

# RECOMMENDED VARIABLE NAMING IN ARPEGE/IFS.

YESSAD K. (METEO-FRANCE/CNRM/GMAP/ALGO)

January 31, 2018

## Contents

<b>1</b>	<b>Introduction.</b>	<b>2</b>
<b>2</b>	<b>Geometry.</b>	<b>4</b>
<b>3</b>	<b>3D and 2D dynamical fields.</b>	<b>5</b>
<b>4</b>	<b>Other diagnosed quantities.</b>	<b>8</b>
<b>5</b>	<b>Diabatic processes.</b>	<b>13</b>
<b>6</b>	<b>GRIB codes and roots.</b>	<b>19</b>

*Abstract:*

*This documentation has for purpose to give a recommended standard root to name meteorological quantities which are used in the model. It starts from an inventory of variables used in cycle 46.*

# 1 Introduction.

In the current ARPEGE/IFS code, we now handle several hundreds of meteorological quantities. We notice that root names used to name variables may currently differ between the different parts of code (dynamics, physics, observation interpolator, diagnostics, post-processing, identifiers containing GRIB codes). That makes the code not easy to read and that can be a source of mistakes.

We can give some examples of multiple roots used for the same quantity:

- surface orography: one currently finds OR, OROG, ECOROG.
- surface hydrostatic pressure: one currently finds PRES, SP.
- ocean mixed layer viscosity: one currently finds OCVVS, DIFM.
- cloud fraction: one currently finds A, CC.
- surface soil (skin) wetness: one currently finds SSW, SRC. But SRC is the standard root for second-order flux for AROME!
- land-sea mask: one currently finds LSM (global variables), SLM (in some local variables), ITM (in some dummy and local variables).
- $U$ -wind at 10 metres: one currently finds UCLS, 10U.

We can give some examples where the same root is currently used for different quantities:

- root [R]: sometimes used for rainfall, sometimes used for moist air constant.
- root [Z]: sometimes used for height  $z$ , sometimes used for geopotential height  $gz$ .
- root [Z0]: sometimes used for  $z_0$ , sometimes used for  $gz_0$ .
- root [CH4F]: sometimes used for “CH4 fire emission”, sometimes used for “CH4 surface flux”.

There are also occurrences of mixing French roots and English roots for similar quantities.

The aim of the present paper is to define a “standard” naming for the most usual quantities used in the model, in order to avoid heterogeneous namings throughout the code. In particular roots must match the following goals:

- Roots are assumed to be understandable for English speaking people.
- A root can be given for only one quantity.

This paper can be considered as a basis in order to improve and make homogeneous variable namings in the future in the code (starting by global variables or attributes of global variables). It can also help to remove the redundancies in FULL-POS: same variable post-processed at different locations (2D quantities, physics outputs, CFU or XFU outputs) with different roots names.

These roots may appear in particular in the following sets of variables:

- GRIB codes in modules YOM\_GRIB\_CODES: name is generally NGRB[root].
- Post-processing identifiers in module YOMAFN: name is generally TFP\_[root] for 3D and 2D dynamical fields, GFP\_[root] for surface quantities, column contents and fluxes used in the physics, GFP\_C[root] for cumulated fluxes, GFP\_X[root] for instantaneous fluxes.
- ARPEGE file descriptors in module YOMFA: name is generally YFA[root].
- GFL, GMV, GMVS and surface fields attributes (modules YOM\_YGFL, TYPE\_GMVS, SURFACE\_FIELDS\_MIX, YOMSP, YOMSPJB, YOMSP\_PTRS).
- GOMS attributes in modules GOMS\_MOD, GOMS\_PLUS, SUPERGOM\_CLASS.
- Standard atmosphere quantities (module YOMSTA).
- Some surface constants used in configuration 923 (module YOMCLI).
- Code under CPG (in particular CPG\_GP).
- Some attributes in arpifs/module/spectral\_fields\_data.F90 (attributes of structure SPECTRAL\_FIELD).
- Some attributes in arpifs/module/yomjq.F90 (attributes of structure ERRMODVCOR\_STRUCTURE).
- Some attributes in arpifs/module/gridpoint\_fields\_mix.F90 (attributes of structure GRIDPOINT\_FIELD).
- Some attributes in arpifs/module/spectral\_columns\_mix.F90 (attributes of structure SPECTRAL\_COLS).

- Some DDH identifiers in YOMMDDH.
- Some pointers in PTRGFU and PTRXFU.
- Some NVAR... variables in YOMCOSJO.
- Some S... variables in YOMCLI.
- Some chemical components found in TM5\_CHEM\_MODULE, TM5\_KPP\_PARAMETERS.
- Miscellaneous variables (in YOMVODCST).
- Variables in YOMANEB: name is generally NANEB[root].
- Variables in YOMSRLX: name is generally TRLX[root].
- Some attributes in type ODB\_VARN0 (module varno\_module.F90).

and a sort of synthesis of names used in the above routines has been done to define and choose the “standard” naming.

Roots currently used in the above dataflows are not always compliant with the proposed standard naming.

Section 6 gives roots which are referenced in module YOM\_GRIB\_CODES (these quantities have a GRIB code).

## 2 Geometry.

### \* Horizontal geometry:

- Gaussian grid related quantities, which do not depend on apparent longitude (CSGLEG):
  - root [RW]: not rescaled Gaussian weight.
  - root [RMU]: sine of apparent latitude.
  - root [RSQM2]: cosine of apparent latitude.
  - root [RLATI]: apparent latitude.
- Gaussian grid related quantities, which depend on apparent longitude (CSGEOM):
  - root [RCOLON]: cosine of apparent longitude.
  - root [RSILON]: sine of apparent longitude.
- Geographic geometry quantities, and other geometry quantities (GSGEOM).
  - root [RCORI]: Coriolis parameter.
  - root [GEMU]: sine of geographic latitude.
  - root [GSQM2]: cosine of geographic latitude.
  - root [GELAM]: geographic longitude.
  - root [GELAT]: geographic latitude.
  - root [GECLO]: cosine of geographic longitude.
  - root [GESLO]: sine of geographic longitude.
  - root [GM]: mapping factor.
  - root [GMAPP]: (mapping factor)<sup>2</sup>.
  - root [GMAPP]: approximation of (mapping factor)<sup>2</sup>.
  - root [GNORDL]: zonal component of vector directed towards geographic North.
  - root [GNORDM]: meridian component of vector directed towards geographic North.
  - root [GAW]: rescaled Gaussian weight.

### \* Vertical geometry:

- Hybrid coordinate based on pressure:
  - root [VA]:  $A$  defining pressure.
  - root [VB]:  $B$  defining pressure.
  - root [VETA]:  $\eta$ -coordinate.

### 3 3D and 2D dynamical fields.

#### \* GMV:

- root [U]: U-horizontal wind component  $U$ .
- root [V]: V-horizontal wind component  $U$ .
- root [DIV]: divergence  $D$ .
- root [VOR]: relative vorticity  $\zeta$ .
- root [T]: temperature  $T$ .
- root [PD]: pressure departure variable (for NH only).
- root [VD]: vertical divergence variable (for NH only).
- root [NHX]: term “NHX”= $d_4 - d$  (for NH only).
- root [GMV]: global structure for GMV variables.

#### \* GMVS:

- root [SP]: surface hydrostatic pressure variable (generally logarithm of surface pressure).
- root [GMVS]: global structure for GMVS variables.

