JRA-55 Product Users' Handbook

Model grid data

Climate Prediction Division
Global Environment and Marine Department
Japan Meteorological Agency
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Change record

Version	Date	Remarks
1.0	3 March 2014	First version
2.0	20 May 2014	Added latitudes and weights to the tables in Section 6.1 Corrected Table 11-1 Linguistic correction
3.0	22 May 2015	Added the comprehensive report on JRA-55 (Kobayashi et al. 2015) to References Corrected Table 7-3
4.0	14 Oct 2015	Added notes on cloud work function and upward mass flux at cloud base in Table 4-12 Parameters of model level average diagnostic fields (fcst_phy3m).
5.0	11 Oct 2018	Added B005 and BR05 to Table 11-1

Contents

List of tables

1. Introduction

This handbook gives an overview of products stemming from the Japanese 55-year Reanalysis (JRA-55) project conducted by the Japan Meteorological Agency (JMA) for the period from 1958 onward (Kobayashi et al. 2015), and also outlines how these products differ from the corresponding JRA-25 versions (Onogi et al. 2007).

2. File format

Both daily and monthly data are encoded in Gridded binary (GRIB) Edition 1 format (WMO 2011). (Daily data include 3-, 6- and 24-hourly data, which vary by category).

3. File names

JRA-55 product file names follow the convention shown in Table 3-1 for historical data and that shown in Table 3-2 for climatological normals.

Table 3-1 Naming convention for historical data.

Time range	Type	Filename
Daily	2D fields	<category>.<year><month><day><hour>
	3D fields	<category>_<parameter>.<year><month><day><hour>
Monthly_diurnal	2D fields, average	<category>.<year><month>_<hour>
	2D fields, variance	<category>_var.<year><month>_<hour>
	3D fields, average	<category>_<parameter>.<year><month>_<hour>
	3D fields, variance	<category>_<parameter>_var.<year><month>_<hour>
Monthly	2D fields, average	<category>.<year><month>
	2D fields, variance	<category>_var.<year><month>
	3D fields, average	<category>_<parameter>.<year><month>
	3D fields, variance	<category>_<parameter>_var.<year><month>

Table 3-2 Naming convention for climatological normals.

Time range	Type	Filename
Daily	2D fields	<category>.clim<period>.day<month><day>
	3D fields	<category>_<parameter>.clim<period>.day<month><day>
Monthly_diurnal Monthly	2D fields, average	<category>.clim<period>.mon<month>
	3D fields, average	<category>_<parameter>.clim<period>.mon<month>

4. Output parameters

4.1. Model grid data

4.1.1. Constant fields (TL319)

Table 4-1 shows the parameters of constant fields.

Table 4-1 Parameters of constant fields (TL319).

Code figure	Field parameter	Unit
6	Geopotential	$m^2 s^{-2}$
81	Land cover (1=land, 0=sea)	Proportion
252	Type of vegetation	Code Table JMA-252

4.1.2. Total column analysis fields (anl_column)

Total column analysis fields (Table 4-2) are produced by integrating the corresponding analyzed fields vertically from the bottom to the top of the atmosphere. These fields are output every six hours at 00, 06, 12 and 18 UTC.

Table 4-2 Parameters of total column analysis fields (anl_column).

Code figure	Field parameter	Unit
54	Precipitable water	$kg\ m^{-2}$
152	Meridional water vapour flux	$kg\ m^{-1} s^{-1}$
157	Zonal water vapour flux	$kg\ m^{-1} s^{-1}$
190	Zonal thermal energy flux$^+$	$W\ m^{-1}$
191	Meridional thermal energy flux$^+$	$W\ m^{-1}$

$^+$ See Section 12.3 “Parameter additions and changes”
Note: Precipitable water contains water vapour only.

4.1.3. Isentropic analysis fields (anl_isentrop)

The parameters shown in Table 4-3 are vertically interpolated to the isentropic surfaces listed in Section 7.2 except specific humidity, which is interpolated to 14 levels from 270 to 400 K only. These fields are output every six hours at 00, 06, 12 and 18 UTC.

