Specification of the HK-200m data product

Data description

Data type	Reanalysis data
Grid type	Unstructured
Spatial coverage	Regional Bounded by a circle centered at (22.35°N, 114.15°E) with a radius of 200km
Spatial resolution	200 meters in Hong Kong Regions outside Hong Kong varied from 200m to 22km
Temporal coverage	2019-07-01 00:00:00 UTC - 2021-06-30 23:50:00 UTC
Temporal resolution	Most variables: Hourly Wind variables: 10-minute
Vertical coverage	0 to 30,000 meters
Vertical resolution	59 model levels in height-based terrain following vertical coordinates
File format	netCDF

Data dimensions

This data product is produced by CPAS, which is built upon the publicly available MPAS-A model[1]. Therefore, it follows the MPAS-A grid system, which is composed of unstructured Voronoi cells. In this data product, there are a total of 59,478 cells in the grid, with 59 vertical layers. The table below shows all dimensions in this data product.

Dimension	**Description**	**Length of dimension**
Time	The number of time steps	unlimited
nCells	The number of cells in the mesh	59,478
nVertLevels	The number of vertical layers	59
nEdges	The number of cell faces (edges) in the mesh	178,547
nVertices	The number of cell corners in the mesh	119,070
maxEdges	The largest number of neighbors that a mesh cell may have	7
maxEdges2	The value of maxEdges multiplied by two	14
R3	The dimensionality of vectors in 3D real coordinate space	3

[1] M. Duda, L. Fowler, B. Skamarock, C. Roesch, D. Jacobsen, and T. Ringler, “MPAS-Atmosphere model user’s guide version 6.0,” 2018. [Online]. Available: http://www2.mmm.ucar.edu/projects/mpas/mpas_atmosphere_users_guide_6.0.pdf

vertexDegree	The number of edges or cells that meet at vertices	3
nVertLevelsP1	The number of staggered vertical levels, always one more than the number of vertical layers (nVertLevels + 1)	60
nLags	The amount of lag time	140
nOznLevels	The number of vertical layers for ozone	59
nMonths	The number of months in a year	12
nSoilLevels	The number of soil layers used by the land-surface scheme	4
TWO	A constant value of 2	2
FIFTEEN	A constant value of 15	15

Time range available

The time range of the data product is from 2019-07-01 00:00:00 UTC to 2021-06-30 23:50:00 UTC. The valid time of each time step is represented by the variable 'xtime'.

Parameter	**Description**	**Dimension**
xtime	Model valid time, written in the format of YYYY-MM-DD_hh:mm:ss	(Time)

In this data product, only some wind variables are provided in a time interval of 10 minutes. Most other variables are either provided in a time interval of 1 hour or static variables that do not change in time. The details of the list of variables available in the dataset are shown in below sections.

List of available static variables

The table below shows the list of static variables which do not change in time. These variables usually represent the grid or static field information of this data product.

Parameter	**Long name**	**Unit**	**Dimension**
latCell	Latitude of cells	rad	(nCells)
lonCell	Longitude of cells	rad	(nCells)
xCell	Cartesian x-coordinate of cells	m	(nCells)
yCell	Cartesian y-coordinate of cells	m	(nCells)
zCell	Cartesian z-coordinate of cells	m	(nCells)
indexToCellID	Mapping from local array index to global cell ID	unitless	(nCells)
latEdge	Latitude of edges	rad	(nEdges)
lonEdge	Longitude of edges	rad	(nEdges)
xEdge	Cartesian x-coordinate of edges	m	(nEdges)