#### \* Diagnosed from GMV and GMVS:

- horizontal displacement, horizontal divergence, horizontal vorticity:
  - root [US]: surface U-horizontal wind.
  - root [VS]: surface V-horizontal wind.
  - root [KHI]: velocity potential  $\chi$ .
  - root [PSI]: stream function  $\psi$ .
  - root [ABSVOR]: absolute vorticity  $\zeta + f$ .
  - root [KENE]: kinetic energy.
  - root [WND]: wind velocity.
  - root [STD]: stretching deformation  $STD$ .
  - root [SHD]: shearing deformation  $SHD$ .
  - root [PV]: potential vorticity  $PV$ .
  - root [SDIV]: vertical integral of divergence.
  - root [KAPPA]: quantity computed from deformation, used in the SLHD diffusion.
  - root [STDDIS]: stretching/shrinking deformation  $STDDIS$ .
  - root [STDDISU] (resp. [STDDISV], [STDDISW]): stretching/shrinking deformation  $STDDISU$  (resp.  $STDDISV$ ,  $STDDISW$ ) along zonal (resp. meridional, vertical) direction.
- vertical velocity:
  - root [W]: true vertical velocity  $w$ .
  - root [GW]:  $g$  times true vertical velocity ( $gw$ ).
  - root [EVEL]:  $\dot{\eta} \frac{\partial \Pi}{\partial \eta}$ .
  - root [ETADOT]:  $\eta$ -coordinate vertical velocity  $\dot{\eta}$ .
  - root [VVEL]: pressure coordinate vertical velocity rescaled by hydrostatic pressure ( $\omega/\Pi$ ).
  - root [VVOM]: pressure coordinate vertical velocity  $\omega$ .
  - root [CTY]: global structure containing the output data of GPCTY.
- terms containing vertical divergence:
  - root [DVER]: vertical divergence.
  - root [3DIVG]: 3D divergence.
- geopotential and height:
  - root [PHI]: geopotential height  $gz$ .
  - root [Z]: altitude  $z$ .

- root [MG]: Montgomery geopotential  $\Phi_{\text{mg}}$ .
- root [OROG]: surface orography.
- root [RSA]: ratio  $r/a$  ( $r$  is the actual radius,  $a$  is the Earth mean radius).
- pressure:
  - root [PRE]: hydrostatic pressure  $\Pi$ .
  - root [PRES]: surface hydrostatic pressure  $\Pi_s$ .
  - root [LNSP]: logarithm of surface hydrostatic pressure  $\log(\Pi_s)$ .
  - root [NHPRE]: total pressure  $p$ .
  - root [NHPPRES]: surface total pressure  $p_s$ .
  - root [NHPP]: ratio  $p/\Pi$ .
  - root [QCHA]:  $\log(p/\Pi)$ .
  - root [PDEP]: NH pressure departure  $p - \Pi$ .
  - root [DELP]: hydrostatic pressure depth across layers.
  - root [LNPR]: “logarithm of hydrostatic pressure” depth across layers.
  - root [MSL]: mean sea level (hydrostatic) pressure.
  - root [MSLNH]: mean sea level total pressure (including NH effects).
  - root [XYB]: global structure containing the output data of GPXYB.
  - root [XYBDER]: global structure containing the output data of GPGRXYB.
  - root [QNH]: QNH (cf. MSL but using standard atmosphere).
- temperature:
  - root [PTH]: potential temperature  $\Theta$ .
  - root [THPW]: moist (irreversible) pseudo-adiabatic potential temperature  $\Theta'_w$ .
  - root [ETH]: equivalent potential temperature  $\Theta_e$ .
  - root [IET]: isobaric equivalent temperature  $\Theta_{\text{vm}}$ .
  - root [PTHV]: virtual potential temperature  $\Theta_v$ .
  - root [TV]: virtual temperature  $T_v$ .
  - root [RT]: air constant  $R$  times temperature.
  - root [TSTAR]: surface temperature used for extrapolations in the post-processing.
  - root [ENTR]: entropy.
- density:
  - root [RHO]: air density.
- for standard atmosphere, add generally ST at the beginning of root. Examples:
  - ST + PRE gives root [STPRE]: standard atmosphere hydrostatic pressure.
  - ST + Z gives root [STZ]: standard atmosphere altitude.
  - ST + T gives root [STT]: standard atmosphere temperature.
  - ST + RHO gives root [STRHO]: standard atmosphere air density.

**\* Prognostic GFL:**

- root [Q]: specific humidity (moisture)  $q$ .
- root [L]: liquid water content  $q_l$ .
- root [I]: ice content  $q_i$ .
- root [A]: cloud fraction  $q_a$ .
- root [RR]: rain  $q_r$ .
- root [S]: snow  $q_s$ .
- root [G]: graupels  $q_g$ .
- root [H]: hail  $q_h$ .
- root [O3]: ozone  $O_3$ .

- root [AERO]: aerosols *AERO*.
- root [TKE]: turbulent kinetic energy *TKE*.
- root [EXT]: extra-GFL fields.
- root [GFL]: global structure for GFL variables.
- root [LCONV]: convective liquid water content  $q_{\text{lconv}}$ .
- root [ICONV]: convective ice content  $q_{\text{iconv}}$ .
- root [RCONV]: convective rain content  $q_{\text{rconv}}$ .
- root [SCONV]: convective snow content  $q_{\text{sconv}}$ .
- root [EFB]: variables for EFB turbulent parameterization.
- root [LIMA]: LIMA prognostic fields ( $q_{\text{LIMA}}$ ).

\* **Diagnostic pseudo-GFL:**

- root [LRAD]: total liquid water content for radiation  $q_{\text{lrad}}$ .
- root [IRAD]: total ice content for radiation  $q_{\text{irad}}$ .
- root [CPF]: convective precipitation flux  $q_{\text{CPF}}$ .
- root [SPF]: stratiform precipitation flux  $q_{\text{SPF}}$ .
- root [SRC]: second-order flux for AROME ( $q_{\text{SRC}}$ ).
- root [FORC]: forcings (1D model) ( $q_{\text{FORC}}$ ).
- root [EZDIAG]: easy diagnostics for AROME physics ( $q_{\text{EZDIAG}}$ ).
- root [GHG]: greenhouse gases ( $q_{\text{GHG}}$ ).
- root [GRG]: reactive gases ( $q_{\text{GRG}}$ ).
- root [GRGTEND]: tendencies of reactive gases for ECMWF physics ( $q_{\text{GRGTEND}}$ ).
- root [CHEM]: chemistry ( $q_{\text{CHEM}}$ ).
- root [TRAC]: tracers for ECMWF physics ( $q_{\text{TRAC}}$ ). Removed in CY46.
- root [ERA40]: ERA40 reanalysis fields (ECMWF) ( $q_{\text{ERA40}}$ ).
- root [CVGQ]: moisture convergence ( $q_{\text{CVGQ}}$ ).
- root [QVA]: total humidity variation for HIRLAM physics ( $q_{\text{QVA}}$ ).
- root [SDSAT]: standard deviation of the saturation depression ( $q_{\text{SDSAT}}$ ).
- root [CVV]: convective vertical velocity ( $q_{\text{CVV}}$ ).
- root [DAL]: downdraught mesh fraction  $q_{\text{dal}}$ .
- root [DOM]: downdraught vertical velocity  $q_{\text{dom}}$ .
- root [UAL]: updraught mesh fraction  $q_{\text{ual}}$ .
- root [UOM]: updraught vertical velocity  $q_{\text{uom}}$ .
- root [UEN]: prognostic pseudo-historic entrainment  $q_{\text{uen}}$ .
- root [UNEBH]: pseudo-historic convective cloudiness  $q_{\text{unehb}}$ .
- root [TTE]: total turbulent energy  $q_{\text{tte}}$ .
- root [MXL]: prognostic mixing length  $q_{\text{mxl}}$ .
- root [SCC2]: square of deficit to saturation for Tompkins scheme  $q_{\text{scc2}}$ .
- root [GCCA]: skewness for Tompkins scheme  $q_{\text{gcca}}$ .
- root [RKTH]: Rasch-Kristjansson enthalpy tendency  $q_{\text{rktth}}$ .
- root [RKTQV]: Rasch-Kristjansson water vapour tendency  $q_{\text{rktqv}}$ .
- root [RKTQC]: Rasch-Kristjansson condensates tendency  $q_{\text{rktqc}}$ .
- root [LRCH4]: methane loss rate ( $q_{\text{LRCH4}}$ ).
- root [CH4S]: methane atmospheric sink ( $q_{\text{CH4S}}$ ).
- root [AEROUT]: output aerosols ( $q_{\text{AEROUT}}$ ).
- root [AERAOT]: aerosol layer optical thicknesses ( $q_{\text{AERAOT}}$ ).
- root [AERLISI]: aerosol lidar simulator ( $q_{\text{AERLISI}}$ ).
- root [UVP]: output fields from UV processor ( $q_{\text{UVP}}$ ).
- root [PHYS]: output fields from physics ( $q_{\text{PHYS}}$ ).
- root [NOGW]: diagnostic fields for NORO GWD scheme ( $q_{\text{NOGW}}$ ).
- root [SLDIA]: semi-Lagrangian dynamics diagnostic fields ( $q_{\text{SLDIA}}$ ).
- root [SHTUR]: shear source term for turbulence ( $q_{\text{SHTUR}}$ ).
- root [FQTUR]: flux form source term for turbulence: moisture ( $q_{\text{FQTUR}}$ ).
- root [FSTUR]: flux form source term for turbulence: enthalpy ( $q_{\text{FSTUR}}$ ).
- root [CRM]: extra fields for “CRM” model ( $q_{\text{CRM}}$ ).