Table 4-3 Parameters of isentropic analysis fields (anl_isentrop).

Code figure	Field parameter	Unit	Filename
1	Pressure+	Pa	anl_isentrop_pres
4	Potential vorticity	K m^2 kg^{-1} s^{-1}	anl_isentrop_pvor
7	Geopotential height	gpm	anl_isentrop_hgt
33	u-component of wind	m s^{-1}	anl_isentrop_ugrd
34	v-component of wind	m s^{-1}	anl_isentrop_vgrd
37	Montgomery stream function	m^2 s^{-2}	anl_isentrop_mntsf
39	Vertical velocity	Pa s^{-1}	anl_isentrop_vvel
51	Specific humidity	kg kg^{-1}	anl_isentrop_spfh
132	Square of Brunt-Vaisala frequency	s^{-2}	anl_isentrop_bvf2

+ See Section 12.3 “Parameter additions and changes”

4.1.4. Land surface analysis fields (anl_land)

The parameters shown in Table 4-4 are output from land surface analysis every six hours at 00, 06, 12 and 18 UTC.

Table 4-4 Parameters of land surface analysis fields (anl_land).

Code figure	Field parameter	Unit	Level
65	Water equivalent of accumulated snow depth	kg m^{-2}	Ground surface
144	Canopy temperature	K	Ground surface
145	Ground temperature	K	Ground surface
85	Soil temperature	K	Entire soil (considered as a single layer)
225	Soil wetness	Proportion	Underground layers

4.1.5. Model level analysis fields (anl_mdl)

The parameters shown in Table 4-5 are output to the model levels listed in Section 7.1 every six hours at 00, 06, 12 and 18 UTC.

Table 4-5 Parameters of model level analysis fields (anl_mdl).

Code figure	Field parameter	Unit	Filename
7	Geopotential height	gpm	anl_mdl_hgt
11	Temperature	K	anl_mdl_tmp
33	u-component of wind	m s^{-1}	anl_mdl_ugrd
34	v-component of wind	m s^{-1}	anl_mdl_vgrd
39	Vertical velocity	Pa s^{-1}	anl_mdl_vvel
51	Specific humidity	kg kg^{-1}	anl_mdl_spfh

4.1.6. Snow depth analysis fields (anl_snow)

The parameter shown in Table 4-6 is output from snow depth analysis at 18 UTC every day.

Table 4-6 Parameter of snow depth analysis fields (anl_snow).

Code figure	Field parameter	Unit	Level
66	Snow depth	m	Ground surface

4.1.7. Surface analysis fields (anl_surf)

Surface analysis fields (Table 4-7) are produced every six hours at 00, 06, 12 and 18 UTC.

Table 4-7 Parameters of surface analysis fields (anl_surf).

Code figure	Field parameter	Unit	Level
1	Pressure	Pa	Ground or water surface
11	Temperature	K	2m
13	Potential temperature	K	Ground or water surface
51	Specific humidity	kg kg^{-1}	2m
52	Relative humidity	%	2m
33	u-component of wind	m s^{-1}	10m
34	v-component of wind	m s^{-1}	10m

Note: The order of the parameters in monthly statistics and climatological normal files differs from that in daily files (Table 4-7), 1, 13, 11, 51, 52, 33 and 34.

4.1.8. Total column forecast fields (fcst_column)

Total column forecast fields (Table 4-8) are produced every three hours, integrating vertically from the bottom to the top of the atmosphere three-hour forecast fields at 03, 09, 15 and 21 UTC, and six-hour forecast fields at 00, 06, 12 and 18 UTC.

Table 4-8 Parameters of total column forecast fields (fcst_column).

Code figure	Field parameter	Unit
10	Total ozone	Dobson
54	Precipitable water	kg m^{-2}
58	Cloud ice^{+}	kg m^{-2}
152	Meridional water vapour flux*	kg m^{-1} s^{-1}
157	Zonal water vapour flux*	kg m^{-1} s^{-1}
190	Zonal thermal energy flux^{+}	W m^{-1}
191	Meridional thermal energy flux^{+}	W m^{-1}
227	Cloud liquid water^{+}	kg m^{-2}

+, * See Section 12.3 "Parameter additions and changes"
Note: Precipitable water contains water vapour only.