yEdge	Cartesian y-coordinate of edges	m	(nEdges)
zEdge	Cartesian z-coordinate of edges	m	(nEdges)
indexToEdgeID	Mapping from local array index to global edge ID	unitless	(nEdges)
latVertex	Latitude of vertices	rad	(nVertices)
lonVertex	Longitude of vertices	rad	(nVertices)
xVertex	Cartesian x-coordinate of vertices	m	(nVertices)
yVertex	Cartesian y-coordinate of vertices	m	(nVertices)
zVertex	Cartesian z-coordinate of vertices	m	(nVertices)
indexToVertexID	Mapping from local array index to global vertex ID	unitless	(nVertices)
cellsOnEdge	IDs of cells divided by an edge	unitless	(nEdges, TWO)
nEdgesOnCell	Number of edges forming the boundary of a cell	unitless	(nCells)
nEdgesOnEdge	Number of edges involved in reconstruction of tangential velocity for an edge	unitless	(nEdges)
edgesOnCell	IDs of edges forming the boundary of a cell	unitless	(nCells, maxEdges)
edgesOnEdge	IDs of edges involved in reconstruction of tangential velocity for an edge	unitless	(nEdges, maxEdges2)
weightsOnEdge	Weights used in reconstruction of tangential velocity for an edge	unitless	(nEdges, maxEdges2)
dvEdge	Spherical distance between vertex endpoints of an edge	unitless	(nEdges)
dcEdge	Spherical distance between cells separated by an edge	m	(nEdges)
angleEdge	Angle between local north and the positive tangential direction of an edge	rad	(nEdges)
areaCell	Spherical area of a Voronoi cell	m^2	(nCells)
areaTriangle	Spherical area of a Delaunay triangle	m^2	(nVertices)
edgeNormalVectors	Cartesian components of the vector normal to an edge and tangential to the surface of the sphere	unitless	(nEdges, R3)
localVerticalUnitVectors	Cartesian components of the vector	unitless	(nCells, R3)

	pointing in the local vertical direction for a cell		
cellTangentPlane	Components of a pair of vectors defining the tangent plane at a cell	unitless	(nCells, TWO, R3)
cellsOnCell	IDs of cells neighboring a cell	unitless	(nCells, maxEdges)
verticesOnCell	IDs of vertices (corner points) of a cell	unitless	(nCells, maxEdges)
verticesOnEdge	IDs of the two vertex endpoints of an edge	unitless	(nEdges, TWO)
edgesOnVertex	IDs of the edges that meet at a vertex	unitless	(nVertices, vertexDegree)
cellsOnVertex	IDs of the cells that meet at a vertex	unitless	(nVertices, vertexDegree)
kiteAreasOnVertex	Intersection areas between primal (Voronoi) and dual (triangular) mesh cells	m^2	(nVertices, vertexDegree)
fEdge	Coriolis parameter at an edge	unitless	(nEdges)
fVertex	Coriolis parameter at a vertex	unitless	(nVertices)
meshDensity	Mesh density function (used when generating the mesh) evaluated at a cell	unitless	(nCells)
meshScalingDel2	Scaling coefficient for ∇^2 eddy viscosity	unitless	(nEdges)
meshScalingDel4	Scaling coefficient for ∇^4 eddy hyper-viscosity	unitless	(nEdges)
meshScalingRegionalCell	Cell-centered Scaling coefficient for relaxation zone	unitless	(nCells)
meshScalingRegionalEdge	Edge-centered Scaling coefficient for relaxation zone	unitless	(nEdges)
bdyMaskCell	Indicator of whether a cell is an interior cell a relaxation-zone cell or a specified-zone cell	unitless	(nCells)
bdyMaskEdge	Indicator of whether an edge is an interior edge a relaxation-zone edge or a specified-zone edge	unitless	(nEdges)
bdyMaskVertex	Indicator of whether a vertex is an	unitless	(nVertices)

	interior vertex a relaxation-zone vertex or a specified-zone vertex		
cf1	Surface interpolation weight for level k=1 value	unitless	()
cf2	Surface interpolation weight for level k=2 value	unitless	()
cf3	Surface interpolation weight for level k=3 value	unitless	()
zgrid	Geometric height of layer interfaces	m MSL	(nCells, nVertLevelsP1)
rdzw	Reciprocal dzw	unitless	(nVertLevels)
dzu	d(zeta) at w levels	unitless	(nVertLevels)
rdzu	Reciprocal dzu	unitless	(nVertLevels)
fzm	Weight for linear interpolation to w(k) point for u(k) level variable	unitless	(nVertLevels)
fzp	Weight for linear interpolation to w(k) point for u(k-1) level variable	unitless	(nVertLevels)
zxu	dz/dx on horizontal coordinate surfaces at u levels	unitless	(nEdges, nVertLevels)
zz	d(zeta)/dz vertical metric term	unitless	(nCells, nVertLevels)
zb	Coefficients for contribution from u to omega diagnosis edge-oriented	unitless	(nEdges, TWO, nVertLevelsP1)
zb3	Coefficients for 3rd-order correction to contribution from u to omega diagnosis edge-oriented	unitless	(nEdges, TWO, nVertLevelsP1)
dss	w-damping coefficient	unitless	(nCells, nVertLevels)
u_init	u reference profile	m s^{-1}	(nVertLevels)
v_init	v reference profile	m s^{-1}	(nVertLevels)
t_init	theta reference profile	K	(nCells, nVertLevels)
qv_init	qv reference profile	kg kg^{-1}	(nVertLevels)
deriv_two	weights for cell-centered second derivative normal to edge for transport scheme	unitless	(nEdges, TWO, FIFTEEN)

