	
richardson_factor_tracer	I	0.5e-5	m/s		
richardson_factor_veloc	I	0.5e-5	m/s		
l_constant_mixing	L	.FALSE.			

3.25 output_nml

Please note: There may be several instances of output_nml in the namelist file, every one defining a list of variables with separate attributes for output.

Parameter	Type	Default	Unit	Description	Scope
dom(:)	I	-1		Array of domains for which this name-list is used. If not specified (or specified as -1 as the first array member), this name-list will be used for all domains. Attention: Depending on the setting of the parameter l_output_phys_patch these are either logical or physical domain numbers!	
file_interval	C	' '		Defines the length of a file in terms of an ISO-8601 duration string. An example for this time stamp format is given below. This namelist parameter can be set instead of `steps_per_file`.	
filename_format	C	see description.		Output filename format. Includes keywords `path`, `output_filename`, `physdom`, etc. (see below). Default is <output_filename>_DOM<physdom>_<levtype>_<jfile>	
filetype	I	4		One of CDI's FILETYPE_XXX constants. Possible values: 2 (=FILETYPE_GRB2), 4 (=FILETYPE_NC2), 5 (=FILETYPE_NC4)	
h_levels(:)	R	None	m	height levels Not yet implemented. The height levels are currently always taken from array zlevels in namelist nh_pzlev_nml.	

Parameter	Type	Default	Unit	Description	Scope
hl_varlist(:)	C	None		Name of height level fields to be output.	
i_levels(:)	R	None	K	isentropic levels Not yet implemented. The isentropic levels are currently always taken from array ilevels in namelist nh_pzlev_nml.	
il_varlist(:)	C	None		Name of isentropic level fields to be output.	
include_last	L	.TRUE.		Flag whether to include the last time step	
ml_varlist(:)	C	None		Name of model level fields to be output.	
mode	I	2		1 = forecast mode, 2 = climate mode In climate mode the time axis of the output file is set to TAXIS_ABSOLUTE. In forecast mode it is set to TAXIS_RELATIVE. Till now the forecast mode only works if the output is at multiples of 1 hour	
north_pole(2)	R	0,90		definition of north pole for rotated lon-lat grids.	
output_bounds(3)	R	None		Post-processing times (in seconds): start, end, increment. We choose the advection time step matching or following the requested output time, therefore we require `output_bounds(3) < dtime*iadv_rcf`. See namelist parameters `output_start`, `output_end`, `output_interval` for an alternative specification of output events.	
output_filename	C	None		Output filename prefix (which may include path). Domain number, level type, file number and extension will be added, according to the format given in namelist parameter "filename_format".	
output_grid	L	.FALSE.		Flag whether grid information is added to output.	
output_end	C	' '		ISO8601 time stamp for end of output. An example for this time stamp format is given below. See namelist parameter `output_bounds` for an alternative specification of output events.	

Parameter	Type	Default	Unit	Description	Scope
output_interval	C	' '		ISO8601 time stamp for repeating output intervals. We choose the advection time step matching or following the requested output time, therefore we require `output_bounds(3) < dtime*iadv_rcf`. An example for this time stamp format is given below. See namelist parameter `output_bounds` for an alternative specification of output events.	
output_start	C	' '		ISO8601 time stamp for begin of output. An example for this time stamp format is given below. See namelist parameter `output_bounds` for an alternative specification of output events.	
p_levels(:)	R	None	hPa	pressure levels Not yet implemented. The pressure levels are currently always taken from array plevels in namelist nh_pzlev_nml.	
pl_varlist(:)	C	None		Name of pressure level fields to be output.	
ready_file	C	'default'		A *ready file* is a technique for handling dependencies between the NWP processes. The completion of the write process is signalled by creating a small file with name `ready_file`. Different `output_nml`'s may be joined together to form a single ready file event. The setting of `ready_file = "default"` does not create a ready file. The ready file name may contain string tokens `<path>`, `<datetime>`, `<ddhhmmss>` which are substituted as described for the namelist parameter `filename_format`.	
reg_def_mode	I	0		Specify if the "delta" value prescribes an interval size or the total *number* of intervals: 0: switch automatically between increment and no. of grid points, 1: `reg_lon/lat_def(2)` specifies increment, 2: `reg_lon/lat_def(2)` specifies no. of grid points.	remap=1

Parameter	Type	Default	Unit	Description	Scope
reg_lat_def(3)	R	None		start, increment, end latitude in degrees. Alternatively, the user may set the number of grid points instead of an increment. Details for the setting of regular grids is given below together with an example.	remap=1
reg_lon_def(3)	R	None		The regular grid points are specified by three values: start, increment, end given in degrees. Alternatively, the user may set the number of grid points instead of an increment. Details for the setting of regular grids is given below together with an example.	remap=1
remap	I	0		interpolate horizontally, 0: none, 1: to regular lat-lon grid	
steps_per_file	I	-1		Max number of output steps in one output file. If this number is reached, a new output file will be opened.	
steps_per_file_inclfirst	L	see descr.		Defines if first step is counted wrt. `steps_per_file` files count. The default is `.FALSE.` for GRIB2 output, and `.TRUE.` otherwise.	
stream_partitions_hl	I	1		Splits height level output of this namelist into several concurrent alternating files. See namelist parameter `stream_partitions_ml` for details.	
stream_partitions_il	I	1		Splits isentropic level output of this namelist into several concurrent alternating files. See namelist parameter `stream_partitions_ml` for details.	
stream_partitions_ml	I	1		Splits model level output of this namelist into several concurrent alternating files. The output is split into N files, where the start date of part i gets an offset of $(i-1) *$ `output_interval`. The output interval is then replaced by $N *$ `output_interval`, the `include_last` flag is set to `.FALSE.`, the `steps_per_file_inclfirst` flag is set to `.FALSE.`, and the `steps_per_file` counter is set to `1`.	

Parameter	Type	Default	Unit	Description	Scope
stream_partitions_pl	I	1		Splits pressure level output of this namelist into several concurrent alternating files. See namelist parameter `stream_partitions_ml` for details.	
taxis_tunit	I	3		1 = TUNIT_SECOND 2 = TUNIT_MINUTE 3 = TUNIT_HOUR Time unit of the TAXIS_RELATIVE time axis. For a complete list of possible values see cdi.inc	mode=1

Interpolation onto regular grids: Horizontal interpolation onto regular grids is possible through the namelist setting `remap=1`, where the mesh is defined by the parameters

- `reg_lon_def`: mesh latitudes in degrees,
- `reg_lat_def`: mesh longitudes in degrees,
- `north_pole`: definition of north pole for rotated lon-lat grids.

The regular grid points in `reg_lon_def`, `reg_lat_def` are each specified by three values, given in degrees: *start*, *increment*, *end*. The mesh then contains all grid points $start + k * increment <= end$, where k is an integer. Instead of defining an increment it is also possible to prescribe the number of grid points.

- Setting the namelist parameter `reg_def_mode=0`: Switch automatically from increment specification to no. of grid points, when the `reg_lon/lat_def(2)` value is larger than 5.0.
- 1: `reg_lon/lat_def(2)` specifies increment
- 2: `reg_lon/lat_def(2)` specifies no. of grid points

For longitude values the last grid point is omitted if the end point matches the start point, e.g. for 0 and 360 degrees.