4.1.9. Land surface forecast fields (fcst_land)

Land surface forecast fields (Table 4-9) are produced every three hours at 00, 03, 06, 09, 12, 15, 18 and 21 UTC.

Table 4-9 Parameters of land surface forecast fields (fcst_land).

Code figure	Field parameter	Unit	Level
65	Water equivalent of accumulated snow depth+	kg m^{-2}	Ground surface
66	Snow depth+	m	Ground surface
144	Canopy temperature	K	Ground surface
145	Ground temperature	K	Ground surface
223	Moisture storage on canopy	m	Ground surface
224	Moisture storage on ground/cover	m	Ground surface
85	Soil temperature	K	Entire soil (considered as a single layer)
225	Soil wetness+	Proportion	Underground layers
226	Mass concentration of condensed water in soil+	kg m^{-3}	Underground layers

+ See Section 12.3 "Parameter additions and changes"

4.1.10. Model level forecast fields (fcst_mdl)

The parameters shown in Table 4-10 are output to the model levels listed in Section 7.1 every six hours at 00, 06, 12 and 18 UTC.

Table 4-10 Parameters of model level forecast fields (fcst_mdl).

Code figure	Field parameter	Unit	Filename
7	Geopotential height	gpm	fcst_mdl_hgt
11	Temperature	K	fcst_mdl_tmp
33	u-component of wind	m s^{-1}	fcst_mdl_ugrd
34	v-component of wind	m s^{-1}	fcst_mdl_vgrd
39	Vertical velocity	Pa s^{-1}	fcst_mdl_vvel
51	Specific humidity	kg kg^{-1}	fcst_mdl_spfh
71	Total cloud cover*	%	fcst_mdl_tcdc
221	Cloud water	kg kg^{-1}	fcst_mdl_cwat
228	Cloud liquid water+	kg kg^{-1}	fcst_mdl_clwc
229	Cloud ice+	kg kg^{-1}	fcst_mdl_ciwc
230	Upward mass flux at cloud base	kg m^{-2} s^{-1}	fcst_mdl_mflxb
237	Ozone mixing ratio	mg kg^{-1}	fcst_mdl_ozone

+, * See Section 12.3 "Parameter additions and changes"

4.1.11. Two-dimensional average diagnostic fields (fcst_phy2m)

Two-dimensional average diagnostic fields are produced every three hours. The parameters shown in Table 4-11 are averaged from the beginning of forecasts up to three hours for 00 - 03, 06 - 09, 12 - 15 and 18 - 21 UTC, and from three to six hours for 03 - 06, 09 - 12, 15 - 18 and 21 - 24 UTC.

Dates in file names indicate the beginning of the averaging period.

Table 4-11 Parameters of two-dimensional average diagnostic fields (fcst_phy2m).

