

付録 D ネームリスト・パラメーター一覧

入力パラメータをまとめたネームリスト (`namelist.txt`) は、GPV 前処理 (第 4 章) と ATM 計算 (第 2 章) のジョブグループ (JG) ごとに用意する。各 JG のネームリストに重複はなく、共通のパラメータについては後続ジョブの ATM 計算で GPV 前処理のネームリストも参照する。また ATM 計算の初期値作成 (第 3 章) には、放出源ごとの計算設定をまとめたリスト (ESP リスト: `emission_time_series.txt`) も用意する。GPV 前処理 (`Tp`) のネームリストはジョブ実行時に定数ディレクトリ `Const` から作業ディレクトリの `Parm` にコピーするのに対し、ATM 計算 (`Tf`) のネームリストと ESP リストは、`Parm` にあるユーザーが編集する元ファイル (conf ファイル: `setting.conf`) から `MkNamelist.sh` の実行により生成される (Figure B.1)。これは ATM を現業で運用する場合、`Tp` のネームリストは静的であるのに対し、`Tf` のネームリストは情報の種類に応じて動的に変化することに対応するためである。

ここでは、GPV 前処理と ATM 計算のネームリストおよび ESP リストにあるネームリスト・パラメータ¹と conf ファイルとの対応について説明する。

D.1 GPV 前処理のネームリスト

GPV 前処理のネームリストは、`namgpv`, `namwadj`, `namdiff`, `namra`, `namcloud` である。GPV の種類ごとに `Const` に用意して作業ディレクトリの `Parm` に `namelist.txt` としてコピーし、ソースコードからはファイル名 `NAMELIST_PRE` で開いて入力する。なお、入力する GPV (NuSDaS) の格子数や格子間隔などの基本情報は、ネームリストでは与えず、`Const/Atm/Nusdef` にある各 GPV の NuSDaS 定義ファイルに書かれた格子情報から読み取る。

以下、各ネームリストのパラメータを表にまとめる。

¹ネームリスト・パラメータには、例えば Table D.7 の `n_switch_calc.mass` のように、1 つしか選択可能でないにも関わらず用意されているスイッチがある。これは将来的に他の方法が追加される可能性を考えてのことである。

Table D.1 namgvp: Setting parameters of GPV

Variable name	Variable type	Description	Default	Remarks	
fcst_time_gpv	real	Forecast time of input GPV [s]	475200.0 (GSM)	From TIMECARD (base time)	
			140400.0 (MSM)		
			36000.0 (LFM)		
interval_gpv	real	Time interval of input GPV [s]	10800.0 (GSM(lower))		
			21600.0 (GSM(upper))		
			3600.0 (MSM, LFM)		
Switch name	Switch kind	Option	Value	Remarks	
n_switch_coordinate_vertical	Vertical coordinates	<i>p</i> -coordinate	1	GSM	
		<i>z</i> -coordinate	2	MSM, LFM	
n_switch_terrain	Model terrain	OFF	0	Flat	
		ON	1		
n_switch_surf_gpv	Surface GPV	OFF	0		
		ON	1		
Variable name	Variable type	Description	Default	Remarks	
Original GPV: NuSDaS (atmosphere)					
type1_air	character(8)	Type1	.GSMLLPP (GSM)	Lat/Lon coordinate, <i>p</i> -plane	
			.MSMLMZS (MSM)		Lambert coordinate, modelled plane
			.LFMLMZS (LFM)		
type2_air	character(4)	Type2	FCSV	Forecast value (instantaneous)	
type3_air	character(4)	Type3	LWR1 (GSM(lower))	Very high resolution GPV	
			UPR1 (GSM(upper))		
			VHRC (MSM)		
			VHRB (LFM)		
member_air	character(4)	Member			
Original GPV: NuSDaS (surface)					
type1_surf	character(8)	Type1	.GSMLLLY (GSM)	Lat/Lon coordinate	
			.MSMLMLY (MSM)	Lambert coordinate	
			.LFMLMLY (LFM)		
type2_surf	character(4)	Type2	FCSV	Forecast value (instantaneous)	
type3_surf	character(4)	Type3	STD1 (GSM)		
			SFC2 (MSM, LFM)		
member_surf	character(4)	Member			
Transformed GPV: NuSDaS (for ATM input)					
type1_gpv	character(8)	Type1	.ATMFGZZ	Free grid, <i>z</i> -coordinate	
type2_gpv	character(4)	Type2	FCSV	Forecast value (instantaneous)	
type3_gpv	character(4)	Type3	GPV1		
member_gpv	character(4)	Member			