defc_a	Coefficients for computing the off-diagonal components of the horizontal deformation	unitless	(nCells, maxEdges)
defc_b	Coefficients for computing the diagonal components of the horizontal deformation	unitless	(nCells, maxEdges)
coeffs_reconstruct	Coefficients to reconstruct velocity vectors at cell centers	unitless	(nCells, maxEdges, R3)
east	Cartesian components of the local unit vector pointing east	unitless	(nCells, R3)
north	Cartesian components of the unit vector pointing north	unitless	(nCells, R3)
pin	fixed pressure levels at which climatological ozone is defined	Pa	(nOznLevels)
ozmixm	monthly-mean climatological ozone defined at fixed pressure levels	mol mol^{-1}	(nCells, nOznLevels, nMonths)
isltyp	dominate soil category	unitless	(nCells)
ivgtyp	dominant vegetation category	unitless	(nCells)
mminlu	land use classification	unitless	()
isice_lu	Index category for snow/ice	unitless	()
iswater_lu	Index category for water	unitless	()
landmask	land-ocean mask (1=land ; 0=ocean)	unitless	(nCells)
shdmin	minimum fractional coverage of annual green vegetation fraction	unitless	(nCells)
shdmax	maximum fractional coverage of annual green vegetation fraction	unitless	(nCells)
snoalb	annual maximum snow albedo	unitless	(nCells)
albedo12m	monthly-mean climatological surface albedo	unitless	(nCells, nMonths)
greenfrac	monthly-mean climatological greenness fraction	unitless	(nCells, nMonths)
varsso	Variance of subgrid-scale orography	m^2	(nCells)
var2d	variance of orography	m^2	(nCells)
con	convexity of orography	m^2	(nCells)
oa1	directional asymmetry function of	unitless	(nCells)

	orography		
oa2	directional asymmetry function of orography	unitless	(nCells)
oa3	directional asymmetry function of orography	unitless	(nCells)
oa4	directional asymmetry function of orography	unitless	(nCells)
ol1	directional asymmetry function of orography	unitless	(nCells)
ol2	directional asymmetry function of orography	unitless	(nCells)
ol3	directional asymmetry function of orography	unitless	(nCells)
ol4	directional asymmetry function of orography	unitless	(nCells)
twind1_ctopo	Correction for topography of option 1	unitless	(nCells)
twind1_ctopo2	Correction for topography 2 of option 1	unitless	(nCells)
twind2_ctopo	Correction for topography of option 2	unitless	(nCells)
twind2_ctopo2	Correction for topography 2 of option 2	unitless	(nCells)

Categorical variables

The table below shows what each index in the soil and vegetation categories represent.

Parameter	**Long name**	**Index**	**Category**
isltyp	dominate soil category	1	Sand
		2	Loamy Sand
		3	Sandy Loam
		4	Silt Loam
		5	Silt
		6	Loam
		7	Sandy Clay Loam
		8	Silty Clay Loam
		9	Clay Loam
		10	Sandy Clay
		11	Silty Clay

		12	Clay
		13	Organic Material
		14	Water
		15	Bedrock
		16	Other(land-ice)
		17	Playa
		18	Lava
		19	White Sand
ivgtyp	dominant vegetation category	1	Evergreen Needleleaf Forest
		2	Evergreen Broadleaf Forest
		3	Deciduous Needleleaf Forest
		4	Deciduous Broadleaf Forest
		5	Mixed Forests
		6	Closed Shrublands
		7	Open Shrublands
		8	Woody Savannas
		9	Savannas
		10	Grasslands
		11	Permanent wetlands
		12	Croplands
		13	Urban and Built-Up
		14	Cropland/natural vegetation mosaic
		15	Snow and Ice
		16	Barren or Sparsely Vegetated
		17	Water
		18	Wooded Tundra
		19	Mixed Tundra
		20	Barren Tundra

List of variables available at **10-minute intervals**

The table below shows the available wind variables provided in a time interval of 10 minutes. The valid time range for these variables is from 2019-07-01 00:00:00 UTC to 2021-06-30 23:50:00 UTC.