Examples

local grid with 0.5 degree increment:

```
reg_lon_def = -30.,0.5,30.
reg_lat_def = 90.,-0.5, -90.
```

global grid with 720x361 grid points:

```
reg_lon_def = 0.,720,360.
reg_lat_def = -90.,360,90.
```

Time stamp format: The namelist parameters `output_start`, `output_end`, `output_interval` allow the specification of time stamps according to ISO 8601. The general format for time stamps is `YYYY-MM-DDThh:mm:ss` where `Y`: year, `M`: month, `D`: day for dates, and `hh`: hour, `mm`: minute, `ss`: second for time strings. The general format for durations is `PnYnMnDTnHnMnS`. See, for example, `http://en.wikipedia.org/wiki/ISO_8601` for details and further specifications.

NOTE: as the mtime library underlaying the output driver currently has some restrictions concerning the specification of durations:

1. Any number `n` in `PnYnMnDTnHnMnS` must have two digits. For instance use `"PT06H"` instead of `"PT6H"`
2. In a duration string `PnyearYnmonMndayDTnhrHnminMnsecS` the numbers `nxyz` must not pass the carry over number to the next larger time unit: 0<=nmon<=12, 0<=nhr<=23, 0<=nmin<=59, 0<=nsec<=59.999. For instance use `"P01D"` instead of `"PT24H"`, or `"PT01M"` instead of `"PT60S"`.

Soon the formatting problem will be resolved and the valid number ranges will be enlarged. (2013-12-16).

Examples

date and time representation (`output_start`, `output_end`)	`2013-10-27T13:41:00Z`
duration (`output_interval`)	`P00DT06H00M00S`

Variable Groups: Using the `"group:"` keyword for the namelist parameters `ml_varlist`, `hl_varlist`, `pl_varlist`, sets of common variables can be added to the output:

`group:all`	output of all variables (caution: do not combine with <u>mixed</u> vertical interpolation)
`group:atmo_ml_vars`	basic atmospheric variables on model levels
`group:atmo_pl_vars`	same set as atmo_ml_vars, but except pres
`group:atmo_zl_vars`	same set as atmo_ml_vars, but expect height
`group:nh_prog_vars`	additional prognostic variables of the nonhydrostatic model
`group:atmo_derived_vars`	derived atmospheric variables
`group:rad_vars`	
`group:precip_vars`	
`group:cloud_diag`	
`group:pbl_vars`	
`group:phys_tendencies`	
`group:land_vars`	
`group:multisnow_vars`	tile-averaged variables

Note:

There exists a special syntax which allows to remove variables from the output list, e. g. if these undesired variables were contained in a previously selected group.
Typing "-<varname>" (for example "-temp") removes the variable from the union set of group variables and other selected variables. Note that typos are not detected but that the corresponding variable is simply not removed!

Keyword substitution in output filename (filename_format):

path	substituted by model_base_dir
output_filename	substituted by output_filename
physdom	substituted by physical patch ID
levtype	substituted by level type "ML", "PL", "HL", "IL"
levtype_l	like levtype, but in lower case
jfile	substituted by output file counter
datetime	substituted by ISO-8601 date-time stamp in format YYYY-MM-DDThh:mm:ss.sssZ
datetime2	substituted by ISO-8601 date-time stamp in format YYYYMMDDThhmmssZ
datetime3	substituted by ISO-8601 date-time stamp in format YYYYMMDDThhmmss.sssZ
ddhhmmss	substituted by *relative* day-hour-minute-second string
hhhmmss	substituted by *relative* hour-minute-second string
npartitions	If namelist is split into concurrent files: number of stream partitions.
ifile_partition	If namelist is split into concurrent files: stream partition index of this file.
total_index	If namelist is split into concurrent files: substituted by the file counter (like in jfile), which an "unsplit" namelist would have produced

Defined and used in: src/namelists/mo_name_list_output.f90

3.26 parallel_nml

Parameter	Type	Default	Unit	Description	Scope
nproma	I	1		chunk length	
n_ghost_rows	I	1		number of halo cell rows	
division_method	I	1		method of domain decomposition 0: read in from file 1: use built-in geometric subdivision 2: use METIS	
division_file_name	C			Name of division file	division_method = 0
ldiv_phys_dom	L	.TRUE.		.TRUE.: split into physical domains before computing domain decomposition (in case of merged domains) (This reduces load imbalance; turning off this option is not recommended except for very small processor numbers)	division_method = 1
p_test_run	L	.FALSE.		.TRUE. means verification run for MPI parallelization (PE 0 processes full domain)	
l_test_openmp	L	.FALSE.		if .TRUE. is combined with p_test_run=.TRUE. and OpenMP paralllelization, the test PE gets only 1 thread in order to verify the OpenMP paralllelization	p_test_run = .TRUE.
l_log_checks	L	.FALSE.		if .TRUE. messages are generated during each synchonization step (use for debugging only)	
l_fast_sum	L	.FALSE.		if .TRUE., use fast (not processor-configuration-invariant) global summation	
use_dycore_barrier	L	.FALSE.		if .TRUE., set an MPI barrier at the beginning of the nonhydrostatic solver (do not use for production runs!)	
itype_exch_barrier	I	0		1: set an MPI barrier at the beginning of each MPI exchange call 2: set an MPI barrier after each MPI WAIT call 3: 1+2 (do not use for production runs!)	

Parameter	Type	Default	Unit	Description	Scope
iorder_sendrecv	I	1		Sequence of send/receive calls: 1 = irecv/send 2 = isend/recv 3 = isend/irecv	
itype_comm	I	1		1: use local memory for exchange buffers 3: asynchronous halo communication for dynamical core (currently deactivated)	
num_io_procs	I	0		Number of I/O processors (running exclusively for doing I/O)	
num_restart_procs	I	0		Number of restart processors (running exclusively for doing restart)	
pio_type	I	1		Type of parallel I/O. Only used if number of I/O processors greater number of domains. Experimental!	
use_icon_comm	L	.FALSE.		Enable the use of MPI bulk communication through the icon_comm_lib	
icon_comm_debug	L	.FALSE.		Enable debug mode for the icon_comm_lib	
max_send_recv _buffer_size	I	131072		Size of the send/receive buffers for the icon_comm_lib.	
use_dp_mpi2io	L	.FALSE.		Enable this flag if output fields shall be gathered by the output processes in DOUBLE PRECISION.	
restart_chunk_size	I	1		Number of levels to be buffered by the asynchronous restart process. The (asynchronous) restart is capable of writing and communicating more than one 2D slice at once.	