Table D.2 namwadj: Adjust parameters of vertical wind

Switch name	Switch kind	Option	Value	Remarks
n_switch_wind_vertical_average	Spatial average of vertical wind	OFF	0	
		ON	9	
n_switch_wind_terrain_following	Terrain following wind	Only surface	1	
		Under lowest level	2	

Table D.3 namdiff: Setting parameters of diffusion

Switch name	Switch kind	Option	Value	Remarks
n_switch_diffusion_type_horizontal	Horizontal fluctuation	Fickian diffusion eq.	1	
		Langevin eq. (1st order)	2	
n_switch_diffusion_type_vertical	Vertical diffusion	Const.	1	
		Zero-eq. model (MY2)	2	
		One-eq. model (TKE)	3	
Variable name	Variable type	Description	Default	Remarks
diffusion_coef_horizontal_limit	real	Horizontal diffusion coefficient (Max) [m ² /s]	5.684×10^4	
diffusion_coef_vertical_limit	real	Vertical diffusion coefficient (Max) [m ² /s]	5.000×10^1	
diffusion_timescale_horizontal	real	Lagrangian time scale (horizontal) [s]	5.0×10^4	
turbulent_u_ini	real	Initial turbulent velocity (E-W) [m/s]	0.253	
turbulent_v_ini	real	Initial turbulent velocity (N-S) [m/s]	0.253	
dt_max_diffusion_vertical	real	Max time step of vertical diffusion [s]	200.0	
boundary_layer_depth	real	Boundary layer depth [m agl]	1000.0	
asym_length_scale_boundary_layer	real	Asymptotic length scale (in boundary layer) [m]	100.0	
asym_length_scale_free_air	real	Asymptotic length scale (in free air) [m]	30.0	

Table D.4 namra: Setting parameters of dry deposition

Switch name	Switch kind	Option	Value	Remarks
n_switch_resistance_aerodynamic	Aerodynamic resistance	Uniform	1	
		Diagnosis	2	
Variable name	Variable type	Description	Default	Remarks
deposition_velocity_limit	real	Deposition velocity (up-pre limit) [m/s]	0.3	
surface_layer_depth	real	Surface boundary layer depth [m agl]	100.0	

Table D.5 namcloud: Setting parameters of cloud top/base height

Switch name	Switch kind	Option	Value	Remarks
n_switch_cloud_height	Diagnosis of cloud height	Air pressure (P)	1	
		Relative humidity (RH)	2	
		Cloud water content (CWC)	3	
Variable name	Variable type	Description	Default	Remarks
threshold_pres_cloud_top	real	Threshold of P (cloud top) [hPa]	100.0	Only n_switch_cloud_height = 1
threshold_pres_cloud_base	real	Threshold of P (cloud base) [hPa]	700.0	
threshold_rh_cloud_top	real	Threshold of RH (cloud top) [%]	60.0	Only n_switch_cloud_height = 2
threshold_rh_cloud_base	real	Threshold of RH (cloud base) [%]	80.0	
threshold_cwc_cloud	real	Threshold of CWC [kg/m ³]	0.0	Only n_switch_cloud_height = 3

D.2 ATM 計算のネームリスト

ATM 計算のネームリストは、`namsrcinfo`, `namsrcopt`, `namsrcparm`, `nampoint`, `namgpvcut`, `namatmcal`, `namfall`, `namwdep`, `namdecay`, `namatmout`, `namatmalt` である。`Parm/setting.conf` (付録 D.4) から `MkNamelist.sh` を実行して同ディレクトリに生成される `namelist.txt` を、ソースコードからはファイル名 `NAMELIST` で開いて入力する。なお、ATM の格子出力 (NuSDaS) の格子数や格子間隔などの基本情報は、Table D.16 で設定する高度面を除きネームリストでは与えず、NuSDaS 定義ファイル `fcst_atm.def` の格子情報で設定する。