Parameter	**Long name**	**Unit**	**Dimension**
u	Horizontal normal velocity at edges	m s^{-1}	(Time, nEdges, nVertLevels)
u10	10-meter zonal wind	m s^{-1}	(Time, nCells)
v10	10-meter meridional wind	m s^{-1}	(Time, nCells)

List of variables available at **hourly intervals**

The table below shows the available wind variables provided in a time interval of an hour. The valid time range for these variables is from 2019-07-01 00:00:00 UTC to 2021-06-30 23:00:00 UTC.

Parameter	**Long name**	**Unit**	**Dimension**
qv	Water vapor mixing ratio	kg kg^{-1}	(Time, nCells, nVertLevels)
qc	Cloud water mixing ratio	kg kg^{-1}	(Time, nCells, nVertLevels)
qr	Rain water mixing ratio	kg kg^{-1}	(Time, nCells, nVertLevels)
qi	Ice mixing ratio	kg kg^{-1}	(Time, nCells, nVertLevels)
qs	Snow mixing ratio	kg kg^{-1}	(Time, nCells, nVertLevels)
qg	Graupel mixing ratio	kg kg^{-1}	(Time, nCells, nVertLevels)
re_cloud	effective radius of cloud water droplets	m	(Time, nCells, nVertLevels)
re_ice	effective radius of cloud ice crystals	m	(Time, nCells, nVertLevels)
re_snow	effective radius of snow crystals	m	(Time, nCells, nVertLevels)
w	Vertical velocity at vertical cell faces	m s^{-1}	(Time, nCells, nVertLevelsP1)
rho_zz	Dry air density divided by d(zeta)/dz	kg m^{-3}	(Time, nCells, nVertLevels)

theta_m	Moist potential temperature: theta*(1+q_v*R_v/R_d)	K	(Time, nCells, nVertLevels)
pressure_p	Perturbation pressure	Pa	(Time, nCells, nVertLevels)
rho	Dry air density	kg m^{-3}	(Time, nCells, nVertLevels)
theta	Potential temperature	K	(Time, nCells, nVertLevels)
relhum	Relative humidity	percent	(Time, nCells, nVertLevels)
uReconstructZonal	Zonal component of reconstructed horizontal velocity at cell centers	m s^{-1}	(Time, nCells, nVertLevels)
uReconstructMeridional	Meridional component of reconstructed horizontal velocity at cell centers	m s^{-1}	(Time, nCells, nVertLevels)
circulation	Horizontal circulation at vertices	m^2 s^{-1}	(Time, nVertices, nVertLevels)
exner	Exner function	unitless	(Time, nCells, nVertLevels)
exner_base	Base-state Exner function	unitless	(Time, nCells, nVertLevels)
rtheta_base	reference state rho*theta/zz	kg K m^{-3}	(Time, nCells, nVertLevels)
pressure_base	Base state pressure	Pa	(Time, nCells, nVertLevels)
rho_base	Base state dry air density	kg m^{-3}	(Time, nCells, nVertLevels)
theta_base	Base state potential temperature	K	(Time, nCells, nVertLevels)
ru	horizontal momentum at cell edge (rho*u/zz)	kg m^{-2} s^{-1}	(Time, nEdges, nVertLevels)
ru_p	acoustic perturbation horizontal momentum at cell edge (rho*u/zz)	kg m^{-2} s^{-1}	(Time, nEdges, nVertLevels)
rw	rho*omega/zz carried at w points	kg m^{-2} s^{-1}	(Time, nCells, nVertLevelsP1)
rw_p	acoustic perturbation rho*omega/zz carried at w points	kg m^{-2} s^{-1}	(Time, nCells, nVertLevelsP1)
rtheta_p	rho*theta_m/zz perturbation from the	kg K m^{-3}	(Time, nCells,