\* **Other hydrometeores:**

- root [SLW]: supercooled liquid water content.

\* **Diagnosed from GFL:**

- root [HU]: relative humidity  $HU$ .
- root [R] or [RMOIST]: moist air constant  $R$ .
- root [CP]: moist  $c_p$ .
- root [KAP]: ratio  $R/c_p$ .
- root [RCP]: global structure containing  $R$ ,  $c_p$  and  $R/c_p$ .
- root [MOCO]: moisture convergence.
- root [SMOCO]: surface moisture convergence.

\* **Chemistry: individual chemicals.**

Root name must be as close as possible to chemical formula. Only a subset of them is currently referenced.

- root [CH4]: methane.
- root [CO2]: carbone dioxyd.
- root [NO2]: natrium dioxyd.
- root [O3]: ozone (already referenced in prognostic GFL).
- root [SO2]: sulphur dioxyd.

\* **Other diagnosed quantities:**

- root [SRE]: simulated reflectivity.
- root [SREX]: maximum simulated reflectivity.
- root [SGRTL]: zonal content of pressure gradient term.
- root [SGRTM]: meridian content of pressure gradient term.
- root [ATND]: global structure containing adiabatic Lagrangian tendencies.
- root [AT]: atmospheric tide.
- root [BTMP]: brightness temperature (in Kelvins).
- root [CLBT]: cloudy brightness temperature (in Kelvins).
- root [CSBT]: clear-sky brightness temperature (in Kelvins).
- root [UCTP]: unbalanced temperature.
- root [UCLN]: unbalanced logarithm of surface hydrostatic pressure.
- root [UCDV]: unbalanced divergence.

## 4 Other diagnosed quantities.

\* **Quantities vertically integrated in one column:**

- root [TCQ]: total water vapour content in a vertical column.
- root [TCL]: total liquid water content in a vertical column.
- root [TCI]: total ice content in a vertical column.
- root [TCRR]: total rain water content in a vertical column.
- root [TCS]: total snow water content in a vertical column.
- root [TCLCONV]: total convective liquid water content in a vertical column.
- root [TCICONV]: total convective ice content in a vertical column.
- root [TCRCONV]: total convective rain water content in a vertical column.
- root [TCSCONV]: total convective snow water content in a vertical column.
- root [TCG]: total graupel content in a vertical column.
- root [TCH]: total hail content in a vertical column.
- root [TCO3]: total ozone content in a vertical column.



- root [TCGHG]: total greenhouse gases content in a vertical column.
- root [TCTRAC]: total tracers content in a vertical column.
- root [TCGRG]: total reactive gases content in a vertical column.
- root [TCW]: total water content in a vertical column.
- root [TCPW]: total precipitable water content in a vertical column.
- root [TCSLW]: total supercooled liquid water content in a vertical column.
- root [VIMD]: vertically integrated mass divergence.
- root [VIWVE]: vertically integrated eastward water vapour flux.
- root [VIWVN]: vertically integrated northward water vapour flux.

\* **Stratospheric and mesospheric quantities:**

- root [UGST]: U-wind gusts out of the model.
- root [VGST]: V-wind gusts out of the model.
- root [FGST]: gusts out of the model.
- root [UJET]: U-wind jet.
- root [VJET]: V-wind jet.

\* **PBL quantities:**

- at 2 meters:
  - root [2U]: U-wind.
  - root [2V]: V-wind.
  - root [2NU]: neutral U-wind.
  - root [2NV]: neutral V-wind.
  - root [2FG]: gust.
  - root [2FG3]: maximum gust during the last 3 hours.
  - root [2FG6]: maximum gust during the last 6 hours.
  - root [I2FG]: instantaneous wind gust.
  - root [2FGCV]: convective gust.
  - root [M2U]: mean U-wind.
  - root [M2V]: mean V-wind.
  - root [2WND]: wind velocity.
  - root [2T]: temperature.
  - root [N2T]: minimum temperature.
  - root [X2T]: maximum temperature.
  - root [N2T3]: minimum temperature during the last 3 hours.
  - root [X2T3]: maximum temperature during the last 3 hours.
  - root [N2T6]: minimum temperature during the last 6 hours.
  - root [X2T6]: maximum temperature during the last 6 hours.
  - root [2Q]: specific humidity.
  - root [2HU]: relative humidity.
  - root [N2HU]: minimum relative humidity.
  - root [X2HU]: maximum relative humidity.
  - root [2DW]: dew point temperature.
- at 10 meters:
  - root [10U]: U-wind.
  - root [10V]: V-wind.
  - root [10NU]: neutral U-wind.
  - root [10NV]: neutral V-wind.

- root [10FG]: gust.
  - root [10FG3]: maximum gust during the last 3 hours.
  - root [10FG6]: maximum gust during the last 6 hours.
  - root [I10FG]: instantaneous wind gust.
  - root [10FGCV]: convective gust.
  - root [M10U]: mean U-wind.
  - root [M10V]: mean V-wind.
  - root [10WND]: wind velocity.
  - root [10T]: temperature.
  - root [N10T]: minimum temperature.
  - root [X10T]: maximum temperature.
  - root [N10T3]: minimum temperature during the last 3 hours.
  - root [X10T3]: maximum temperature during the last 3 hours.
  - root [N10T6]: minimum temperature during the last 6 hours.
  - root [X10T6]: maximum temperature during the last 6 hours.
  - root [10Q]: specific humidity.
  - root [10HU]: relative humidity.
  - root [N10HU]: minimum relative humidity.
  - root [X10HU]: maximum relative humidity.
  - root [10DW]: dew point temperature.
- at 100 meters:
    - root [100U]: U-wind.
    - root [100V]: V-wind.
    - root [100WND]: wind velocity.
- roughness length:
    - root [Z0]: surface roughness length.
    - root [GZ0]:  $g$  times surface roughness length.
    - root [LNZ0]: logarithm of surface roughness length.
    - root [Z0BS]: surface roughness length for bare surface.
    - root [GZ0BS]:  $g$  times surface roughness length for bare surface.
    - root [Z0H]: surface roughness length for heat.
    - root [LNZ0H]: logarithm of surface roughness length for heat.
    - root [GZ0H]:  $g$  times surface roughness length for heat.
    - root [Z0V]: surface roughness length for vegetation.
    - root [GZ0V]:  $g$  times surface roughness length for vegetation.
- other quantities:
    - root [NHUCLS]: minimum relative humidity in the PBL.
    - root [XHUCLS]: maximum relative humidity in the PBL.
    - root [BLH]: boundary layer depth (PBL height).