Code figure	Field parameter	Unit	Level
1	Pressure	Pa	Ground or water surface
57	Evapolation+	mm day^{-1}	Ground or water surface
61	Total precipitation+	mm day^{-1}	Ground or water surface
62	Large scale precipitation	mm day^{-1}	Ground or water surface
63	Convective precipitation	mm day^{-1}	Ground or water surface
64	Snowfall rate water equivalent	mm day^{-1}	Ground or water surface
121	Latent heat flux	W m^{-2}	Ground or water surface
122	Sensible heat flux	W m^{-2}	Ground or water surface
124	Momentum flux, u component	N m^{-2}	Ground or water surface
125	Momentum flux, v component	N m^{-2}	Ground or water surface
147	Zonal momemtum flux by long gravity wave	N m^{-2}	Ground or water surface
148	Meridional momemtum flux by long gravity wave	N m^{-2}	Ground or water surface
154	Meridional momemtum flux by short gravity wave	N m^{-2}	Ground or water surface
159	Zonal momemtum flux by short gravity wave	N m^{-2}	Ground or water surface
160	Clear sky upward solar radiation flux	W m^{-2}	Ground or water surface
161	Clear sky downward solar radiation flux	W m^{-2}	Ground or water surface
163	Clear sky downward long wave radiation flux	W m^{-2}	Ground or water surface
170	Frequency of deep convection+	%	Ground or water surface
171	Frequency of shallow convection+	%	Ground or water surface
172	Frequency of stratocumulus parameterisation+	%	Ground or water surface
204	Downward solar radiation flux	W m^{-2}	Ground or water surface
205	Downward long wave radiation flux	W m^{-2}	Ground or water surface
211	Upward solar radiation flux	W m^{-2}	Ground or water surface
212	Upward long wave radiation flux	W m^{-2}	Ground or water surface
160	Clear sky upward solar radiation flux	W m^{-2}	Nominal top of atmosphere
162	Clear sky upward long wave radiation flux	W m^{-2}	Nominal top of atmosphere
204	Downward solar radiation flux	W m^{-2}	Nominal top of atmosphere
211	Upward solar radiation flux	W m^{-2}	Nominal top of atmosphere
212	Upward long wave radiation flux	W m^{-2}	Nominal top of atmosphere

+ See Section 12.3 “Parameter additions and changes”

4.1.12. Model level average diagnostic fields (fcst_phy3m)

Model level average diagnostic fields are produced every six hours. The parameters shown in Table 4-12 are averaged from the beginning of forecasts up to six hours for 00 - 06, 06 - 12, 12 - 18 and 18 - 24 UTC, and output to the model levels listed in Section 7.1.

Dates in file names indicate the beginning of the averaging period.

Table 4-12 Parameters of model level average diagnostic fields (fcst_phy3m).

Code figure	Field parameter	Unit	Filename
146	Cloud work function#	J kg^{-1}	fcst_phy3m_cwork
151	Adiabatic zonal acceleration	m s^{-1} day^{-1}	fcst_phy3m_adua
165	Adiabatic meridional acceleration	m s^{-1} day^{-1}	fcst_phy3m_adva
173	Gravity wave zonal acceleration	m s^{-1} day^{-1}	fcst_phy3m_gwdua
174	Gravity wave meridional acceleration	m s^{-1} day^{-1}	fcst_phy3m_gwdva
222	Adiabatic heating rate	K day^{-1}	fcst_phy3m_adhr
230	Upward mass flux at cloud base##	kg m^{-2} s^{-1}	fcst_phy3m_mflxb
231	Upward mass flux	kg m^{-2} s^{-1}	fcst_phy3m_mflux
236	Adiabatic moistening rate	kg kg^{-1} day^{-1}	fcst_phy3m_admr
239	Convective zonal acceleration	m s^{-1} day^{-1}	fcst_phy3m_cnvua
240	Convective meridional acceleration	m s^{-1} day^{-1}	fcst_phy3m_cnvva
241	Large scale condensation heating rate	K day^{-1}	fcst_phy3m_lrghr
242	Convective heating rate	K day^{-1}	fcst_phy3m_cnvhr
243	Convective moistening rate	kg kg^{-1} day^{-1}	fcst_phy3m_cnvmr
246	Vertical diffusion heating rate	K day^{-1}	fcst_phy3m_vdfhr
247	Vertical diffusion zonal acceleration	m s^{-1} day^{-1}	fcst_phy3m_vdfua
248	Vertical diffusion meridional acceleration	m s^{-1} day^{-1}	fcst_phy3m_vdfva
249	Vertical diffusion moistening rate	kg kg^{-1} day^{-1}	fcst_phy3m_vdfmr
250	Solar radiative heating rate	K day^{-1}	fcst_phy3m_swhr
251	Longwave radiative heating rate	K day^{-1}	fcst_phy3m_lwhr
253	Large scale moistening rate	kg kg^{-1} day^{-1}	fcst_phy3m_lrgmr

Cloud work functions at model levels from 1 to 10 are constant at 0 in the specifications of physical parameterization, but model levels from 2 to 5 are used to output temporary variables of the cumulus convection scheme. Please discard those data.