Defined and used in: `src/namelists/mo_parallel_nml.f90`

3.27 radiation_nml

Parameter	Type	Default	Unit	Description	Scope
ldiur	L	.TRUE.		switch for solar irradiation: .TRUE.:diurnal cycle, .FALSE.:zonally averaged irradiation	
nmonth	I	0		0: Earth circles on orbit 1-12: Earth orbit position fixed for specified month	
lyr_perp	L	.FALSE.		.FALSE.: transient Earth orbit following VSOP87 .TRUE.: Earth orbit of year yr_perp of the VSOP87 orbit is perpertuated	
yr_perp	L	-99999		year used for lyr_perp = .TRUE.	
isolrad	I	3		Insolation scheme 0: Use original SRTM insolation. 1: Use insolation from external file containing the spectrally resolved insolation (monthly means) 2: Use preindustrial insolation as in CMIP5 (average from 1844–1856) 3: Use insolation for AMIP–type CMIP5 simulation (average from 1979–1988)	
izenith	I	3 4 (for iforcing = inwp)		Choice of zenith angle formula for the radiative transfer computation. 0: Sun in zenith everywhere 1: Zenith angle depends only on latitude 2: Zenith angle depends only on latitude. Local time of day fixed at 07:14:15 for radiative transfer computation (sin(time of day) = 1/pi 3: Zenith angle changing with latitude and time of day 4: Zenith angle and irradiance changing with season, latitude, and time of day (iforcing=inwp only)	
albedo_type	I	1		Type of surface albedo 1: based on soil type specific tabulated values (dry soil) 2: MODIS albedo	iforcing=inwp

Parameter	Type	Default	Unit	Description	Scope
irad_h2o irad_co2 irad_ch4 irad_n2o irad_o3 irad_o2 irad_cfc11 irad_cfc12 irad_aero	I	1 2 3 3 3 2 2 2 2		Switches for the concentration of radiative agents 0: 0. 1: prognostic variable 2: global constant 3: externally specified irad_aero = 5: Tanre aerosol climatology for run_nml/iforcing = 3 (NWP) irad_aero = 6: Tegen aerosol climatology for run_nml/iforcing = 3 (NWP) .AND. itopo =1 irad_o3 = 2: ozone climatology from MPI irad_o3 = 4: ozone clim for Aqua Planet Exp irad_o3 = 6: ozone climatology with T5 geographical distribution and Fourier series for seasonal cycle for run_nml/iforcing = 3 (NWP) irad_o3 = 7: GEMS ozone climatology (from IFS) for run_nml/iforcing = 3 (NWP)	Note: until further notice, please use irad_h2o = 1 irad_co2 = 2 and 0 for all the other agents for run_nml/iforcing = 2 (ECHAM).
vmr_co2 vmr_ch4 vmr_n2o vmr_o2 vmr_cfc11 vmr_cfc12	R	353.9e-6 1693.6e-9 309.5e-9 0.20946 252.8e-12 466.2e-12		Volume mixing ratio of the radiative agents	

Defined and used in: `src/namelists/mo_radiation_nml.f90`

3.28 run_nml

Parameter	Type	Default	Unit	Description	Scope
nsteps	I	0		number of time steps of this run.	
dtime	R	600.0	s	time step	
ltestcase	L	.TRUE.		Idealized testcase runs	
ldynamics	L	.TRUE.		Compute adiabatic dynamic tendencies	

Parameter	Type	Default	Unit	Description	Scope
iforcing	I	0		Forcing of dynamics and transport by parameterized processes. Use positive indices for the atmosphere and negative indices for the ocean. 0: no forcing 1: Held-Suarez forcing 2: ECHAM forcing 3: NWP forcing 4: local diabatic forcing without physics 5: local diabatic forcing with physics -1: MPIOM forcing (to be done)	
ltransport	L	.FALSE.		Compute large-scale tracer transport	
ntracer	I	0		Number of advected tracers handled by the large-scale transport scheme	
lvert_nest	L	.FALSE.		If set to .true. vertical nesting is switched on (i.e. variable number of vertical levels)	
num_lev	I(max_dom)	31		Number of full levels (atm.) for each domain	lvert_nest=.TRUE.
nshift	I(max_dom)	0		vertical half level of parent domain which coincides with upper boundary of the current domain	lvert_nest=.TRUE.
ltimer	L	.TRUE.		TRUE: Timer for monitoring thr runtime of specific routines is on (FALSE = off)	
timers_level	I	1			
activate_sync_timers	L	F		TRUE: Timer for monitoring runtime of communication routines (FALSE = off)	
msg_level	I	10		controls how much printout is written during runtime. For values less than 5, only the time step is written.	
msg_timestamp	L	.FALSE.		If .TRUE., precede output messages by time stamp.	

Parameter	Type	Default	Unit	Description	Scope
test_mode	I	0		Setting a value larger than 0 activates a dummy mode in which time stepping is changed into just doing iterations, and MPI communication is replaced by copying some value from the send buffer into the receive buffer (does not work with nesting and reduced radiation grid because the send buffer may then be empty on some PEs)	iequations = 3
debug_check_level	I	0		Setting a value larger than 0 activates debug checks.	
output	C(:)	“nml”, ”totint”		Main switch for enabling/disabling components of the model output. One or more choices can be set (as an array of string constants). Possible choices are: • “none”: switch off all output; • “nml”: new output mode (cf. `output_nml`); • “totint”: computation of total integrals. If the `output` namelist parameter is not set explicitly, the default setting “nml”,”totint” is assumed.	
restart_filename	C			File name for restart/checkpoint files (containg keyword substitution patterns `<gridfile>`, `<idom>`, `<rsttime>`, `<mtype>`). default: ”`<gridfile>_restart_<mtype>_<rsttime>.nc`”.	
profiling_output	I	1		controls how profiling printout is written: TIMER_MODE_AGGREGATED=1, TIMER_MODE_DETAILED=2, TIMER_MODE_WRITE_FILES=3.	

Defined and used in: `src/namelists/mo_run_nml.f90`

3.29 sea_ice_nml

Parameter	Type	Default	Unit	Description	Scope
i_ice_therm	I	2		Switch for thermodynamic model: 1: Zero-layer model 2: Two layer Winton (2000) model 3: Zero-layer model with analytical forcing (for diagnostics) 4: Zero-layer model for atmosphere-only runs (for diagnostics)	In an ocean run i_sea_ice must be >=1. In an atmospheric run the ice surface type must be defined.
i_ice_dyn	I	0		Switch for sea-ice dynamics: 0: No dynamics 1: FEM dynamics (from AWI)	
i_ice_albedo	I	1		Switch for albedo model. Only one is implemented so far.	
i_Qio_type	I	2		Switch for ice-ocean heat-flux calculation method: 1: Proportional to ocean cell thickness (like MPI-OM) 2: Proportional to speed difference between ice and ocean	Defaults to 1 when i_ice_dyn=0 and 2 otherwise.
kice	I	1		Number of ice classes (must be one for now)	
hnull	R	0.5	m	Hibler's h_0 parameter for new-ice growth.	
hmin	R	0.05	m	Minimum sea-ice thickness allowed.	
ramp_wind	R	10	days	Number of days it takes the wind to reach correct strength. Only used at the start of an OMIP/NCEP simulation (not after restart).	

3.30 sleve_nml (relevant if nonhydrostatic_nml:ivctype=2)

Parameter	Type	Default	Unit	Description	Scope
min_lay_thckn	R	50	m	Layer thickness of lowermost layer; specifying zero or a negative value leads to constant layer thicknesses determined by top_height and nlev	
top_height	R	23500.0	m	Height of model top	

Parameter	Type	Default	Unit	Description	Scope
stretch_fac	R	1.0		Stretching factor to vary distribution of model levels; values <1 increase the layer thickness near the model top	
decay_scale_1	R	4000	m	Decay scale of large-scale topography component	
decay_scale_2	R	2500	m	Decay scale of small-scale topography component	
decay_exp	R	1.2		Exponent of decay function	
flat_height	R	16000	m	Height above which the coordinate surfaces are flat	
lread_smt	L	.FALSE.		read smoothed topography from file (TRUE) or compute internally (FALSE)	

Defined and used in: `src/namelists/mo_sleve_nml.f90`

3.31 time_nml

Parameter	Type	Default	Unit	Description	Scope
calendar	I	1		Calendar type: 0=Julian/Gregorian 1=proleptic Gregorian 2=30day/month,360day/year	
dt_restart	R	86400.*30.	s	Length of restart cycle in seconds. Note that the frequency of writing restart files is controlled by io_nml:dt_checkpoint. If the value of dt_checkpoint resulting from model default or user's specification is longer than dt_restart, it will be reset (by the model) to dt_restart so that at least one restart file is generated during the restart cycle. If dt_restart is larger than but not a multiple of dt_checkpoint, restart file will NOT be generated at the end of the restart cycle.	
ini_datetime_string	C	'2008-09-01T 00:00:00Z'		Initial date and time of the simulation	

Parameter	Type	Default	Unit	Description	Scope
end_datetime_string	C	'2008-09-01T 01:40:00Z'		End date and time of the simulation	
is_relative_time	L	.FALSE.		.TRUE., if time loop shall start with step 0 regardless whether we are in a standard run or in a restarted run (which means re-initialized run).	