## \* Surface quantities:

- albedo:
  - root [ALB]: surface albedo.
  - root [ALS]: surface albedo for bare soil.
  - root [ALSN]: surface snow albedo.
  - root [ALNS]: surface albedo for non snowed areas.
  - root [ALV]: surface albedo for soil with vegetation.
  - root [ALUVP]: MODIS albedo UVis parallel radiation.
  - root [ALUVD]: MODIS albedo UVis diffuse radiation.
  - root [ALNIP]: MODIS albedo N-IR parallel radiation.
  - root [ALNID]: MODIS albedo N-IR diffuse radiation.
- orography:
  - root [ACOR] (or [ISOR]): anisotropy coefficient of orography.
  - root [SLOR]: slope of surface orography.
  - root [MAOR]: direction (angle) of main axis of orography.
  - root [SDOR]: standard deviation of orography.
  - root [SDFOR]: standard deviation of a filtered orography.
  - root [GSDOR]:  $g$  times standard deviation of orography.
  - root [VSOR]: variance of sub-grid scale orography.
  - root [EWOV]: east-west (zonal) component of sub-grid scale orographic variance.
  - root [NSOV]: north-south (meridian) component of sub-grid scale orographic variance.
  - root [NWOV]: NW-SE component of sub-grid scale orographic variance.
  - root [NEOV]: NE-SW component of sub-grid scale orographic variance.
  - root [VOLCALTI]: altitude of volcanoes.
- ocean, land:
  - root [CHAR]: Charnock parameter.
  - root [SIC]: sea ice cover.
  - root [SICTH] (rather than [ICTH]): sea ice cover thickness.
  - root [LAN]: percentage of land.
  - root [LSM]: land-sea mask.
  - root [UCUR]: ocean U-current.
  - root [VCUR]: ocean V-current.
  - root [SSS]: sea surface salinity.
  - root [SSH]: sea surface level.
  - root [DMSO]: oceanic DMS.
  - root [SMLD] (rather than [MLD]): sea mixed layer depth.
- vegetation:
  - root [CVH]: high vegetation cover.
  - root [CVL]: low vegetation cover.
  - root [TVH]: high vegetation type.
  - root [TVL]: low vegetation type.
  - root [LAI]: leaf area index.
  - root [LAIH]: leaf area index for high vegetation cover.
  - root [LAIL]: leaf area index for low vegetation cover.
  - root [IVEG]: index of vegetation.
  - root [VEG]: percentage of vegetation.
  - root [PVGMX]: maximum proportion of vegetation.

- root [RSMIN]: minimum stomatal resistance.
- urban areas:
  - root [PURB]: proportion of urbanisation.
- lakes:
  - root [CLK]: lake cover.
  - root [DL]: lake depth.
  - root [LMLT]: lake mixed layer temperature.
  - root [LMLD]: lake mixed layer depth.
  - root [LBLT]: lake bottom layer temperature.
  - root [LTLT]: lake total layer temperature.
  - root [LSHF]: lake shape factor.
  - root [LICT]: lake ice temperature.
  - root [LICD]: lake ice thickness.
- soil composition:
  - root [CLAY] (rather than [ARG]): percentage of clay within soil.
  - root [SAND] (rather than [SAB]): percentage of sand within soil.
  - root [SOTY]: soil type.
- snow:
  - root [SNDE]: snow density.
  - root [SNS]: snow mass.
  - root [SD]: snow depth.
- temperature:
  - root [SST]: sea surface temperature.
  - root [ST]: surface (skin) temperature.
  - root [TSN]: temperature of snow layer.
  - root [INTST]: interpolated surface temperature.
- wetness:
  - root [QSH]: surface moisture historic variable (used for example by TOUCANS).
  - root [SSW]: surface soil (skin) wetness.
  - root [SSHU]: surface soil relative moisture.
- miscellaneous:
  - root [MSK]: mask extra domain.

**\* Inner soil quantities:**

- temperature:
  - root [DST]: deep reservoir soil temperature.
  - root [STL(n)]: soil temperature for reservoir number (n).
  - root [ISTL(n)]: ice surface temperature for reservoir number (n).
- wetness:
  - root [DSW]: deep reservoir soil wetness.
  - root [SWL(n)]: soil wetness for reservoir number (n).
  - root [CDSW]: climatological relative deep soil wetness.
  - root [CSSW]: climatological relative surface soil wetness.
- frozen wetness (ice):
  - root [SSI]: surface reservoir soil frozen wetness.
  - root [DSI]: deep reservoir soil frozen wetness.
  - root [SIL(n)]: soil frozen wetness for reservoir number (n).
- soil depth:
  - root [D2]: soil depth.
  - root [D2MX]: maximum soil depth.

\* **Ocean mixed layer quantities:**

- root [OCT]: ocean temperature.
- root [OCS]: ocean salinity.
- root [OCU]: ocean U-wind velocity.
- root [OCV]: ocean V-wind velocity.
- root [OCVVS]: ocean viscosity.
- root [OCVDF]: ocean diffusibility (or diffusivity?) coefficient.
- root [OCDEP]: ocean bathymetry (bottom layer depth).
- root [OCLDP]: ocean layer thickness.
- root [OCLZ]: ocean layer depth.
- root [ADVT]: correction term for ocean temperature.
- root [ADVS]: correction term for ocean salinity.
- root [OCUC]: ocean U-wind velocity climatology.
- root [OCVC]: ocean V-wind velocity climatology.
- root [USTRC]: ocean “tau-x” climatology.
- root [VSTRC]: ocean “tau-y” climatology.

\* **Levels:**

- root [0DEGL]:  $T=0$  degree Celsius level (altitude of iso-0).
- root [HTPW0]:  $\Theta'_w=0$  degree Celsius level (from bottom).
- root [HTPW1]:  $\Theta'_w=1$  degree Celsius level (from bottom).
- root [HTPW2]:  $\Theta'_w=1.5$  degree Celsius level (from bottom).

## 5 Diabatic processes.

\* **Aerosols profiles:**

- root [AEROSEA]: marine aerosols.
- root [AEROLAN]: continental aerosols.
- root [AEROSOO]: carbone (soot) aerosols.
- root [AERODES]: desert aerosols.
- root [AEROSUL]: sulfate aerosols.
- root [AEROVOL]: volcano aerosols.
- root [O3A], root [O3B], root [O3C]: ozone profiles.

\* **Clouds:**

- root [CCC]: convective cloud cover.
- root [SCC]: stratiform cloud cover.
- root [TOCC]: total cloud cover.
- root [HCC]: high cloud cover.
- root [MCC]: medium cloud cover.
- root [LCC]: low cloud cover.
- root [CBASE]: cloud base level.
- root [CTOP]: cloud summit level.
- root [CCBASE]: convective cloud base level.
- root [CCTOP]: convective cloud summit level.
- root [SCBASE]: stratiform cloud base level.
- root [SCTOP]: stratiform cloud summit level.
- root [CBASEA]: ceiling = cloud base level (for aviation).

## \* Precipitations:

- large scale precipitations:
  - root [LSRR]: large scale liquid precipitation (rain fall).
  - root [LSS] (or [LSSFR]?): large scale snow fall.
  - root [LSG]: large scale graupel fall.
  - root [LSH]: large scale hail fall.
  - root [LSPR]: large scale precipitations.
  - root [LSPFR]: large scale precipitations fraction.
  - root [ILSPF]: instantaneous large scale precipitations fraction.
  - root [MNLPR]: minimum large scale precipitation since last post-processing.
  - root [MNLPR3]: minimum large scale precipitation since last 3 hours.
  - root [MNLPR6]: minimum large scale precipitation since last 6 hours.
  - root [MXLPR]: maximum large scale precipitation since last post-processing.
  - root [MXLPR3]: maximum large scale precipitation since last 3 hours.
  - root [MXLPR6]: maximum large scale precipitation since last 6 hours.
- convective precipitations:
  - root [CRR]: convective liquid precipitation (rain fall).
  - root [CS] (or [CSFR]?): convective snow fall.
  - root [CG]: convective graupel fall.
  - root [CH]: convective hail fall.
  - root [CPR]: convective precipitations.
  - root [CPFR]: convective precipitations fraction.
  - root [ICSPF]: instantaneous convective precipitations fraction.
  - root [MNCPR]: minimum convective precipitation since last post-processing.
  - root [MNCPR3]: minimum convective precipitation since last 3 hours.
  - root [MNCPR6]: minimum convective precipitation since last 6 hours.
  - root [MXCPR]: maximum convective precipitation since last post-processing.
  - root [MXCPR3]: maximum convective precipitation since last 3 hours.
  - root [MXCPR6]: maximum convective precipitation since last 6 hours.
- total precipitations:
  - root [TRR]: total liquid precipitation (rain fall).
  - root [TS]: total snow fall.
  - root [TG]: total graupel fall.
  - root [TH]: total hail fall.
  - root [TP]: total precipitations.
  - root [TPR]: total precipitations rate.
  - root [CDUTP]: duration of total precipitations.
  - root [MNTPR]: minimum total precipitation since last post-processing.
  - root [MNTPR3]: minimum total precipitation since last 3 hours.
  - root [MNTPR6]: minimum total precipitation since last 6 hours.
  - root [MXTPR]: maximum total precipitation since last post-processing.
  - root [MXTPR3]: maximum total precipitation since last 3 hours.
  - root [MXTPR6]: maximum total precipitation since last 6 hours.
- miscellaneous:
  - root [PAW]: precipitation analysis weights.
  - root [FZRA]: freezing rain.
  - root [PTYPE]: precipitation type.