以下、各ネームリストのパラメータを表にまとめる。

Table D.6 `namsrcinfo`: Basic parameter of ESP

Variable name	Variable type	Description	Default	Remarks
<code>n.tracer_esp</code>	integer	Tracer number of ESP	250,000	Sum of each emission tracer (12th field of Table D.17)
<code>n.stage_esp</code>	integer	Emission source (stage) number of ESP	1	

Table D.7 `namsrcopt`: Option parameters of ESP

Switch name	Switch kind	Option	Value	Remarks
<code>n.switch_shape.horizontal</code>	Shape of emission source	Line	1	
		Inverted cone	2	
<code>n.switch_shape.vertical</code>	Vertical distribution of emission source	Uniform	1	
		Suzuki function	2	Suzuki (1983)
<code>n.switch_emission.rate</code>	Formation time of emission source	Uniform	1	
		Diffusion time	2	
<code>n.switch_size.distribution</code>	Grain-size distribution of tracer	Single	0	Fixed median
		Uniform	1	Min-Max sizes
		Log-normal	2	
<code>n.switch_particle.density</code>	Density distribution of tracer	Uniform	1	
		Specific	2	Size dependent
<code>n.switch_mass.distribution</code>	Mass distribution of tracer	Uniform	1	
<code>n.switch_calc.mass</code>	Total mass of emission	Power law	1	

Table D.8 `namsrcparm`: Setting parameters of ESP (Suzuki, 1983)

Variable name	Variable type	Description	Default	Remarks
<code>entrainment_eruption.column</code>	real	Entrainment coefficient of eruption column	0.198	
<code>lambda</code>	real	Power of plume rising velocity	1.0	
<code>eddy.diffusion</code>	real	Parameter of eddy diffusivity inside plume [$\text{m}^2/\text{s}^{5/2}$]	400.0×10^{-4}	(Diffusion coef.) $\propto t^{3/2}$
<code>emission_ratio</code>	real	Adjust ratio of emission mass	1.0	
<code>km.mass</code>	real	Coefficient for total mass [$\text{kg}/\text{km}^4/\text{s}$]	193.0	$\approx 6.95 \times 10^5 \text{kg}/\text{km}^4/\text{h}$
<code>power.mass</code>	real	Power exponent of plume height for total mass	4.0	

Table D.9 nampoint: Setting parameter of Point

Switch name	Switch kind	Option	Value	Remarks
n.switch.point.vertical.profile	Output of point value	For ESP	1	
		Vertical profile	2	

Table D.10 namgpvcut: Setting parameters of GPV (CUT)

Switch name	Switch kind	Option	Value	Remarks
n.switch.cut.gpv	Cut region	OFF	0	
		ON	1	NUSDAS_CUT
Variable name	Variable type	Description	Default	Remarks
cut.startpoint.ix	integer	Lower limit index of x -direction		Valid for n.switch.cut.gpv=1
cut.endpoint.ix	integer	Upper limit index of x -direction		
cut.startpoint.jy	integer	Lower limit index of y -direction		
cut.endpoint.jy	integer	Upper limit index of y -direction		