Length of the run If "nsteps" in run_nml is positive, then nsteps*dtime is used to compute the end date and time of the run. Else the initial date and time, the end date and time, dt_restart, as well as the time step are used to compute "nsteps".

3.32 transport_nml (used if run_nml/ltransport=.TRUE.)

Parameter	Type	Default	Unit	Description	Scope
lvadv_tracer	L	.TRUE.		TRUE : compute vertical tracer advection FALSE: do not compute vertical tracer advection	
ihadv_tracer	I(ntracer)	2 5		Tracer specific method to compute horizontal advection: 0: no horiz. transport (note that tracer mass ρq instead of the specific tracer quantity q is kept constant) 1: upwind (1st order) 2: Miura (2nd order, lin. reconstr.) 3: Miura3 (quadr. or cubic reconstr.) 4: FFSL (quadr. or cubic reconstr.) 5: hybrid Miura3/FFSL (quadr. or cubic reconstr.) 20: miura (2nd order, lin. reconstr.) with subcycling 22: combination of miura and miura with subcycling 32: combination of miura3 and miura with subcycling 42: combination of FFSL and miura with subcycling 52: combination of hybrid FFSL/Miura3 with subcycling	 lsq_high_ord $\in$ [2,3] lsq_high_ord $\in$ [2,3] lsq_high_ord $\in$ [2,3]
ivadv_tracer	I(ntracer)	3		Tracer specific method to compute vertical advection: 0: no vert. transport (note that tracer mass ρq instead of the specific tracer quantity q is kept constant) 1: upwind (1st order) 3: ppm_cfl (3^{rd} order, handles CFL > 1) 30: ppm (3rd order)	lvadv_tracer=TRUE
lstrang	L	.FALSE.		splitting into fractional steps	

Parameter	Type	Default	Unit	Description	Scope
				- second order Strang splitting (.TRUE.) - first order Godunov splitting (.FALSE.)	
ctracer_list	C	”		list of tracer names	
itype_hlimit	I(ntracer)	3 4		Type of limiter for horizontal transport: 0: no limiter 3: monotonous flux limiter 4: positive definite flux limiter	 ihadv_tracer ≠ ’iup3[4]’
itype_vlimit	I(ntracer)	1		Type of limiter for vertical transport: 0: no limiter 1: semi-monotone slope limiter 2: monotonous slope limiter 4: positive definite flux limiter	
niter_fct	I	1		number of iterations of monotone flux correction procedure	ihadv_tracer = 3, 32, 4 itype_hlimit = 3
beta_fct	R	1.005		factor of allowed over-/undershooting in monotonous limiter	ihadv_tracer = 3, 32, 4, 42, 5, 52 itype_hlimit = 3
iord_backtraj	I	1		order of backward trajectory calculation: 1: first order 2: second order (iterative; currently 1 iteration hardcoded)	 ihadv_tracer=’miura’
igrad_c_miura	I	1		Method for gradient reconstruction at cell center for 2nd order miura 1: Least-squares (linear, non-consv) 2: Green-Gauss	 ihadv_tracer=2
ivcfl_max	I	5		determines stability range of vertical PPM-scheme in terms of the maximum allowable CFL-number	ivadv_tracer=3
llsq_svd	L	.FALSE.		use QR decomposition (FALSE) or SV decomposition (TRUE) for least squares design matrix A	
lclip_tracer	L	.FALSE.		Clipping of negative values	

Defined and used in: `src/namelists/mo_advection_nml.f90`

3.33 turbdiff_nml

Parameter	Type	Default	Unit	Description	Scope
itype_tran	I	2		type of surface-atmosphere transfer	inwp_turb = 1
imode_tran	I	1		mode of surface-atmosphere transfer	inwp_turb = 1
icldm_tran	I	0		mode of cloud representation in transfer parametr	inwp_turb = 1
imode_turb	I	3		mode of turbulent diffusion parametrization	inwp_turb = 1
icldm_turb	I	2		mode of cloud representation in turbulence parametr	inwp_turb = 1
itype_sher	I	1		type of shear production for TKE	inwp_turb = 1
ltkesso	L	.FALSE.		calculation SSO-wake turbulence production for TKE	inwp_turb = 1
ltkecon	L	.FALSE.		consider convective buoyancy production for TKE	inwp_turb = 1
lexpcor	L	.FALSE.		explicit corrections of the implicit calculated turbul. diff.	inwp_turb = 1
ltmpcor	L	.FALSE.		consideration of thermal TKE-sources in the enthalpy budget	inwp_turb = 1
lprfcor	L	.FALSE.		using the profile values of the lowest main level instead of the mean value of the lowest layer for surface flux calulations	inwp_turb = 1
lnonloc	L	.FALSE.		nonlocal calculation of vertical gradients used for turbul. diff.	inwp_turb = 1
lcpfluc	L	.FALSE.		consideration of fluctuations of the heat capacity of air	inwp_turb = 1
limpltkediff	L	.TRUE.		consideration of fluctuations of the heat capacity of air	inwp_turb = 1
itype_wcld	I	2		type of water cloud diagnosis	inwp_turb = 1
itype_synd	I	2		type of diagnostics of synoptical near surface variables	inwp_turb = 1
lconst_z0	L	.FALSE.		TRUE: horizontally homogeneous roughness length z0	inwp_turb = 1
const_z0	R	0.001	m	value for horizontally homogeneous roughness length z0	inwp_turb = 1 lconst_z0=.TRUE.

Parameter	Type	Default	Unit	Description	Scope
tkhmin	R	0.75	m^2/s	Scaling factor for minimum vertical diffusion coefficient (proportional to $1/\sqrt{Ri}$ inwp_turb = 10, constant for inwp_turb = 1) for for heat and moisture	inwp_turb = 1,10
tkmmin	R	0.75	m^2/s	Scaling factor for minimum vertical diffusion coefficient (proportional to $1/\sqrt{Ri}$ inwp_turb = 10, constant for inwp_turb = 1) for momentum	inwp_turb = 1,10

Defined and used in: `src/namelists/mo_turbdiff_nml.f90`

3.34 vdiff_nml

Parameter	Type	Default	Unit	Description	Scope
lsfc_mon_flux	L	.TRUE.		Switch on surface momentum flux.	lvdiff = .TRUE.
lsfc_heat_flux	L	.TRUE.		Switch on surface sensible and latent heat flux.	lvdiff = .TRUE.

Defined and used in: `src/namelists/mo_vdiff_nml.f90`

4 Namelist parameters for testcases (NAMELIST_ICON)

The ICON model code includes several experiments, so-called test cases, for the shallow water model as well as the 3-dimensional atmosphere. Depending on the specified experiment, initial conditions and boundary conditions are computed internally.