Upward mass fluxes at cloud base at model levels from 1 to 10 are constant at 0 in the specifications of physical parameterization, but model levels from 1 to 3 are used to output temporary variables of the cumulus convection scheme. Please discard those data.

4.1.13. Land surface average diagnostic fields (fcst_phyland)

Land surface average diagnostic fields are produced every three hours. The parameters shown in Table 4-13 are averaged from the beginning of forecasts up to three hours for 00 - 03, 06 - 09, 12 - 15 and 18 - 21 UTC, and from three to six hours for 03 - 06, 09 - 12, 15 - 18 and 21 - 24 UTC.

Dates in file names indicate the beginning of the averaging period.

Table 4-13 Parameters of land surface average diagnostic fields (fcst_phyland).

Code figure	Field parameter	Unit	Level
90	Water run-off	mm day^{-1}	Ground surface
155	Ground heat flux	W m^{-2}	Ground surface
202	Evapotranspiration	W m^{-2}	Ground surface
203	Interception loss	W m^{-2}	Ground surface
90	Water run-off[+]	mm day^{-1}	The bottom of land surface model

[+] See Section 12.3 “Parameter additions and changes”

4.1.14. Two-dimensional instantaneous diagnostic fields (fcst_surf)

Two-dimensional instantaneous diagnostic fields (Table 4-14) are produced every three hours at 00, 03, 06, 09, 12, 15, 18 and 21 UTC.

Table 4-14 Parameters of two-dimensional instantaneous diagnostic fields (fcst_surf).

Code figure	Field parameter	Unit	Level
1	Pressure	Pa	Ground or water surface
83	Surface roughness	m	Ground or water surface
118	Brightness temperature[+]	K	Ground or water surface
71	Total cloud cover[*]	%	90 - 1100 hPa
75	High cloud cover[*]	%	90 - 500 hPa
74	Medium cloud cover[*]	%	500 - 850 hPa
73	Low cloud cover[*]	%	850 - 1100 hPa
2	Pressure reduced to MSL	Pa	Mean sea level
11	Temperature	K	2m
51	Specific humidity	kg kg^{-1}	2m
52	Relative humidity	%	2m
33	u-component of wind	m s^{-1}	10m
34	v-component of wind	m s^{-1}	10m

[+, *] See Section 12.3 “Parameter additions and changes”

4.1.15. Sea ice fields (ice)

Sea ice fields (Table 4-15) are output every three hours.

Table 4-15 Parameter of sea ice fields (ice).

Code figure	Field parameter	Unit
91	Ice cover (1 = ice, 0 = no ice)	Proportion

4.1.16. Two-dimensional extreme fields (minmax_surf)

Two-dimensional extreme fields (minmax_surf) are produced every three hours. The parameters shown in Table 4-16 are computed from the beginning of forecasts up to three hours for 00 - 03, 06 - 09, 12 - 15 and 18 - 21 UTC, and from three to six hours for 03 - 06, 09 - 12, 15 - 18 and 21 - 24 UTC.

Dates in file names indicate the end of the valid time.

Two-dimensional extreme fields (minmax_surf) are produced for daily data only; they are not produced for monthly statistics.

Table 4-16 Parameters of two-dimensional extreme fields (minmax_surf).

Code figure	Field parameter	Unit	Level
15	Maximum temperature	K	2m
16	Minumum temperature	K	2m
219	Maximum wind speed	$m\ s^{-1}$	10m

5. Type of vegetation

Types of vegetation defined for JRA-55 are as follows:

Table 5-1 Types of vegetation (Code table JMA-252).