\* **Lightnings:**

- root [LITOTI]: instantaneous total lightning flash density.
- root [LITOTA]: averaged total lightning flash density.
- root [LICGI]: instantaneous cloud-to-ground lightning flash density.
- root [LICGA]: averaged cloud-to-ground lightning flash density.

\* **Diabatic fluxes and tendencies:**

- thermodynamics, change of water phases:
  - root [WEVP]: water evaporation.
  - root [PEV]: potential water evaporation.
  - root [SEVP]: snow evaporation (sublimation).
  - root [CT]: water and snow sublimation.
  - root [SMLT]: snow melt.
  - root [LHE]: latent heat.
  - root [LHS]: latent heat sublimation.
  - root [CLHT]: total latent heat.
  - root [TME]: top mesospheric enthalpy.
  - root [DHLC]: diabatic heating by large-scale condensation.
- radiation:
  - radiances:
    - \* root [MSAT(m)C(n)]: radiances from MSAT(m) MVIRI channel number (n).
    - \* root [MTSAT(m)C(n)]: radiances from MTSAT(m) IMAGER channel number (n).
    - \* root [GOES(m)C(n)]: radiances from GOES(m) IMAGER channel number (n).
    - \* root [EMIS]: surface longwave emissivity.
  - surface:
    - \* root [SSR]: surface solar radiation.
    - \* root [SSRC]: surface solar radiation clear sky.
    - \* root [STR]: surface thermal radiation.
    - \* root [STRC]: surface thermal radiation clear sky.
    - \* root [SPAR]: surface photo active radiation.
    - \* root [SUVB]: surface UV-B radiation.
    - \* root [SPARC]: surface clear sky parallel radiation.
    - \* root [SFDIR]: surface total sky direct shortwave radiation.
    - \* root [SCDIR]: surface clear sky direct shortwave radiation.
    - \* root [SOC]: surface clear sky shortwave radiative flux.
    - \* root [THC]: surface clear sky longwave radiative flux.
    - \* root [SOP]: surface parallel solar flux.
    - \* root [SOD]: surface downward solar flux.
    - \* root [THD]: surface downward thermic flux.
    - \* root [SMR]: surface downward moon radiation.
    - \* root [SSRD]: surface downward solar radiation.
    - \* root [SSRDC]: surface clear sky downward solar radiation.
    - \* root [STRD]: surface downward thermic radiation.
    - \* root [STRDC]: surface clear sky downward thermic radiation.
    - \* root [SNR]: surface net radiation.
    - \* root [CDNI]: surface direct normal irradiance.
  - top:
    - \* root [TSR]: top solar radiation.
    - \* root [TSRC]: top solar radiation clear sky.
    - \* root [TTR]: top thermal radiation.
    - \* root [TTRC]: top thermal radiation clear sky.
    - \* root [TOP]: top parallel solar flux.

- \* root [TSOC]: top clear sky shortwave radiative flux.
- \* root [TTHC]: top clear sky longwave radiative flux.
- \* root [TNR]: top net radiation.
- optical depth:
  - \* root [ODTO]: aerosol total optical depth.
  - \* root [ODTO469]: aerosol total optical depth 469 nm.
  - \* root [ODTO670]: aerosol total optical depth 670 nm.
  - \* root [ODTO865]: aerosol total optical depth 865 nm.
  - \* root [ODTO1240]: aerosol total optical depth 1240 nm.
  - \* root [ODSS]: optical depth for sea salt aerosols.
  - \* root [ODDU]: optical depth for dust aerosols.
  - \* root [ODOM]: optical depth for organic matter aerosols.
  - \* root [ODBC]: optical depth for black C aerosols.
  - \* root [ODSU]: optical depth for sulphate aerosols.
  - \* root [ODVFA]: optical depth for volcanic flying ash aerosols.
  - \* root [ODVSU]: optical depth for volcanic sulfate aerosols.
  - \* root [ODNI]: optical depth for nitrate.
  - \* root [ODAM]: optical depth for ammonium.
- other:
  - \* root [STINC]: TOA incident solar radiation.
  - \* root [DSRP]: direct solar radiation (incident on a plane perpendicular to the sun direction).
  - \* root [DNDZN]: min. refractivity gradient in trapping layer.
  - \* root [DNDZA]: mean refractivity gradient in trapping layer.
  - \* root [VISIH]: horizontal visibility.
  - \* root [SUND]: sunshine duration.
  - \* root [DHR]: diabatic heating by radiation.
  - \* root [UVBED]: UV biologically effective dose.
  - \* root [UVBEDCS]: UV biologically effective dose by clear sky.
- convection, precipitations, microphysics:
  - root [LCL]: lifting condensation level.
  - root [FCL]: free convection level.
  - root [EL]: equilibrium level.
  - root [CAPE]: convective available potential energy (CAPE).
  - root [CAPES]: CAPE shear.
  - root [MXCAP6]: maximum CAPE since last 6 hours.
  - root [MXCAPS6]: maximum CAPE shear since last 6 hours.
  - root [CIEN]: convective inhibition energy.
  - root [CCVU]: contribution of convection to  $U$ .
  - root [CCVV]: contribution of convection to  $V$ .
  - root [CCVQ]: contribution of convection to  $q$ .
  - root [CCVS]: contribution of convection to  $c_p T$ .
  - root [DHCC]: diabatic heating by cumulus convection.
- turbulence, boundary layer:
  - root [BLD]: boundary layer dissipation.
  - root [ZUST]: friction velocity.
  - root [TVU]: contribution of turbulence to  $U$ .
  - root [TVV]: contribution of turbulence to  $V$ .
  - root [TVQ]: contribution of turbulence to  $q$ .
  - root [TVS]: contribution of turbulence to  $c_p T$ .
  - root [DHVD]: diabatic heating by vertical diffusion.
  - root [CGPP]: GPP flux adjustment coefficients.



- root [CREC]: REC flux adjustment coefficients.
- gravity wave drag:
  - root [USS]: U-wind stress.
  - root [VSS]: V-wind stress.
  - root [UGWS]: U-wind gravity-wave stress.
  - root [VGWS]: V-wind gravity-wave stress.
  - root [CUTO]: U-wind total stress.
  - root [CVTO]: V-wind total stress.
  - root [GWDU]: contribution of gravity wave drag to  $U$ .
  - root [GWDV]: contribution of gravity wave drag to  $V$ .
  - root [GWDI]: gravity wave dissipation.
  - root [PADOU]: anisotropy vector  $U$ -momentum.
  - root [PADOV]: anisotropy vector  $V$ -momentum.
- surfaces and soil processes:
  - surface fluxes and stresses:
    - \* root [SGRGF]: reactives gases surface flux.
    - \* root [STRACF]: tracers surface flux.
    - \* root [SSHF]: sensible heat surface flux.
    - \* root [SLHF]: latent heat surface flux.
    - \* root [SWF]: moisture surface flux.
    - \* root [SHF]: heat surface flux.
    - \* root [STHWF]:  $\Theta'_w$  surface flux.
    - \* root [SUSS]: surface U-wind stress.
    - \* root [SVSS]: surface V-wind stress.
    - \* root [ETPF]: evapotranspiration flux.
    - \* root [TPF]: transpiration flux.
  - soil fluxes and runoff:
    - \* root [RO]: (interception) soil runoff.
    - \* root [SRO]: surface soil runoff.
    - \* root [SSRO]: sub-surface soil runoff.
    - \* root [DRO]: deep soil runoff (= SSRO?).
    - \* root [SOWF]: moisture flux in soil.
    - \* root [SOHF]: heat flux in soil.
  - other:
    - \* root [HV]: resistance to evapotranspiration.
    - \* root [IC]: interception content.
    - \* root [INCHUN]: increment to mini relative moisture.
    - \* root [INCHUX]: increment to maxi relative moisture.
    - \* root [INCTN]: increment to mini temperature.
    - \* root [INCTX]: increment to maxi temperature.
    - \* root [ASCAT\_SM\_CDF\_A]:  $A$  parameter for ASCAT soil moisture transformation.
    - \* root [ASCAT\_SM\_CDF\_B]:  $B$  parameter for ASCAT soil moisture transformation.
- chemistry, aerosols:
  - root [CO2NBF]: CO2 biospheric flux.
  - root [CO2OF]: CO2 oceanic flux.
  - root [CO2APF]: CO2 anthropic emission.
  - root [CO2FIRE]: CO2 biomass burning flux.
  - root [CO2NEE]: net ecosystem exchange for CO2.
  - root [CO2GPP]: gross primary production for CO2.
  - root [CO2REC]: ecosystem respiration for CO2.