	reference state value		nVertLevels)
rho_p	rho/zz perturbation from the reference state value advanced over acoustic steps	kg m^{-3}	(Time, nCells, nVertLevels)
surface_pressure	Diagnosed surface pressure	Pa	(Time, nCells)
tend_sfc_pressure	Tendency of surface pressure	Pa s^{-1}	(Time, nCells)
rt_diabatic_tend	Tendency of coupled potential temperature from physics	kg K s^{-1}	(Time, nCells, nVertLevels)
nsteps_accum	number of accumulated time-steps in a day	unitless	(Time, nCells)
ndays_accum	number of accumulated days in a year	unitless	(Time, nCells)
tlag	daily mean surface temperature of prior days	K	(Time, nCells, nLags)
tday_accum	accumulated daily surface temperature for current day	K	(Time, nCells)
tyear_mean	annual mean surface temperature	K	(Time, nCells)
tyear_accum	accumulated yearly surface temperature for current year	K	(Time, nCells)
refl10cm_max	10 cm maximum radar reflectivity	dBZ	(Time, nCells)
i_rainnc	incidence of accumulated grid-scale precipitation greater than config_bucket_rainnc	unitless	(Time, nCells)
rainncv	time-step total grid-scale precipitation	mm	(Time, nCells)
rainnc	accumulated total grid-scale precipitation	mm	(Time, nCells)
snownc	accumulated grid-scale precipitation of snow	mm	(Time, nCells)
graupelnc	accumulated grid-scale precipitation of graupel	mm	(Time, nCells)
sr	time-step ratio of frozen versus total grid-scale precipitation	unitless	(Time, nCells)
i_rainc	incidence of accumulated convective precipitation greater than config_bucket_rainc	unitless	(Time, nCells)
cuprec	convective precipitation rate	mm s^{-1}	(Time, nCells)
rainc	accumulated convective precipitation	mm	(Time, nCells)

raincv	time-step convective precipitation	mm	(Time, nCells)
cubot	index of highest level of convection	unitless	(Time, nCells)
cutop	index of lowest level of convection	unitless	(Time, nCells)
tke_pbl	turbulent kinetic energy from PBL	$m^2 s^{-2}$	(Time, nCells, nVertLevels)
wstar	mixed velocity scale from PBL scheme	$m s^{-1}$	(Time, nCells)
hgamt	thermal perturbation	K	(Time, nCells)
hgamq	moisture perturbation	$kg kg^{-1}$	(Time, nCells)
delta	entrainment layer depth from PBL scheme	m	(Time, nCells)
el_pbl	mixing length from PBL scheme	m	(Time, nCells, nVertLevels)
kpbl	index level of PBL top	unitless	(Time, nCells)
hpbl	Planetary Boundary Layer (PBL) height	m	(Time, nCells)
hfx	upward heat flux at the surface	$W m^{-2}$	(Time, nCells)
mavail	surface moisture availability (between 0 and 1)	unitless	(Time, nCells)
mol	T* in similarity theory	K	(Time, nCells)
qfx	upward moisture flux at the surface	$kg m^{-2} s^{-1}$	(Time, nCells)
qsfc	specific humidity at lower boundary	$kg kg^{-1}$	(Time, nCells)
ust	U* in similarity theory	$m s^{-1}$	(Time, nCells)
ustm	U* in similarity theory without vconv	$m s^{-1}$	(Time, nCells)
zol	z/L height over Monin-Obukhov length	unitless	(Time, nCells)
znt	roughness length	m	(Time, nCells)
br	Richardson number	unitless	(Time, nCells)
cd	drag coefficient at 10-meter	unitless	(Time, nCells)
cda	drag coefficient at lowest model level	unitless	(Time, nCells)
chs	surface exchange coefficient for heat and moisture	$m s^{-1}$	(Time, nCells)
chs2	surface exchange coefficient for heat at 2-meter	$m s^{-1}$	(Time, nCells)
cqs2	surface exchange coefficient for moisture at 2-meter	$m s^{-1}$	(Time, nCells)