4.1 ha_testcase_nml (Scope: ltestcase=.TRUE. and iequations=[0,1,2] in run_nml)

Parameter	Type	Default	Unit	Description	Scope
ctest_name	C	'JWw'		Name of test case:	
				'SW_GW': gravity wave	lshallow_water=.TRUE.
				'USBR': unsteady solid body rotation	lshallow_water=.TRUE.
				'Will_2': Williamson test 2	lshallow_water=.TRUE.
				'Will_3': Williamson test 3	lshallow_water=.TRUE.

Parameter	Type	Default	Unit	Description	Scope
				’Will_5’: Williamson test 5	lshallow_water=.TRUE.
				’Will_6’: Williamson test 6	lshallow_water=.TRUE.
				’GW’: gravity wave (nlev=20 only!)	lshallow_water=.FALSE.
				’LDF’: local diabatic forcing test without physics	lshallow_water=.FALSE. and iforcing=4
				’LDF-Moist’: local diabatic forcing test with physics initalised with zonal wind field	lshallow_water=.FALSE., and iforcing=5
				’HS’: Held-Suarez test	lshallow_water=.FALSE.
				’JWs’: Jablonowski-Will. steady state	lshallow_water=.FALSE.
				’JWw’: Jablonowski-Will. wave test	lshallow_water=.FALSE.
				’JWw-Moist’: Jablonowski-Will. wave test including moisture	lshallow_water=.FALSE.
				’APE’: aqua planet experiment	lshallow_water=.FALSE.
				’MRW’: mountain induced Rossby wave	lshallow_water=.FALSE.
				’MRW2’: modified mountain induced Rossby wave	lshallow_water=.FALSE.
				’PA’: pure advection	lshallow_water=.FALSE.
				’SV’: stationary vortex	lshallow_water=.FALSE., ntracer = 2
				’DF1’: deformational flow test 1	
				’DF2’: deformational flow test 2	
				’DF3’: deformational flow test 3	
				’DF4’: deformational flow test 4	
				’RH’: Rossby-Haurwitz wave test	lshallow_water=.FALSE.
rotate_axis_deg	R	0.0	deg	Earth’s rotation axis pitch angle	ctest_name= ’Will_2’, ’Will_3’, ’JWs’, ’JWw’, ’PA’, ’DF1234’
gw_brunt_vais	R	0.01	1/s	Brunt Vaisala frequency	ctest_name= ’GW’
gw_u0	R	0.0	m/s	zonal wind parameter	ctest_name= ’GW’
gw_lon_deg	R	180.0	deg	longitude of initial perturbation	ctest_name= ’GW’
gw_lat_deg	R	0.0	deg	latitude of initial perturbation	ctest_name= ’GW’
jw_uptb	R	1.0	m/s (?)	amplitude of the wave pertubation	ctest_name= ’JWw’
mountctr_lon_deg	R	90.0	deg	longitude of mountain peak	ctest_name= ’MRW(2)’
mountctr_lat_deg	R	30.0	deg	latitude of mountain peak	ctest_name= ’MRW(2)’

Parameter	Type	Default	Unit	Description	Scope
mountctr_height	R	2000.0	m	mountain height	ctest_name= 'MRW(2)'
mountctr_half_width	R	1500000.0	m	mountain half width	ctest_name= 'MRW(2)'
mount_u0	R	20.0	m/s	wind speed for MRW cases	ctest_name= 'MRW(2)'
rh_wavenum	I	4		wave number	ctest_name= 'RH'
rh_init_shift_deg	R	0.0	deg	pattern shift	ctest_name= 'RH'
ihs_init_type	I	1		Choice of initial condition for the Held-Suarez test. 1: the zonal state defined in the JWs test case; other integers: isothermal state (T=300 K, ps=1000 hPa, u=v=0.)	ctest_name= 'HS'
lhs_vn_ptb	L	.TRUE.		Add random noise to the initial wind field in the Held-Suarez test.	ctest_name= 'HS'
hs_vn_ptb_scale	R	1.	m/s	Magnitude of the random noise added to the initial wind field in the Held-Suarez test.	ctest_name= 'HS'
lrh_linear_pres	L	.FALSE.		Initialize the relative humidity using a linear function of pressure.	ctest_name= 'JWw-Moist','APE', 'LDF-Moist'
rh_at_1000hpa	R	0.75		relative humidity $0, 1$ at 1000 hPa	ctest_name= 'JWw-Moist','APE', 'LDF-Moist'
linit_tracer_fv	L	.TRUE.		Finite volume initialization for tracer fields	ctest_name='PA'
ape_sst_case	C	'sst1'		SST distribution selection 'sst1': Control experiment 'sst2': Peaked experiment 'sst3': Flat experiment 'sst4': Control-5N experiment 'sst_qobs': Qobs SST distribution exp 'sst_ice': Control SST distribution with -1.8 C above 64 N/S.	ctest_name='APE'
ildf_init_type	I	0		Choice of initial condition for the Local diabatic forcing test. 1: the zonal state defined in the JWs test case; other: isothermal state (T=300 K, ps=1000 hPa, u=v=0.)	ctest_name= 'LDF'

Parameter	Type	Default	Unit	Description	Scope
ldf_symm	L	.TRUE.		Shape of local diabatic forcing: .TRUE.: local diabatic forcing symmetric about the equator (at 0 N) .FALSE.: local diabatic forcing asym. about the equator (at 30 N)	ctest_name= 'LDF','LDF-Moist'

Defined and used in: `src/testcases/mo_ha_testcases.f90`

4.2 nh_testcase_nml (Scope: ltestcase=.TRUE. and iequations=3 in run_nml)

Parameter	Type	Default	Unit	Description	Scope
nh_test_name	C	'jabw'		testcase selection '**zero**': no orography '**bell**': bell shaped mountain at 0E,0N '**schaer**': hilly mountain at 0E,0N '**jabw**': Initializes the full Jablonowski Williamson test case. '**jabw_s**': Initializes the Jablonowski Williamson steady state test case. '**jabw_m**': Initializes the Jablonowski Williamson test case with a mountain instead of the wind perturbation (specify mount_height). '**mrw_nh**': Initializes the full Mountain-induced Rossby wave test case. '**mrw2_nh**': Initializes the modified mountain-induced Rossby wave test case. '**mwbr_const**': Initializes the mountain wave with two layers test case. The lower layer is isothermal and the upper layer has constant brunt vaisala frequency. The interface has constant pressure. '**PA**': Initializes the pure advection test case.	