Table D.11 namatmcal: Basic parameters of ATM

Variable name	Variable type	Description	Default	Remarks
dt.atm	real	Time step [s]	200.0	Case of n.switch.integral_method= 4
atm_end.time(1)	integer	End time of ATM forecast (Year) [UTC]		
atm_end.time(2)	integer	End time of ATM forecast (Month) [UTC]		
atm_end.time(3)	integer	End time of ATM forecast (Day) [UTC]		
atm_end.time(4)	integer	End time of ATM forecast (Hour) [UTC]		
atm_end.time(5)	integer	End time of ATM forecast (Minutes) [UTC]		
Switch name	Switch kind	Option	Value	Remarks
n.switch.advection.horizontal	Horizontal advection	OFF	0	
		ON	1	
n.switch.advection.vertical	Vertical advection	OFF	0	
		ON	1	
n.switch.diffusion.horizontal	Horizontal diffusion	OFF	0	
		ON	1	
n.switch.diffusion.vertical	Vertical diffusion	OFF	0	
		ON	1	
n.switch.fallout.gravity	Gravitational fallout	OFF	0	
		ON	1	
n.switch.deposition.dry	Dry deposition	OFF	0	
		ON	1	
n.switch.scavenging.below.cloud	Wet scavenging (Below cloud)	OFF	0	Washout
		ON	1	
n.switch.scavenging.in.cloud	Wet scavenging (In cloud)	OFF	0	Rainout
		ON	1	
n.switch.reflection.surface	Reflection (On surface)	OFF	0	
		ON	1	
n.switch.decay	Decay	OFF	0	
		ON	1	
n.switch.cycle.calc	Cycle calculation	OFF	0	
		Add previous forecast (same basetime)	1	TBD
		Continue previous forecast (different basetime)	2	TBD
n.switch.time.integral	Time reversal flag	Forward	1	
		Backward	-1	TBD
n.switch.integral.method	Time integral method	Euler	1	1st order w/ one stage
		Runge-Kutta	4	4th order w/ four stages
n.switch.tendency.horizontal	Space integral method	Local coordinate	1	Horizontal advection and diffusion
		Spherical triangle	2	

Table D.12 namfall: Setting parameters of gravitational fallout

Switch name	Switch kind	Option	Value	Remarks
n.switch_terminal.velocity	Terminal fall velocity	Stokes' law	1	
		Suzuki's law	2	Suzuki (1983)
n.switch_slip_correction	Slip correction	OFF	0	
		Cunningham correction	1	
Variable name	Variable type	Description	Default	Remarks
form	real	Shape factor of tracer	1/3	Wilson and Huang (1979)
maxd.dens	real	Density of Max grain size [kg/m ³]	1000.0	
mind.dens	real	Density of Min grain size [kg/m ³]	2400.0	

Table D.13 namwdep: Setting parameters of wet scavenging

Switch name	Switch kind	Option	Value	Remarks
n.switch_scavenging_tracer_type	Tracer species	Noble gas	0	
		Depositing gas	1	
		Particle	2	
Variable name	Variable type	Description	Default	Remarks
scavenging_coef_rain	real	Scavenging A-coefficient (rain) [1/s]	2.98×10^{-5}	
scavenging_power_rain	real	Scavenging B-coefficient (rain)	0.75	
threshold_intensity_rain	real	Precipitation threshold (rain) [mm/h]	999.9	
scavenging_coef_snow	real	Scavenging A-coefficient (snow) [1/s]	2.98×10^{-5}	
scavenging_power_snow	real	Scavenging B-coefficient (snow)	0.30	
threshold_intensity_snow	real	Precipitation threshold (snow) [mm/h]	999.9	
scavenging_coef_grpl	real	Scavenging A-coefficient (graupel) [1/s]	2.98×10^{-5}	
scavenging_power_grpl	real	Scavenging B-coefficient (graupel)	0.30	
threshold_intensity_grpl	real	Precipitation threshold (graupel) [mm/h]	999.9	
henry_const	real	Henry constant [M/atm]*	8.0×10^{-2}	Only n.switch_scavenging_tracer_type= 1
fraction_nuclei	real	Fraction of particles that is activated	0.9	Only n.switch_scavenging_tracer_type= 2

* M ≡ mol/L

Table D.14 namdecay: Setting parameters of decay

Variable name	Variable type	Description	Default	Remarks
half_life	real	Half-lifetime [d]	1.10×10^4	Only n.switch_decay= 1