- root [CO2INEE]: instantaneous net ecosystem exchange for CO2.
  - root [CO2IGPP]: instantaneous gross primary production for CO2.
  - root [CO2IREC]: instantaneous ecosystem respiration for CO2.
  - root [CH4AG]: CH4 (methane) surface flux.
  - root [CH4F]: CH4 (methane) fire emission.
  - root [SF6APF]: SF6 anthropic emission.
  - root [FCA1]: fraction of calcite over dust 1st bin.
  - root [FCA2]: fraction of calcite over dust 2nd bin.
  - root [AERDEP]: dust emission potential.
  - root [AERLTS]: lifting threshold speed.
  - root [BCBF]: black carbon biogenic flux.
  - root [BCFF]: black carbon fossil fuel flux.
  - root [BCGF]: black carbon GFED flux.
  - root [OMBF]: organic matter biogenic flux.
  - root [OMFF]: organic matter fossil fuel flux.
  - root [OMGF]: organic matter GFED flux.
  - root [SO2L]: sulphate (SO2) low-level emission flux.
  - root [SO2H]: sulphate (SO2) high-level emission flux.
  - root [SOGF]: sulphate (SO2) GFED flux.
  - root [VOLC]: volcanic continuous emission SO2.
  - root [VOLE]: volcanic explosive emission SO2.
  - root [SO2DDV]: sulphate (SO2) dry deposition velocity.
  - root [SOA]: secondary organic matter.
  - root [SOAF]: secondary organic matter emission flux.
  - root [AEPM1]: particulate matter le 1 um.
  - root [AEPM25]: particulate matter le 2.5 um.
  - root [AEPM10]: particulate matter le 10 um.
  - root [INJF]: biomass burning injection height.
- miscellaneous:
    - root [DCTB]: duct base height.
    - root [TPLB]: trapping layer base height.
    - root [TPLT]: trapping layer top height.
    - root [BV]: budget values.
    - root [TSP]: tendency of surface pressure.
    - root [VEIN]: ventilation index.

## 6 GRIB codes and roots.

GRIB codes and the corresponding roots are given:

### \* 001 to 255:

- 001: root [PSI] (NGRBSTRF)
- 002: root [KHI] (NGRBVP)
- 003: root [PTH] (NGRBPT)
- 004: not used currently
- 005: not used currently
- 006: not used currently
- 007: not used currently
- 008: root [SRO] (NGRBSRO)
- 009: root [SSRO] (NGRBSSRO)
- 010: not used currently
- 011: not used currently
- 012: not used currently
- 013: not used currently
- 014: not used currently
- 015: root [ALUVP] (NGRBALUVP)
- 016: root [ALUVD] (NGRBALUVD)
- 017: root [ALNIP] (NGRBALNIP)
- 018: root [ALNID] (NGRBALNID)
- 019: not used currently
- 020: root [SPARC] (NGRBPARCS)
- 021: root [UCTP] (NGRBUCTP)
- 022: root [UCLN] (NGRBUCLN)
- 023: root [UCDV] (NGRBUCDV)
- 024: not used currently
- 025: not used currently
- 026: root [CLK] (NGRBCL)
- 027: root [CVL] (NGRBCVL)
- 028: root [CVH] (NGRBCVH)
- 029: root [TVL] (NGRBTVL)
- 030: root [TVH] (NGRBTVH)
- 031: root [SIC] (NGRBCI)
- 032: root [ALSN] (NGRBASN)
- 033: root [SNDE] (NGRBRSN)
- 034: root [SST] (NGRBSSTK)
- 035: root [ISTL1] (NGRBISTL1)
- 036: root [ISTL2] (NGRBISTL2)
- 037: root [ISTL3] (NGRBISTL3)
- 038: root [ISTL4] (NGRBISTL4)
- 039: root [SWL1] (NGRBSWVL1)
- 040: root [SWL2] (NGRBSWVL2)
- 041: root [SWL3] (NGRBSWVL3)
- 042: root [SWL4] (NGRBSWVL4)
- 043: root [SOTY] (NGRBSLT)
- 044: root [SEVP] (NGRBES)
- 045: root [SMLT] (NGRBSMLT)
- 046: not used currently
- 047: root [DSRP] (NGRBDSRP)
- 048: not used currently

- 049: root [10FG] (NGRB10FG)
- 050: root [LSPFR] (NGRBLSPF)
- 051: not used currently
- 052: not used currently
- 053: root [MG] (NGRBMONT)
- 054: root [PRE] (NGRBPRES)
- 055: not used currently
- 056: not used currently
- 057: root [SUVB] (NGRBUVB)
- 058: root [SPAR] (NGRBPAP)
- 059: root [CAPE] (NGRBCAPE)
- 060: root [PV] (NGRBPV)
- 061: not used currently
- 062: not used currently
- 063: not used currently
- 064: not used currently
- 065: not used currently
- 066: root [LAIL] (NGRBLAIL)
- 067: root [LAIH] (NGRBLAIH)
- 068: not used currently
- 069: not used currently
- 070: not used currently
- 071: not used currently
- 072: not used currently
- 073: not used currently
- 074: root [SDFOR] (NGRBSDFOR)
- 075: root [R] (NGRBCRWC)
- 076: root [S] (NGRBCSWC)
- 077: root [ETADOT] (NGRBETADOT)
- 078: root [TCL] (NGRBTCLW)
- 079: root [TCI] (NGRBTCIW)
- 080: root [PD] (NGRBSPD)
- 081: root [VD] (NGRBSVD)
- 082 to 117: reserved for extra fields (NGRB082 to NGRB117)
- 098: root [OCT] (NGRBOCT), and also (NGRB098)
- 100: root [OCS] (NGRBOCS), and also (NGRB100)
- 101: root [OCU] (NGRBOCU), and also (NGRB101)
- 102: root [OCV] (NGRBOCV), and also (NGRB102)
- 105: root [OCVVS] (NGRBOCVVS), and also (NGRB105)
- 106: root [OCVDF] (NGRBOCVDF), and also (NGRB106)
- 107: root [OCDEP] (NGRBOCDEP), and also (NGRB107)
- 108: root [OCLDP] (NGRBOCLDP), and also (NGRB108)
- 109: root [OCLZ] (NGRBOCLZ), and also (NGRB109)
- 110: root [ADVT] (NGRBADVT), and also (NGRB110)
- 111: root [ADVS] (NGRBADVS), and also (NGRB111)
- 112: root [OCUC] (NGRBOCUC), and also (NGRB112)
- 113: root [OCVC] (NGRBOCVC), and also (NGRB113)
- 114: root [USTRC] (NGRBUSTRC), and also (NGRB114)
- 115: root [VSTRC] (NGRBVSTRC), and also (NGRB115)
- 118: not used currently
- 119: not used currently
- 120: not used currently