Parameter	Type	Default	Unit	Description	Scope
				'**HS_nh**': Initializes the Held-Suarez test case. At the moment with an isothermal atmosphere at rest (T=300K, ps=1000hPa, u=v=0, topography=0.0).	
				'**HS_jw**': Initializes the Held-Suarez test case with Jablonowski Williamson initial conditions and zero topography.	
				'**APE_nh**': Initializes the APE experiments. With the jabw test case, including moisture.	
				'**wk82**': Initializes the Weisman Klemp test case	l_limited_area =.TRUE.
				'**g_lim_area**': Initializes a series of general limited area test cases: itype_atmos_ana determines the atmospheric profile, itype_anaprof_uv determines the wind profile and itype_topo_ana determines the topography	
				'**dcmip_pa_12**': Initializes Hadley-like meridional circulation pure advection test case.	
				'**dcmip_rest_200**': atmosphere at rest test (Schaer-type mountain)	lcoriolis = .FALSE.
				'**dcmip_mw_2x**': nonhydrostatic mountain waves triggered by Schaer-type mountain	lcoriolis = .FALSE.
				'**dcmip_gw_31**': nonhydrostatic gravity waves triggered by a localized perturbation (nonlinear)	
				'**dcmip_gw_32**': nonhydrostatic gravity waves triggered by a localized perturbation (linear)	l_limited_area =.TRUE. and lcoriolis = .FALSE.
				'**dcmip_tc_51**': tropical cyclone test case with 'simple physics' parameterizations (**not yet implemented**)	lcoriolis = .TRUE.
				'**dcmip_tc_52**': tropical cyclone test case with with full physics in Aqua-planet mode	lcoriolis = .TRUE.
				'**CBL**': convective boundary layer simulations for LES package on torus (doubly periodic) grid	is_plane_torus= .TRUE.
jw_up	R	1.0	m/s	amplitude of the u-perturbation in jabw test case	nh_test_name='jabw'

Parameter	Type	Default	Unit	Description	Scope
u0_mrw	R	20.0	m/s	wind speed for mrw(2) and mwbr_const cases	nh_test_name= 'mrw(2)_nh' and 'mwbr_const'
mount_height_mrw	R	2000.0	m	maximum mount height in mrw(2) and mwbr_const	nh_test_name= 'mrw(2)_nh' and 'mwbr_const'
mount_half_width	R	1500000.0	m	half width of mountain in mrw(2), mwbr_const and bell	nh_test_name= 'mrw(2)_nh', 'mwbr_const' and 'bell'
mount_lonctr_mrw_deg	R	90.	deg	lon of mountain center in mrw(2) and mwbr_const	nh_test_name= 'mrw(2)_nh' and 'mwbr_const'
mount_latctr_mrw_deg	R	30.	deg	lat of mountain center in mrw(2) and mwbr_const	nh_test_name= 'mrw(2)_nh' and 'mwbr_const'
temp_i_mwbr_const	R	288.0	K	temp at isothermal lower layer for mwbr_const case	nh_test_name= 'mwbr_const'
p_int_mwbr_const	R	70000.	Pa	pres at the interface of the two layers for mwbr_const case	nh_test_name= 'mwbr_const'
bruntvais_u_mwbr_const	R	0.025	1/s	constant brunt vaissala frequency at upper layer for mwbr_const case	nh_test_name= 'mwbr_const'
mount_height	R	100.0	m	peak height of mountain	nh_test_name= 'bell'
layer_thickness	R	-999.0	m	thickness of vertical layers	If layer_thickness < 0, the vertical level distribution is read in from externally given HYB_PARAMS_XX.
n_flat_level	I	2		level number for which the layer is still flat and not terrain-following	layer_thickness > 0
nh_u0	R	0.0	m/s	initial constant zonal wind speed	nh_test_name = 'bell'
nh_t0	R	300.0	K	initial temperature at lowest level	nh_test_name = 'bell'
nh_brunt_vais	R	0.01	1/s	initial Brunt-Vaisala frequency	nh_test_name = 'bell'
torus_domain_length	R	100000.0	m	length of slice domain	nh_test_name = 'bell', lplane=.TRUE.

Parameter	Type	Default	Unit	Description	Scope
rotate_axis_deg	R	0.0	deg	Earth's rotation axis pitch angle	nh_test_name= 'PA'
lhs_nh_vn_ptb	L	.TRUE.		Add random noise to the initial wind field in the Held-Suarez test.	nh_test_name= 'HS_nh'
lhs_fric_heat	L	.FALSE.		add frictional heating from Rayleigh friction in the Held-Suarez test.	nh_test_name= 'HS_nh'
hs_nh_vn_ptb_scale	R	1.	m/s	Magnitude of the random noise added to the initial wind field in the Held-Suarez test.	nh_test_name= 'HS_nh'
rh_at_1000hpa	R	0.7	1	relative humidity at 1000 hPa	nh_test_name= 'jabw', nh_test_name= 'mrw'
qv_max	R	20.e-3	kg/kg	specific humidity in the tropics	nh_test_name= 'jabw', nh_test_name= 'mrw'
ape_sst_case	C	'sst1'		SST distribution selection 'sst1': Control experiment 'sst2': Peaked experiment 'sst3': Flat experiment 'sst4': Control-5N experiment 'sst_qobs': Qobs SST distribution exp.	nh_test_name='APE_nh'
linit_tracer_fv	L	.TRUE.		Finite volume initialization for tracer fields	pure advection tests, only
lcoupled_rho	L	.FALSE.		Integrate density equation 'offline'	pure advection tests, only
qv_max_wk	R	0.014	Kg/kg	maximum specific humidity near the surface, range 0.012 - 0.016 used to vary the buoyancy	nh_test_name='wk82'
u_infty_wk	R	20.	m/s	zonal wind at infinity height range 0. - 45. used to vary the wind shear	nh_test_name='wk82'
bub_amp	R	2.	K	maximum amplitud of the thermal perturbation	nh_test_name='wk82'
bubctr_lat	R	0.	deg	latitude of the center of the thermal perturbation	nh_test_name='wk82'
bubctr_lon	R	90.	deg	longitude of the center of the thermal perturbation	nh_test_name='wk82'
bubctr_z	R	1400.	m	height of the center of the thermal perturbation	nh_test_name='wk82'
bub_hor_width	R	10000.	m	horizontal radius of the thermal perturbation	nh_test_name='wk82'
bub_ver_width	R	1400.	m	vertical radius of the thermal perturbation	nh_test_name='wk82'
itype_atmo_ana	I	1		kind of atmospheric profile: 1 piecewise N constant layers 2 piecewise polytropic layers	nh_test_name= 'g_lim_area'

Parameter	Type	Default	Unit	Description	Scope
itype_anaprof_uv	I	1		kind of wind profile: 1 piecewise linear wind layers 2 constant zonal wind 3 constant meridional wind	nh_test_name= 'g_lim_area'
itype_topo_ana	I	1		kind of orography: 1 schaer test case mountain 2 gaussian_2d mountain 3 gaussian_3d mountain any other no orography	nh_test_name= 'g_lim_area'
nlayers_nconst	I	1		Number of the desired layers with a constant Brunt-Vaisala-frequency	nh_test_name= 'g_lim_area' and itype_atmo_ana=1
p_base_nconst	R	100000.	Pa	pressure at the base of the first N constant layer	nh_test_name= 'g_lim_area' and itype_atmo_ana=1
theta0_base_nconst	R	288.	K	potential temperature at the base of the first N constant layer	nh_test_name= 'g_lim_area' and itype_atmo_ana=1
h_nconst	R(nlayers _nconst)	0., 1500., 12000.	m	height of the base of each of the N constant layers	nh_test_name= 'g_lim_area' and itype_atmo_ana=1
N_nconst	R(nlayers _nconst)	0.01	1/s	Brunt-Vaisala-frequency at each of the N constant layers	nh_test_name= 'g_lim_area' and itype_atmo_ana=1
rh_nconst	R(nlayers _nconst)	0.5	%	relative humidity at the base of each N constant layers	nh_test_name= 'g_lim_area' and itype_atmo_ana=1
rhgr_nconst	R(nlayers _nconst)	0.	%	relative humidity gradient at each of the N constant layers	nh_test_name= 'g_lim_area' and itype_atmo_ana=1
nlayers_poly	I	2		Number of the desired layers with constant gradient temperature	nh_test_name= 'g_lim_area' and itype_atmo_ana=2