ck	enthalpy exchange coeff at 10-meter	unitless	(Time, nCells)
cka	enthalpy exchange coefficient at lowest model level	unitless	(Time, nCells)
cpm	specific heat of dry air at constant pressure at lowest model level	J K^{-1} kg^{-1}	(Time, nCells)
flhc	exchange coefficient for heat	W m^{-2} K^{-1}	(Time, nCells)
flqc	exchange coefficient for moisture	kg m^{-2} s^{-1}	(Time, nCells)
gz1oz0	log(z/z0) where z0 is roughness length	unitless	(Time, nCells)
lh	latent heat flux at the surface	W m^{-2}	(Time, nCells)
psim	similarity stability function for momentum	unitless	(Time, nCells)
psih	similarity stability function for heat	unitless	(Time, nCells)
qgh	lowest level saturation mixing ratio	kg kg^{-1}	(Time, nCells)
regime	flag indicating the PBL regime (stable, unstable, ...)	unitless	(Time, nCells)
rmol	1./L Monin Obukhov length	unitless	(Time, nCells)
wspd	wind speed at lowest model level	m s^{-1}	(Time, nCells)
fh	integrated stability function for heat	unitless	(Time, nCells)
fm	integrated stability function for moisture	unitless	(Time, nCells)
q2	2-meter specific humidity	kg kg^{-1}	(Time, nCells)
t2m	2-meter temperature	K	(Time, nCells)
th2m	2-meter potential temperature	K	(Time, nCells)
dusfcg	vertically-integrated gravity wave drag over orography u-stress	Pa m s^{-1}	(Time, nCells)
dvsfcg	vertically-integrated gravity wave drag over orography v-stress	Pa m s^{-1}	(Time, nCells)
dtaux3d	gravity wave drag over orography u-stress	m s^{-1}	(Time, nCells, nVertLevels)
dtauy3d	gravity wave drag over orography v-stress	m s^{-1}	(Time, nCells, nVertLevels)
rubldiff	change in PBL zonal wind tendency due to gravity wave drag over orography	m s^{-2}	(Time, nCells, nVertLevels)
rvbldiff	change in PBL meridional wind	m s^{-2}	(Time, nCells,

	tendency due to gravity wave drag over orography		nVertLevels)
i_acswdnb	incidence of accumulated all-sky downward surface shortwave radiation greater than config_bucket_radt	unitless	(Time, nCells)
i_acswdnbc	incidence of accumulated clear-sky downward surface shortwave radiation greater than config_bucket_radt	unitless	(Time, nCells)
i_acswdnt	incidence of accumulated all-sky downward top-of-atmosphere shortwave radiation greater than config_bucket_radt	unitless	(Time, nCells)
i_acswdntc	incidence of accumulated clear-sky downward top-of-atmosphere shortwave radiation greater than config_bucket_radt	unitless	(Time, nCells)
i_acswupb	incidence of accumulated all-sky upward surface shortwave radiation greater than config_bucket_radt	unitless	(Time, nCells)
i_acswupbc	incidence of accumulated clear-sky upward surface shortwave radiation greater than config_bucket_radt	unitless	(Time, nCells)
i_acswupt	incidence of accumulated all-sky upward top-of-atmosphere shortwave radiation greater than config_bucket_radt	unitless	(Time, nCells)
i_acswuptc	incidence of accumulated clear-sky upward top-of-atmosphere shortwave radiation greater than config_bucket_radt	unitless	(Time, nCells)
acswdnb	accumulated all-sky downward surface shortwave radiation flux	W m^{-2}	(Time, nCells)
acswdnbc	accumulated clear-sky downward surface shortwave radiation flux	W m^{-2}	(Time, nCells)
acswdnt	accumulated all-sky downward top-of-atmosphere shortwave radiation flux	W m^{-2}	(Time, nCells)
acswdntc	accumulated clear-sky downward top-of-atmosphere shortwave radiation	W m^{-2}	(Time, nCells)

	flux		
acswupb	accumulated all-sky upward surface shortwave radiation flux	W m^{-2}	(Time, nCells)
acswupbc	accumulated clear-sky upward surface shortwave radiation flux	W m^{-2}	(Time, nCells)
acswupt	accumulated all-sky upward top-of-atmosphere shortwave radiation flux	W m^{-2}	(Time, nCells)
acswuptc	accumulated clear-sky upward top-of-atmosphere shortwave radiation flux	W m^{-2}	(Time, nCells)
gsw	net surface shortwave radiation flux	W m^{-2}	(Time, nCells)
i_aclwdnb	incidence of accumulated all-sky downward surface longwave radiation greater than config_bucket_radt	unitless	(Time, nCells)
i_aclwdnbc	incidence of accumulated clear-sky downward surface longwave radiation greater than config_bucket_radt	unitless	(Time, nCells)
i_aclwdnt	incidence of accumulated all-sky downward top-of-atmosphere longwave radiation greater than config_bucket_radt	unitless	(Time, nCells)
i_aclwdntc	incidence of accumulated clear-sky downward top-of-atmosphere longwave radiation greater than config_bucket_radt	unitless	(Time, nCells)
i_aclwupb	incidence of accumulated all-sky upward surface longwave radiation greater than config_bucket_radt	unitless	(Time, nCells)
i_aclwupbc	incidence of accumulated clear-sky upward surface longwave radiation greater than config_bucket_radt	unitless	(Time, nCells)
i_aclwupt	incidence of accumulated all-sky upward top-of-atmosphere longwave radiation greater than config_bucket_radt	unitless	(Time, nCells)
i_aclwuptc	incidence of accumulated clear-sky upward top-of-atmosphere longwave radiation greater than	unitless	(Time, nCells)