Table D.15 namatmout: Output parameters of ATM

Variable name	Variable type	Description	Default	Remarks
interval_atm	real	Time interval of output ATM [s]	3600.0	
Switch name	Switch kind	Option	Value	Remarks
n_switch_atm_output	Output timing	From TIMECARD (base time)	1	VAFF
		From TIMECARD_RUN (calculation start time)	2	VAA
n_switch_atm_value_deposit	Value attribute (deposition)	Snap	1	
		Mean	2	
		Accumulated	3	VAFF
n_switch_atm_value_concent	Value attribute (concentration)	Snap	1	VAA
		Mean	2	
n_switch_atm_interp	Space interpolation	Nearest neighbor	1	
		Bi-Linear	2	
Output ATM: NuSDaS				
type1_atm	character(8)	Type1	_ATMLLY	Lat/Lon coordinate
type2_atm	character(4)	Type2	FCAV	Forecast value (accumulated)
type3_atm	character(4)	Type3	STD1	
member_atm	character(4)	Member		

Table D.16 namatmalt: z-plane parameters of ATM

Variable name	Variable type	Description	Default	Remarks
plane_alt_atm	real	Plane altitude [m asl]	0.0, 5486.4, 16764.0	≈ 0, 18000, 55000 ft. Number of planes is arbitrarily

D.3 ESP リスト

放出源に固有の ESP は 1 行 (1 レコード) にまとめて `emission_time_series.txt` に記入し、放出源が複数ある場合 (個々の放出源をステージと呼ぶ) は第 2 レコード以降に追記する。そのフォーマットを下表に示す。

Table D.17 Format of ESP list (`emission_time_series.txt`)

Column index	Variable type	Description	Default	Remarks
Record #1				
1	character(24)	Name of source		
2	real	Latitude of source [°]		
3	real	Longitude of source [°]		
4	integer	Start time of emission (year) [UTC]		TIMECARD.RUN
5	integer	Start time of emission (month) [UTC]		
6	integer	Start time of emission (day) [UTC]		
7	integer	Start time of emission (hour) [UTC]		
8	integer	Start time of emission (minutes) [UTC]		
9	real	Duration of emission [s]	600.0	
10	real	Bottom altitude of source [m asl]		
11	real	Top altitude of source [m asl]		
12	integer	Number of tracer in this stage	40,000	VAA
			250,000	VAFF
13	real	Cutoff grain size (Min) [m]	0.65×10^{-6}	
14	real	Cutoff grain size (Max) [m]	9.60×10^{-2}	
15	real	Median diameter of grain-size distribution [m]	2.50×10^{-4}	
16	real	Standard deviation of grain-size distribution	1.0	
17	real	Release constant in Suzuki function	0.017	β of Suzuki (1983)
18	integer(8)	ID of emission point		
Record #2- (Same format as Record #1)				

D.4 conf ファイル

ユーザーが編集する conf ファイルと ATM 計算のネームリスト (付録 D.2) および ESP リスト (付録 D.3) の対応を下表にまとめる。

Table D.18 Correspondence of NAMELIST (ATM), ESP list and configuration file (`setting.conf`)

Environment variable of configuration file	ESP list	Remarks
STAGE_01	Record #1	Table D.17
STAGE_02	Record #2	
...		
STAGE_50	Record #50	
Environment variable of configuration file	NAMELIST of ATM	Remarks
Option of ESP		
N_SWITCH_SHAPE_HORIZONTAL	n_switch_shape_horizontal	Table D.7
N_SWITCH_SHAPE_VERTICAL	n_switch_shape_vertical	
N_SWITCH_EMISSION_RATE	n_switch_emission_rate	
N_SWITCH_SIZE_DISTRIBUTION	n_switch_size_distribution	
N_SWITCH_PARTICLE_DENSITY	n_switch_particle_density	
N_SWITCH_MASS_DISTRIBUTION	n_switch_mass_distribution	
N_SWITCH_CALC_MASS	n_switch_calc_mass	
Parameter of ESP		
ENTRAINMENT_ERUPTION_COLUMN	entrainment_eruption_column	Table D.8
LAMBDA	lambda	
EDDY_DIFFUSION	eddy_diffusion	
EMISSION_RATIO	emission_ratio	
KM_MASS	km_mass	
POWER_MASS	power_mass	
Point setting		
N_SWITCH_POINT_VERTICAL_PROFILE	n_switch_point_vertical_profile	Table D.9