Parameter	Type	Default	Unit	Description	Scope
p_base_poly	R	100000.	Pa	pressure at the base of the first polytropic layer	nh_test_name= 'g_lim_area' and itype_atmo_ana=2
h_poly	R(nlayers _poly)	0., 12000.	m	height of the base of each of the polytropic layers	nh_test_name= 'g_lim_area' and itype_atmo_ana=2
t_poly	R(nlayers _poly)	288., 213.	K	temperature at the base of each of the polytropic layers	nh_test_name= 'g_lim_area' and itype_atmo_ana=2
rh_poly	R(nlayers _poly)	0.8, 0.2	%	relative humidity at the base of each of the polytropic layers	nh_test_name= 'g_lim_area' and itype_atmo_ana=2
rhgr_poly	R(nlayers _poly)	5.e-5, 0.	%	relative humidity gradient at each of the polytropic layers	nh_test_name= 'g_lim_area' and itype_atmo_ana=2
nlayers_linwind	I	2		Number of the desired layers with constant U gradient	nh_test_name= 'g_lim_area' and itype_anaprof_uv=1
h_linwind	R(nlayers _lin-wind)	0., 2500.	m	height of the base of each of the linear wind layers	nh_test_name= 'g_lim_area' and itype_anaprof_uv=1
u_linwind	R(nlayers _lin-wind)	5, 10.	m/s	zonal wind at the base of each of the linear wind layers	nh_test_name= 'g_lim_area' and itype_anaprof_uv=1
ugr_linwind	R(nlayers _lin-wind)	0., 0.	1/s	zonal wind gradient at each of the linear wind layers	nh_test_name= 'g_lim_area' and itype_anaprof_uv=1
vel_const	R	20.	m/s	constant zonal/meridional wind (itype_anaprof_uv=2,3)	nh_test_name= 'g_lim_area' and itype_anaprof_uv=2,3
mount_lonc_deg	R	90.	deg	longitud of the center of the mountain	nh_test_name= 'g_lim_area'
mount_latc_deg	R	0.	deg	latitud of the center of the mountain	nh_test_name= 'g_lim_area'

Parameter	Type	Default	Unit	Description	Scope
schaer_h0	R	250.	m	h0 parameter for the schaer mountain	nh_test_name= 'g_lim_area' and itype_topo_ana=1
schaer_a	R	5000.	m	-a- parameter for the schaer mountain, also half width in the north and south side of the finite ridge to round the sharp edges	nh_test_name= 'g_lim_area' and itype_topo_ana=1,2
schaer_lambda	R	4000.	m	lambda parameter for the schaer mountain	nh_test_name= 'g_lim_area' and itype_topo_ana=1
lshear_dcmip	L	FALSE		run dcmip_mw_2x with/without vertical wind shear FALSE: dcmip_mw_21: non-sheared TRUE : dcmip_mw_22: sheared	nh_test_name= 'dcmip_mw_2x'
halfwidth_2d	R	10000.	m	half lenght of the finite ridge in the north-south direction	nh_test_name= 'g_lim_area' and itype_topo_ana=1,2
m_height	R	1000.	m	height of the mountain	nh_test_name= 'g_lim_area' and itype_topo_ana=2,3
m_width_x	R	5000.	m	half width of the gaussian mountain in the east-west direction half width in the north-south direction in the rounding of the finite ridge (gaussian_2d)	nh_test_name= 'g_lim_area' and itype_topo_ana=2,3
m_width_y	R	5000.	m	half width of the gaussian mountain in the north-south direction	nh_test_name= 'g_lim_area' and itype_topo_ana=2,3
gw_u0	R	0.	m/s	maximum amplitude of the zonal wind	nh_test_name= 'dcmip_gw_3X'
gw_clat	R	90.	deg	Lat of perturbation center	nh_test_name= 'dcmip_gw_3X'
gw_delta_temp	R	0.01	K	maximum temperature perturbation	nh_test_name= 'dcmip_gw_32'

Parameter	Type	Default	Unit	Description	Scope
u_cbl(2)	R	0:0	m/s and 1/s	to prescribe initial zonal velocity profile for convective boundary layer simulations where u_cbl(1) sets the constant and u_cbl(2) sets the vertical gradient	nh_test_name=CBL
v_cbl(2)	R	0:0	m/s and 1/s	to prescribe initial meridional velocity profile for convective boundary layer simulations where v_cbl(1) sets the constant and v_cbl(2) sets the vertical gradient	nh_test_name=CBL
th_cbl(2)	R	290:0.006	K and K/m	to prescribe initial potential temperature profile for convective boundary layer simulations where th_cbl(1) sets the constant and th_cbl(2) sets the gradient	nh_test_name=CBL

Defined and used in: `src/testcases/mo_nh_testcases.f90`

5 External data

5.1 extpar_nml (Scope: itopo=1 in run_nml)

Parameter	Type	Default	Unit	Description	Scope
itopo	I	0		0: analytical topography/ext. data 1: topography/ext. data read from file	
n_iter_smooth_topo	I(n_dom)	0		iterations of topography smoother	itopo = 1
fac_smooth_topo	R	0.015625		pre-factor of topography smoother	n_iter_smooth_topo > 0
heightdiff_threshold	R(n_dom)	3000.	m	height difference between neighboring grid points above which additional local nabla2 diffusion is applied	
l_emiss	L	.TRUE.		read and use external surface emissivity map	itopo = 1
extpar_filename	C			Filename of external parameter input file, default: "`<path>extpar_<gridfile>`". May contain the keyword `<path>` which will be substituted by `model_base_dir`.	

Parameter	Type	Default	Unit	Description	Scope
extpar_varnames_map_file	C	' '		Filename of external parameter dictionary, This is a text file with two columns separated by whitespace, where left column: NetCDF name, right column: GRIB short name.	

Defined and used in: `src/namelists/mo_extpar_nml.f90`

6 External packages

6.1 art_nml

Parameter	Type	Default	Unit	Description	Scope
lart	L	.FALSE.		main switch for ART-package	
lemi_volc	L	.FALSE.		Emission of volcanic ash	
lconv_tracer	L	.FALSE.		Convection of tracers	
lwash_tracer	L	.FALSE.		Washout of tracers	
lrad_volc	L	.FALSE.		Radiative impact of volcanic ash	
lcld_tracer	L	.FALSE.		Impact on clouds	

Defined and used in: `src/namelists/mo_art_nml.f90`

7 Information on vertical level distribution

The hydrostatic and nonhydrostatic models need hybrid vertical level information to generate the terrain following coorindates. The hybrid level specification is stored in <icon home>/hyb_params/HYB_PARAMS_<nlev>. The **hydrostatic** model assumes to get **pressure based** coordinates, the **nonhydrostatic** model expects **height based** coordinates. For further information see <icon home>/hyb_params/README.

8 Changes incompatible with former versions of the model code

Change:	**var_names_map_file, out_varnames_map_file**
Date of Change:	**2013-04-25**
Revision:	**12016**

- Renamed **var_names_map_file** → **output_nml_dict**.
- Renamed **out_varnames_map_file** → **netcdf_dict**.
- The dictionary in *netcdf_dict* is now reversed, s.t. the same map file as in output_nml_dict can be used to translate variable names to the ICON internal names and back.

Change:	**output_nml: namespace**
Date of Change:	**2013-04-26**
Revision:	**12051**

- Removed obsolete namelist variable **namespace** from **output_nml**.