Code figure	Meaning
0	Sea or inland water
1	Broadleaf-evergreen trees
2	Broadleaf-deciduous trees
3	Broadleaf and needleleaf trees
4	Needleleaf-evergreen trees
5	Needleleaf-deciduous trees
6	Broadleaf trees with groundcover
7	Groundcover
8	Broadleaf shrubs with groundcover
9	Broadleaf shrubs with bare soil
10	Dwarf trees and shrubs with groundcover (tundra)
11	No vegetation: bare soil
12	Broadleaf-deciduous trees with winter wheat
13	Perennial land ice

6. Grid

6.1. Quasi-regular Gaussian latitude/longitude grid

Model grid data are output to the quasi-regular Gaussian latitude/longitude grid. Latitudes of the model grid correspond to nodes for the 320-point Gauss-Legendre formula. The number of grid points along each parallel varies with latitude (Table 6-1, Table 6-2, Table 6-3 and Table 6-4). The grid points in each parallel are evenly spaced and the first point is positioned at the standard meridian.

Table 6-1, Table 6-2, Table 6-3 and Table 6-4 also show weights for the 320-point Gauss-Legendre formula.

Table 6-1 Latitudes of the model grid and the number of grid points along each parallel (#1-40).

#	(±) Latitude	Weight	Points
1	8.95700895506066E+01	7.22417022893012E-05	48
2	8.90131761310220E+01	1.68158195616948E-04	64
3	8.84529738367130E+01	2.64200571979866E-04	80
4	8.78920284453444E+01	3.60229901103989E-04	80
5	8.73308011797376E+01	4.56227095866134E-04	96
6	8.67694375145276E+01	5.52181197609065E-04	112
7	8.62079976214231E+01	6.48082526890580E-04	112
8	8.56465108479528E+01	7.43921712961107E-04	128
9	8.50849932009119E+01	8.39689484512363E-04	128
10	8.45234541489144E+01	9.35376611415834E-04	144
11	8.39618996497181E+01	1.03097388562788E-03	144
12	8.34003336387369E+01	1.12647211435034E-03	160
13	8.28387588197095E+01	1.22186211760014E-03	160
14	8.22771771114337E+01	1.31713472754676E-03	192
15	8.17155899132664E+01	1.41228078862246E-03	192
16	8.11539982697129E+01	1.50729115799506E-03	192
17	8.05924029761777E+01	1.60215670622107E-03	192
18	8.00308046490314E+01	1.69686831799275E-03	224
19	7.94692037732916E+01	1.79141689293615E-03	224
20	7.89076007358379E+01	1.88579334643737E-03	224
21	7.83459958490356E+01	1.97998861048504E-03	224
22	7.77843893678486E+01	2.07399363452170E-03	240
23	7.72227815024451E+01	2.16779938630021E-03	240
24	7.66611724276204E+01	2.26139685274268E-03	256
25	7.60995622899381E+01	2.35477704080024E-03	256
26	7.55379512132081E+01	2.44793097831276E-03	288
27	7.49763393027374E+01	2.54084971486788E-03	288
28	7.44147266486620E+01	2.63352432265867E-03	288
29	7.38531133285838E+01	2.72594589733983E-03	288
30	7.32914994096763E+01	2.81810555888202E-03	288
31	7.27298849503795E+01	2.90999445242416E-03	320
32	7.21682700017747E+01	3.00160374912351E-03	320
33	7.16066546087075E+01	3.09292464700346E-03	320
34	7.10450388107113E+01	3.18394837179883E-03	320
35	7.04834226427713E+01	3.27466617779859E-03	320
36	6.99218061359604E+01	3.36506934868594E-03	336
37	6.93601893179717E+01	3.45514919837554E-03	336
38	6.87985722135654E+01	3.54489707184801E-03	384
39	6.82369548449477E+01	3.63430434598132E-03	384
40	6.76753372320917E+01	3.72336243037927E-03	384

Table 6-2 Latitudes of the model grid and the number of grid points along each parallel (#41-80).