	config_bucket_radt		
aclwdnb	accumulated all-sky downward surface longwave radiation flux	W m^{-2}	(Time, nCells)
aclwdnbc	accumulated clear-sky downward surface longwave radiation flux	W m^{-2}	(Time, nCells)
aclwdnt	accumulated all-sky downward top-of-the-atmosphere longwave radiation flux	W m^{-2}	(Time, nCells)
aclwdntc	accumulated clear-sky downward top-of-the-atmosphere longwave radiation flux	W m^{-2}	(Time, nCells)
aclwupb	accumulated all-sky upward surface longwave radiation flux	W m^{-2}	(Time, nCells)
aclwupbc	accumulated clear-sky upward surface longwave radiation flux	W m^{-2}	(Time, nCells)
aclwupt	accumulated all-sky upward top-of-the-atmosphere longwave radiation flux	W m^{-2}	(Time, nCells)
aclwuptc	accumulated clear-sky upward top-of-the-atmosphere longwave radiation flux	W m^{-2}	(Time, nCells)
glw	all-sky downward surface longwave radiation	W m^{-2}	(Time, nCells)
o3clim	climatological ozone on prescribed pressure levels at current time	mol mol^{-1}	(Time, nCells, nOznLevels)
o3vmr	ozone volume mixing ratio	mol mol^{-1}	(Time, nCells, nVertLevels)
acsnom	accumulated melted snow	kg m^{-2}	(Time, nCells)
acsnow	accumulated snow	kg m^{-2}	(Time, nCells)
canwat	water in canopy	kg m^{-2}	(Time, nCells)
chklowq	surface saturation flag	unitless	(Time, nCells)
grdflx	ground heat flux	W m^{-2}	(Time, nCells)
lai	leaf area index	m^{-2} m^{-2}	(Time, nCells)
noahres	residual of the Noah surface energy budget	W m^{-2}	(Time, nCells)
potevp	accumulated potential evaporation	m	(Time, nCells)

sfc_albedo	surface albedo	unitless	(Time, nCells)
sfc_albedo_seaice	surface albedo over seaice	unitless	(Time, nCells)
sfc_emiss	surface emissivity	unitless	(Time, nCells)
sfc_emibck	background surface emissivity	unitless	(Time, nCells)
sfcrunoff	surface runoff	mm	(Time, nCells)
smstav	surface moisture availability	unitless	(Time, nCells)
smstot	total soil moisture	m^3 m^{-3}	(Time, nCells)
snopcx	snow phase change heat flux	W m^{-2}	(Time, nCells)
snotime	initial number of time-steps since last snow fall	unitless	(Time, nCells)
sstsk	skin sea-surface temperature	K	(Time, nCells)
sstsk_dtc	skin sea-surface temperature cooling	K	(Time, nCells)
sstsk_dtw	skin sea-surface temperature warming	K	(Time, nCells)
thc	thermal inertia	Cal cm^{-2} K^{-1} $s^{-0.5}$	(Time, nCells)
udrunoff	underground runoff	mm	(Time, nCells)
xicem	sea-ice flag from previous time-step	unitless	(Time, nCells)
z0	roughness height	m	(Time, nCells)
zs	depth of centers of soil layers	m	(Time, nCells)
rthcuten	tendency of potential temperature due to cumulus convection	K s^{-1}	(Time, nCells, nVertLevels)
rqvcuten	tendency of water vapor mixing ratio due to cumulus convection	kg kg^{-1} s^{-1}	(Time, nCells, nVertLevels)
rqccuten	tendency of cloud water mixing ratio due to cumulus convection	kg kg^{-1} s^{-1}	(Time, nCells, nVertLevels)
rqicuten	tendency of cloud ice mixing ratio due to cumulus convection	kg kg^{-1} s^{-1}	(Time, nCells, nVertLevels)
rqvdynten	tendency of water vapor due to horizontal and vertical advections	kg kg^{-1} s^{-1}	(Time, nCells, nVertLevels)
rthdynten	tendency of temperature due to horizontal and vertical advections	K s^{-1}	(Time, nCells, nVertLevels)
rucuten	tendency of zonal wind due to cumulus convection	m s^{-1} s^{-1}	(Time, nCells, nVertLevels)
rvcuten	tendency of meridional wind due to cumulus convection	m s^{-1} s^{-1}	(Time, nCells, nVertLevels)
rublten	tendency of zonal wind due to pbl	m s^{-1} s^{-1}	(Time, nCells,