Change:	**gribout_nml: generatingCenter, generatingSubcenter**
Date of Change:	**2013-04-26**
Revision:	**12051**

- Introduced new namelist variables **generatingCenter** and **generatingSubcenter**.
- If not set explicitly, center and subcenter information is copied from the input grid file

Change:	**radiation_nml: albedo_type**
Date of Change:	**2013-05-03**
Revision:	**12118**

- Introduced new namelist variable **albedo_type**

- If set to 2, the surface albedo will be based on the MODIS data set.

Change:	**initicon_nml: dwdinc_filename**
Date of Change:	**2013-05-24**
Revision:	**12266**

- Renamed dwdinc_filename to dwdana_filename

Change:	**initicon_nml: l_ana_sfc**
Date of Change:	**2013-06-25**
Revision:	**12582**

- Introduced new namelist flag **l_ana_sfc**
- If true, soil/surface analysis fields are read from the analysis fiel dwdfg_filename. If false, surface analyis fields are not read. Soil and surface are initialized with the first guess instead.

Change:	**new_nwp_phy_tend_list: output names consistent with variable names**
Date of Change:	**2013-06-25**
Revision:	**12590**

- temp_tend_radlw → ddt_temp_radlw
- temp_tend_turb → ddt_temp_turb
- temp_tend_drag → ddt_temp_drag

Change:	**prepicon_nml, remap_nml, input_field_nml**
Date of Change:	**2013-06-25**
Revision:	**12597**

- Removed the sources for the "prepicon" binary!
- The "prepicon" functionality (and most of its code) has become part of the ICON tools.

Change:	**initicon_nml**
Date of Change:	**2013-08-19**
Revision:	**13311**

- The number of vertical input levels is now read from file. The namelist parameter **nlev_in** has become obsolete in r12700 and has been removed.

Change:	**parallel_nml**
Date of Change:	**2013-10-14**
Revision:	**14160**

- The namelist parameter exch_msgsize has been removed together with the option iorder_sendrecv=4.

Change:	**parallel_nml**
Date of Change:	**2013-08-14**
Revision:	**14164**

- The namelist parameter **use_sp_output** has been replaced by an equivalent switch **use_dp_mpi2io** (with an inverse meaning, i.e. we have **use_dp_mpi2io** = **.NOT. use_sp_output**).

Change:	**parallel_nml**
Date of Change:	**2013-08-15**
Revision:	**14175**

- The above-mentioned namelist parameter **use_dp_mpi2io** got the default .FALSE. By this, the output data are sent now in single precision to the output processes.

Change:	**initicon_nml: l_ana_sfc**
Date of Change:	**2013-10-21**
Revision:	**14280**

- The above-mentioned namelist parameter **l_ana_sfc** has been replaced by **lread_ana**. The default is set to .TRUE., meaning that analysis fields are required and read on default. With lread_ana=.FALSE. ICON is able to start from first guess fields only.

Change:	**output_nml: lwrite_ready, ready_directory**
Date of Change:	**2013-10-25**
Revision:	**14391**

- The namelist parameters **lwrite_ready** and **ready_directory** have been replaced by a single namelist parameter **ready_file**, where `ready_file /= 'default'` enables writing ready files.
- Different `output_nml`'s may be joined together to form a single ready file event – they share the same `ready_file`.

Change:	**output_nml: output_bounds**
Date of Change:	**2013-10-25**
Revision:	**14391**

- The namelist parameter **output_bounds** specifies a start, end, and increment of output invervals. It does no longer allow multiple triples.

Change:	**output_nml: steps_per_file**
Date of Change:	**2013-10-30**
Revision:	**14422**

- The default value of the namelist parameter **steps_per_file** has been changed to `-1`.

Change: **run_nml**
Date of Change: **2013-11-13**
Revision: **14759**

- The dump/restore functionality for domain decompositions and interpolation coefficients has been removed from the model code. This means, that the parameters
  - `ldump_states`,
  - `lrestore_states`,
  - `ldump_dd`,
  - `lread_dd`,
  - `nproc_dd`,
  - `dd_filename`,
  - `dump_filename`,
  - `l_one_file_per_patch`

  have been removed together with the corresponding functionality from the ICON model code.

Change: **output_nml: filename_format**
Date of Change: **2013-12-02**
Revision: **15068**

- The string token `<ddhhmmss>` is now substituted by the *relative* day-hour-minute-second string, whereas the absolute date-time stamp can be inserted using `<datetime>`.

Change: **output_nml: ready_file**
Date of Change: **2013-12-03**
Revision: **15081**

- The ready file name has been changed and may now contain string tokens `<path>`, `<datetime>`, `<ddhhmmss>` which are substituted as described for the namelist parameter `filename_format`.

Change: **interpl_nml: rbf_vec_scale_ll**
Date of Change: **2013-12-06**
Revision: **15156**

- The real-valued namelist parameter `rbf_vec_scale_ll` has been removed.
- Now, there exists a new integer-valued namelist parameter, `rbf_scale_mode_ll` which specifies the mode, how the RBF shape parameter is determined for lon-lat interpolation.

Change: **io_nml**
Date of Change: **2013-12-06**
Revision: **15161**

- Removed remaining vlist-related namelist parameter. This means that the parameters
  - out_filetype
  - out_expname
  - dt_data
  - dt_file
  - lwrite_dblprec, lwrite_decomposition, lwrite_vorticity, lwrite_divergence, lwrite_pres, lwrite_z3, lwrite_tracer, lwrite_tend_phy, lwrite_radiation, lwrite_precip, lwrite_cloud, lwrite_tke, lwrite_surface, lwrite_omega, lwrite_initial, lwrite_oce_timestepping

  are no longer available.

Change: **gridref_nml**
Date of Change: **2014-01-07**
Revision: **15436**

- Changed namelist defaults for nesting: `grf_intmethod_e`, `l_mass_consvcorr`, `l_density_nudging`.

> *Change:* **interpol_nml**
> *Date of Change:* **2014-02-10**
> *Revision:* **16047**

- Changed namelist default for `rbf_scale_mode_ll`: The RBF scale factor for lat-lon interpolation is now determined automatically by default.

> *Change:* **echam_phy_nml**
> *Date of Change:* **2014-02-27**
> *Revision:* **16313**

- Replace the logical switch `lcover` by the integer switch `icover` that is used in ECHAM-6.2. Values are transferred as follows: .FALSE. = 1 (=default), .TRUE. = 2.

> *Change:* **turbdiff_nml**
> *Date of Change:* **2014-03-12**
> *Revision:* **16527**

- Change constant minimum vertical diffusion coefficients to variable ones proportional to $1/\sqrt{Ri}$ for inwp_turb = 10; at the same time the defaults for tkhmin and tkmmin are increased from $0.2\,\mathrm{m}^2/\mathrm{s}$ to $0.75\,\mathrm{m}^2/\mathrm{s}$.

> *Change:* **nwp_phy_nml**
> *Date of Change:* **2014-03-13**
> *Revision:* **16560**

- Removed namelist parameter `dt_ccov`, since practically it had no effect. For the quasi-operational NWP-setup, the calling frequency of the cloud cover scheme is the same as that of the convection scheme. I.e. both are synchronized.

Change:	**nwp_phy_nml**
Date of Change:	**2014-03-24**
Revision:	**16668**

- Changed namelist default for **itype_z0**: use land cover related roughness only (itype_z0=2).