Table D.18 (Continued)

Enviroment variable of configuration file	NAMELIST of ATM	Remarks
GPV (CUT) settings		
N_SWITCH_CUT_GPV	n_switch_cut_gpv	Table D.10
CUT_STARTPOINT_IX	cut_startpoint_ix	
CUT_ENDPOINT_IX	cut_endpoint_ix	
CUT_STARTPOINT_JY	cut_startpoint_jy	
CUT_ENDPOINT_JY	cut_endpoint_jy	
ATM settings		
DT_ATM	dt_atm	Table D.11
ATM_END_TIME_YYYY	atm_end_time(1)	
ATM_END_TIME_MM	atm_end_time(2)	
ATM_END_TIME_DD	atm_end_time(3)	
ATM_END_TIME_HH	atm_end_time(4)	
ATM_END_TIME_MIN	atm_end_time(5)	
N_SWITCH_ADVECTION_HORIZONTAL	n_switch_advection_horizontal	
N_SWITCH_ADVECTION_VERTICAL	n_switch_advection_vertical	
N_SWITCH_DIFFUSION_HORIZONTAL	n_switch_diffusion_horizontal	
N_SWITCH_DIFFUSION_VERTICAL	n_switch_diffusion_vertical	
N_SWITCH_FALLOUT_GRAVITY	n_switch_fallout_gravity	
N_SWITCH_DEPOSITION_DRY	n_switch_deposition_dry	
N_SWITCH_SCAVENGING_BELOW_CLOUD	n_switch_scavenging_below_cloud	
N_SWITCH_SCAVENGING_IN_CLOUD	n_switch_scavenging_in_cloud	
N_SWITCH_REFLECTION_SURFACE	n_switch_reflection_surface	
N_SWITCH_DECAY	n_switch_decay	
N_SWITCH_CYCLE_CALC	n_switch_cycle_calc	
N_SWITCH_TIME_INTEGRAL	n_switch_time_integral	
N_SWITCH_INTEGRAL_METHOD	n_switch_integral_method	
N_SWITCH_TENDENCY_HORIZONTAL	n_switch_tendency_horizontal	
Settings of gravitational fallout		
N_SWITCH_TERMINAL_VELOCITY	n_switch_terminal_velocity	Table D.12
N_SWITCH_SLIP_CORRECTION	n_switch_slip_correction	
FORM	form	
MAXD_DENS	maxd_dens	
MIND_DENS	mind_dens	
Settings of wet scavenging		
N_SWITCH_SCAVENGING_TRACER_TYPE	n_switch_scavenging_tracer_type	Table D.13
SCAVENGING_COEF_RAIN	scavenging_coef_rain	
SCAVENGING_POWER_RAIN	scavenging_power_rain	
THRESHOLD_INTENSITY_RAIN	threshold_intensity_rain	
SCAVENGING_COEF_SNOW	scavenging_coef_snow	
SCAVENGING_POWER_SNOW	scavenging_power_snow	
THRESHOLD_INTENSITY_SNOW	threshold_intensity_snow	
SCAVENGING_COEF_GRPL	scavenging_coef_grpl	
SCAVENGING_POWER_GRPL	scavenging_power_grpl	
THRESHOLD_INTENSITY_GRPL	threshold_intensity_grpl	
HENRY_CONST	henry_const	
FRACTION_NUCLEI	fraction_nuclei	
Parameter of decay		
HALF_LIFE	half_life	Table D.14
I/O settings		
INTERVAL_ATM	interval_atm	Table D.15
N_SWITCH_ATM_OUTPUT	n_switch_atm_output	
N_SWITCH_ATM_VALUE_DEPOSIT	n_switch_atm_value_deposit	
N_SWITCH_ATM_VALUE_CONCENT	n_switch_atm_value_concent	
N_SWITCH_ATM_INTERP	n_switch_atm_interp	
TYPE1_ATM	type1_atm	
TYPE2_ATM	type2_atm	
TYPE3_ATM	type3_atm	
MEMBER_ATM	member_atm	
PLANE_ALT_ATM	plane_alt_atm	Table D.16