- 121: root [X2T6] (NGRBMX2T6)
- 122: root [N2T6] (NGRBMN2T6)
- 123: root [10FG6] (NGRB10FG6)
- 124: root [EMIS] (NGRBEMIS)
- 125: not used currently
- 126: not used currently
- 127: root [AT] (NGRBAT)
- 128: root [BV] (NGRBBV)
- 129: root [PHI] (NGRBZ)
- 130: root [T] (NGRBT)
- 131: root [U] (NGRBU)
- 132: root [V] (NGRBV)
- 133: root [Q] (NGRBQ)
- 134: root [PRES] (NGRBSP)
- 135: root [W] (NGRBW)
- 136: root [TCW] (NGRBTCW)
- 137: root [TCQ] (NGRBTCWV)
- 138: root [VOR] (NGRBVO)
- 139: root [STL1] (NGRBSTL1)
- 140: not used currently
- 141: root [SD] (NGRBSD)
- 142: root [LSPR] (NGRBLSP)
- 143: root [CPR] (NGRBCP)
- 144: root [TS] (NGRBSF)
- 145: root [BLD] (NGRBBLD)
- 146: root [SSHF] (NGRBSSHF)
- 147: root [SLHF] (NGRBSLHF)
- 148: root [CHAR] (NGRBCHNK)
- 149: root [SNR] (NGRBSNR)
- 150: root [TNR] (NGRBTNR)
- 151: root [MSL] (NGRBMSL)
- 152: root [LNSP] (NGRBLNSP)
- 153: not used currently
- 154: not used currently
- 155: root [DIV] (NGRBD)
- 156: root [PHI] (NGRBGH)
- 157: root [HU] (NGRBR)
- 158: root [TSP] (NGRBTSP)
- 159: root [BLH] (NGRBBLH)
- 160: root [SDOR] (NGRBSDOR)
- 161: root [ACOR] (NGRBISOR)
- 162: root [MAOR] (NGRBANOR)
- 163: root [SLOR] (NGRBSLOR)
- 164: root [TOCC] (NGRBTCC)
- 165: root [10U] (NGRB10U)
- 166: root [10V] (NGRB10V)
- 167: root [2T] (NGRB2T)
- 168: root [2DW] (NGRB2D)
- 169: root [SSRD] (NGRBSSRD)
- 170: root [STL2] (NGRBSTL2)
- 171: not used currently

- 172: root [LSM] (NGRBLSM)
- 173: root [Z0] (NGRBZR)
- 174: root [ALB] (NGRBAL)
- 175: root [STRD] (NGRBSTRD)
- 176: root [SSR] (NGRBSSR)
- 177: root [STR] (NGRBSTR)
- 178: root [TSR] (NGRBTSR)
- 179: root [TTR] (NGRBTTTR)
- 180: root [USS] (NGRBEWSS)
- 181: root [VSS] (NGRBNSSS)
- 182: root [WEVP] (NGRBE)
- 183: root [STL3] (NGRBSTL3)
- 184: not used currently
- 185: root [CCC] (NGRBCCC)
- 186: root [LCC] (NGRBLCC)
- 187: root [MCC] (NGRBMCC)
- 188: root [HCC] (NGRBHCC)
- 189: root [SUND] (NGRBSUND)
- 190: root [EWOV] (NGRBEWOV)
- 191: root [NSOV] (NGRBNSOV)
- 192: root [NWOV] (NGRBNWOV)
- 193: root [NEOV] (NGRBNEOV)
- 194: root [BTMP] (NGRBBTMP)
- 195: root [UGWS] (NGRBLGWS)
- 196: root [VGWS] (NGRBMGWS)
- 197: root [GWDI] (NGRBGWD)
- 198: root [SSW] (NGRBSRC)
- 199: root [VEG] (NGRBVEG)
- 200: root [VSOR] (NGRBVSO)
- 201: root [X2T] (NGRBMX2T)
- 202: root [N2T] (NGRBMN2T)
- 203: root [O3] (NGRBO3)
- 204: root [PAW] (NGRBPBW)
- 205: root [RO] (NGRBRO)
- 206: root [TCO3] (NGRBTCO3)
- 207: root [10WND] (NGRB10SI)
- 208: root [TSRC] (NGRBTSRC)
- 209: root [TTRC] (NGRBTTRC)
- 210: root [SSRC] (NGRBSSRC)
- 211: root [STRC] (NGRBSTRC)
- 212: root [STINC] (NGRBTISR)
- 213: root [VIMD] (NGRBVIMD)
- 214: root [DHR] (NGRBDHR)
- 215: root [DHVD] (NGRBDHVD)
- 216: root [DHCC] (NGRBDHCC)
- 217: root [DHLC] (NGRBDHLC)
- 218: root [INTST] (NGRBVDZW)
- 219: root [DST] (NGRBVDMW)
- 220: not used currently
- 221: not used currently
- 222: not used currently

- 223: not used currently
- 224: not used currently (NGRBVDH)
- 225: not used currently (NGRBHTCC)
- 226: not used currently (NGRBHTLC)
- 227: not used currently (NGRBCRNH)
- 228: root [TP] (NGRBTP)
- 229: root [SUSS] (NGRBIIEWS)
- 230: root [SVSS] (NGRBINSS)
- 231: root [SHF] (NGRBISHF)
- 232: root [SWF] (NGRBIE)
- 233: not used currently
- 234: root [LNZ0] (NGRBLSRH)
- 235: root [ST] (NGRBSKT)
- 236: root [STL4] (NGRBSTL4)
- 237: not used currently
- 238: root [TSN] (NGRBTSN)
- 239: root [CS] (NGRBCSF)
- 240: root [LSS] (NGRBLSF)
- 241: not used currently
- 242: not used currently
- 243: root [ALB] (NGRBFAL)
- 244: root [Z0] (NGRBFSR)
- 245: root [LNZ0H] (NGRBFLSR)
- 246: root [L] (NGRBCLWC)
- 247: root [I] (NGRBCIWC)
- 248: root [A] (NGRBCC)
- 249: not used currently
- 250: not used currently
- 251: not used currently
- 252: not used currently
- 253: not used currently
- 254: not used currently
- 255: not used currently

\* **Table 3:**

- 3020: root [VISIH] (NGRBVISIH)
- 3088: root [SSS] (NGRBSSSO)
- 3092: root [???] (NGRBICETK) (is it what is denoted [ICTH] or [SICTH] above?)

\* **Table 129:**

- 129080: root [???] (NGRBALPHA) (what is “alpha control variable”?)

\* **Table 151 (ocean fields):**

- 151130: root [SSS] (NGRBSSS)
- 151131: root [UCUR] (NGRBUCUR)
- 151132: root [VCUR] (NGRBVCUR)
- 151145: root [SSH]? (NGRBSL)
- 151148: root [MLD] or [SMLD] (NGRBMLD)
- 151163: root [???] (NGRB20D)

\* **Table 162 (ERA40 fields):**

- 162071: root [VIWVE] (NGRBVIWVE)
- 162072: root [VIWVN] (NGRBVIWVN)
- 162100: root [ERA40] (NGRBMINERA)
- 162113: root [ERA40] (NGRBMAXERA)