	processes		nVertLevels)
rvblten	tendency of meridional wind due to pbl processes	m s^{-1} s^{-1}	(Time, nCells, nVertLevels)
rthblten	tendency of potential temperature due to pbl processes	K s^{-1}	(Time, nCells, nVertLevels)
rqvblten	tendency of water vapor mixing ratio due to pbl processes	kg kg^{-1} s^{-1}	(Time, nCells, nVertLevels)
rqcblten	tendency of cloud water mixing ratio due to pbl processes	kg kg^{-1} s^{-1}	(Time, nCells, nVertLevels)
rqiblten	tendency of cloud ice mixing ratio due to pbl processes	kg kg^{-1} s^{-1}	(Time, nCells, nVertLevels)
rthratensw	tendency of potential temperature due to short wave radiation	K s^{-1}	(Time, nCells, nVertLevels)
rthratenlw	tendency of potential temperature due to short wave radiation	K s^{-1}	(Time, nCells, nVertLevels)
rthfddaten	tendency of potential temperature due to four-dimensional data assimilation	K s^{-1}	(Time, nCells, nVertLevels)
rqvfddaten	tendency of water vapor mixing ratio due to four-dimensional data assimilation	kg kg^{-1} s^{-1}	(Time, nCells, nVertLevels)
rufddaten	tendency of zonal wind due to four-dimensional data assimilation	m s^{-1} s^{-1}	(Time, nCells, nVertLevels)
rvfddaten	tendency of meridional wind due to four-dimensional data assimilation	m s^{-1} s^{-1}	(Time, nCells, nVertLevels)
sfc_albbck	background surface albedo	unitless	(Time, nCells)
skintemp	ground or water surface temperature	K	(Time, nCells)
snow	snow water equivalent	kg m^{-2}	(Time, nCells)
snowc	flag for snow on ground (=0 no snow; =1 otherwise)	unitless	(Time, nCells)
snowh	physical snow depth	m	(Time, nCells)
sst	sea-surface temperature	K	(Time, nCells)
tmn	deep soil temperature	K	(Time, nCells)
vegfra	vegetation fraction	unitless	(Time, nCells)
seaice	sea-ice flag (0=no seaice; =1 otherwise)	unitless	(Time, nCells)
xice	fractional area coverage of sea-ice	unitless	(Time, nCells)

xland	land-ocean mask (1=land including sea-ice ; 2=ocean)	unitless	(Time, nCells)
dzs	soil layer thickness	m	(Time, nCells, nSoilLevels)
smcrel	soil moisture threshold below which transpiration begins to stress	m^3 m^{-3}	(Time, nCells, nSoilLevels)
sh2o	soil equivalent liquid water	m^3 m^{-3}	(Time, nCells, nSoilLevels)
smois	soil moisture	m^3 m^{-3}	(Time, nCells, nSoilLevels)
tslb	soil layer temperature	K	(Time, nCells, nSoilLevels)
t_oml	ocean mixed layer temperature	K	(Time, nCells)
t_oml_initial	ocean mixed layer temperature at initial time	K	(Time, nCells)
t_oml_200m_initial	ocean mixed layer 200 m mean temperature at initial time	K	(Time, nCells)
h_oml	ocean mixed layer depth	m	(Time, nCells)
h_oml_initial	Initial depth of ocean mixed layer	m	(Time, nCells)
hu_oml	ocean mixed layer integrated u (zonal velocity)	m^2 s^{-1}	(Time, nCells)
hv_oml	ocean mixed layer integrated v (meridional velocity)	m^2 s^{-1}	(Time, nCells)