\* **Table 210 (aerosols):**

- 210001 to 210015: root [AERO]? (NGRBAERM01 to NGRBAERM15)
- 210016 to 210030: root [???] (NGRBAERGN01 to NGRBAERGN15); not used currently.
- 210031 to 210045: root [???] (NGRBAERLS01 to NGRBAERLS15); used for some VF=VARSF surface dataflow fields.
- 210046: root [???] (NGRBAERPR); not used currently.
- 210047: root [???] (NGRBAERSM); not used currently.
- 210048: root [???] (NGRBAERLG)
- 210049: root [???] (NGRBAODPR); not used currently.
- 210050: root [???] (NGRBAODSM); not used currently.
- 210051: root [???] (NGRBAODLG); not used currently.
- 210052: root [AERDEP] (NGRBAERDEP)
- 210053: root [AERLTS] (NGRBAERLTS)
- 210054: root [AERSCC] or [CLAY]? (NGRBAERSCC)
- 210061 to 210063: root [GHG] (NGRBGHG)
- 210064 to 210066: root [TCGHG] (NGRBTCGHG)
- 210067: root [CO2OF] (NGRBCO2OF)
- 210068: root [CO2NBF] (NGRBCO2NBF)
- 210069: root [CO2APF] (NGRBCO2APF)
- 210070: root [CH4AG] (NGRBCH4F)
- 210072: root [AEPM1] (NGRBAEPM1)
- 210073: root [AEPM25] (NGRBAEPM25)
- 210074: root [AEPM10] (NGRBAEPM10)
- 210080: root [CO2FIRE] (NGRBCO2FIRE)
- 210082: root [CH4F] (NGRBCH4FIRE)
- 210119: root [INJF] (NGRBINJFIRE)
- 210121: root [???] (NGRBNOXLOG)
- 210207: root [ODTO] (NGRBAEODTO)
- 210208: root [ODSS] (NGRBAEODSS)
- 210209: root [ODDU] (NGRBAEODDU)
- 210210: root [ODOM] (NGRBAEODOM)
- 210211: root [ODBC] (NGRBAEODBC)
- 210212: root [ODSU] (NGRBAEODSU)
- 210213: root [ODTO469] (NGRBAEODTO469)
- 210214: root [ODTO670] (NGRBAEODTO670)
- 210215: root [ODTO865] (NGRBAEODTO865)
- 210216: root [ODTO1240] (NGRBAEODTO1240)
- 210243: root [ODVSU] (NGRBAEODVSU)
- 210244: root [ODVFA] (NGRBAEODVFA)
- 210245: root [DEC550]? (NGRBAEDEC550)
- 210246: root [DAB550]? (NGRBAEDAB550)

\* **Table 214:**

- 214002: root [UVBED] (NGRBUVBED)
- 214003: root [UVBEDCS] (NGRBUVBEDCS)



\* **Table 215 (aerosols):**

- 215089: root [ACCAOD550]? (NGRBACCAOD550)
- 215093: root [AOT532]? (NGRBAOT532)
- 215094: root [NAOT532]? (NGRBNAOT532)
- 215095: root [AAOT532]? (NGRBAAOT532)
- 215180: root [AEREXT355]? (NGRBAEREXT355)
- 215181: root [AEREXT532]? (NGRBAEREXT532)
- 215182: root [AEREXT1064]? (NGRBAEREXT1064)
- 215183: root [AERBACKSCATTOA355]? (NGRBAERBACKSCATTOA355)
- 215184: root [AERBACKSCATTOA532]? (NGRBAERBACKSCATTOA532)
- 215185: root [AERBACKSCATTOA1064]? (NGRBAERBACKSCATTOA1064)
- 215186: root [AERBACKSCATGND355]? (NGRBAERBACKSCATGND355)
- 215187: root [AERBACKSCATGND532]? (NGRBAERBACKSCATGND532)
- 215188: root [AERBACKSCATGND1064]? (NGRBAERBACKSCATGND1064)

\* **Table 216:**

- 216001: root [AERO]? (NGRBAERM16)
- 216002: root [AERO]? (NGRBAERM17)
- 216003: root [AERO]? (NGRBAERM18)
- 216004: root [ODNI] (NGRBAEODNI)
- 216005: root [ODAM] (NGRBAEODAM)
- 216006: root [SO2DVV] (NGRBAERSO2DD)
- 216007: root [SOAF] (NGRBAERSOAC)
- 216043: root [FCA1] (NGRBAERFCA1)
- 216044: root [FCA2] (NGRBAERFCA2)
- 216045: root [VOLC]? (NGRBAERVOLC)

\* **Table 228:**

- 228001: root [CIEN] (NGRBCIN)
- 228003: root [ZUST] (NGRBZUST)
- 228007: root [DL] (NGRBDL)
- 228008: root [LMLT] (NGRBLMLT)
- 228009: root [LMLD] (NGRBLMLD)
- 228010: root [LBLT] (NGRBLBLT)
- 228011: root [LTLT] (NGRBLTLT)
- 228012: root [LSHF] (NGRBLSHF)
- 228013: root [LICT] (NGRBLICT)
- 228014: root [LICD] (NGRBLICD)
- 228015: root [DNDZN] (NGRBDNDZN)
- 228016: root [DNDZA] (NGRBDNDZA)
- 228017: root [DCTB] (NGRBDCTB)
- 228018: root [TPLB] (NGRBTPLB)
- 228019: root [TPLT] (NGRBTPLT)
- 228021: root [SFDIR] (NGRBFDIR)
- 228022: root [SCDIR] (NGRBCDIR)
- 228023: root [CBASE] (NGRBCBASE)
- 228024: root [0DEGL] (NGRB0DEGL)
- 228026: root [X2T3] (NGRBMX2T3)
- 228027: root [N2T3] (NGRBMN2T3)
- 228028: root [10FG3] (NGRB10FG3)
- 228029: root [I10FG] (NGRBI10FG)

- 228035: root [MXCAP6] (NGRBMXCAP6)
- 228036: root [MXCAPS6] (NGRBMXCAPS6)
- 228044: root [CAPES] (NGRBCAPES)
- 228046: root [CCTOP] (NGRBCTOPC)
- 228047: root [HTPW0] (NGRBZTWETB0)
- 228048: root [HTPW1] (NGRBZTWETB1)
- 228050: root [LITOTI] (NGRBLITOTI)
- 228051: root [LITOTA] (NGRBLITOTA)
- 228052: root [LICGI] (NGRBLICGI)
- 228053: root [LICGA] (NGRBLICGA)
- 228078: root [???] (NGRBFASGPPCOEF)
- 228079: root [???] (NGRBFASRECCOEF)
- 228080: root [CO2NEE] (NGRBNEE)
- 228081: root [CO2GPP] (NGRBGPP)
- 228082: root [CO2REC] (NGRBREC)
- 228083: root [CO2INEE] (NGRBINEE)
- 228084: root [CO2IGPP] (NGRBIGPP)
- 228085: root [CO2IREC] (NGRBIREC)
- 228088: root [TCSLW] (NGRBTCSLW)
- 228089: root [TCRR] (NGRBTCRW)
- 228090: root [TCS] (NGRBTCRW)
- 228129: root [SSRDC] (NGRBSSRDC)
- 228130: root [STRDC] (NGRBSTRDC)
- 228131: root [10NU] (NGRB10NU)
- 228132: root [10NV] (NGRB10NV)
- 228216: root [FZRA] (NGRBFZRA)
- 228217: root [ILSPF] (NGRBILSPF)
- 228218: root [CRR] (NGRBCRR)
- 228219: root [LSRR] (NGRBLSRR)
- 228220: root [CSFR] (NGRBCSFR)
- 228221: root [LSSFR] (NGRBLSSFR)
- 228222: root [MXTPR3] (NGRBMXTPR3)
- 228223: root [MNTPR3] (NGRBMNTPR3)
- 228224: root [MXTPR6] (NGRBMXTPR6)
- 228225: root [MNTPR6] (NGRBMNTPR6)
- 228226: root [MXTPR] (NGRBMXTPR)
- 228227: root [MNTPR] (NGRBMNTPR)
- 228246: root [100U] (NGRB100U)
- 228247: root [100V] (NGRB100V)
- 228249: root [100WND] (NGRB100SI)
- 228251: root [PEV] (NGRBPEV)
- 228253: root [ASCAT\_SM\_CDFA] (NGRBASCAT.SM\_CDFA)
- 228254: root [ASCAT\_SM\_CDFB] (NGRBASCAT.SM\_CDFB)

\* **Table 260:**

- 260015: root [PTYPE] (NGRBPTYPE)
- 260048: root [TPR] (NGRBTPR)
- 260109: root [CBASEA] (NGRBCBASEA)
- 260121: root [KINDEX]? (NGRBKINDEX) (what is convective K-index?)
- 260123: root [TTINDEX]? (NGRBTTINDEX) (what is convective TT-index?)
- 260510: root [CLBT] (NGRBCLBT)
- 260511: root [CSBT] (NGRBCSBT)