#	(±) Latitude	Weight	Points
41	6.71137193930113E+01	3.81206276819674E-03	384
42	6.65521013439961E+01	3.90039683696182E-03	384
43	6.59904830998127E+01	3.98835614939459E-03	384
44	6.54288646738789E+01	4.07593225422256E-03	384
45	6.48672460784143E+01	4.16311673699262E-03	384
46	6.43056273245713E+01	4.24990122087953E-03	400
47	6.37440084225492E+01	4.33627736749070E-03	400
48	6.31823893816941E+01	4.42223687766737E-03	400
49	6.26207702105861E+01	4.50777149228198E-03	432
50	6.20591509171167E+01	4.59287299303171E-03	432
51	6.14975315085564E+01	4.67753320322809E-03	432
52	6.09359119916146E+01	4.76174398858260E-03	432
53	6.03742923724930E+01	4.84549725798827E-03	432
54	5.98126726569327E+01	4.92878496429701E-03	432
55	5.92510528502565E+01	5.01159910509285E-03	448
56	5.86894329574061E+01	5.09393172346077E-03	448
57	5.81278129829758E+01	5.17577490875123E-03	448
58	5.75661929312427E+01	5.25712079734024E-03	480
59	5.70045728061936E+01	5.33796157338490E-03	480
60	5.64429526115493E+01	5.41828946957433E-03	480
61	5.58813323507866E+01	5.49809676787602E-03	480
62	5.53197120271579E+01	5.57737580027733E-03	480
63	5.47580916437092E+01	5.65611894952227E-03	480
64	5.41964712032965E+01	5.73431864984338E-03	512
65	5.36348507085999E+01	5.81196738768865E-03	512
66	5.30732301621377E+01	5.88905770244343E-03	512
67	5.25116095662779E+01	5.96558218714727E-03	512
68	5.19499889232498E+01	6.04153348920559E-03	512
69	5.13883682351539E+01	6.11690431109609E-03	512
70	5.08267475039710E+01	6.19168741106998E-03	512
71	5.02651267315709E+01	6.26587560384770E-03	560
72	4.97035059197200E+01	6.33946176130936E-03	560
73	4.91418850700887E+01	6.41243881317955E-03	560
74	4.85802641842574E+01	6.48479974770674E-03	560
75	4.80186432637230E+01	6.55653761233693E-03	560
76	4.74570223099043E+01	6.62764551438165E-03	560
77	4.68954013241470E+01	6.69811662168028E-03	560
78	4.63337803077285E+01	6.76794416325643E-03	560
79	4.57721592618623E+01	6.83712142996855E-03	560
80	4.52105381877018E+01	6.90564177515453E-03	560

Table 6-3 Latitudes of the model grid and the number of grid points along each parallel (#81-120).

#	(±) Latitude	Weight	Points
81	4.46489170863444E+01	6.97349861527033E-03	560
82	4.40872959588346E+01	7.04068543052255E-03	576
83	4.35256748061674E+01	7.10719576549483E-03	576
84	4.29640536292911E+01	7.17302322976814E-03	576
85	4.24024324291106E+01	7.23816149853473E-03	576
86	4.18408112064890E+01	7.30260431320588E-03	576
87	4.12791899622508E+01	7.36634548201319E-03	640
88	4.07175686971841E+01	7.42937888060353E-03	640
89	4.01559474120422E+01	7.49169845262744E-03	640
90	3.95943261075457E+01	7.55329821032109E-03	640
91	3.90327047843849E+01	7.61417223508153E-03	640
92	3.84710834432205E+01	7.67431467803540E-03	640
93	3.79094620846860E+01	7.73371976060089E-03	640
94	3.73478407093888E+01	7.79238177504295E-03	640
95	3.67862193179117E+01	7.85029508502170E-03	640
96	3.62245979108143E+01	7.90745412613397E-03	640
97	3.56629764886338E+01	7.96385340644796E-03	640
98	3.51013550518869E+01	8.01948750703089E-03	640
99	3.45397336010700E+01	8.07435108246969E-03	640
100	3.39781121366611E+01	8.12843886138454E-03	640
101	3.34164906591199E+01	8.18174564693541E-03	640
102	3.28548691688896E+01	8.23426631732136E-03	640
103	3.22932476663967E+01	8.28599582627264E-03	640
104	3.17316261520529E+01	8.33692920353555E-03	640
105	3.11700046262550E+01	8.38706155535001E-03	640
106	3.06083830893861E+01	8.43638806491971E-03	640
107	3.00467615418160E+01	8.48490399287498E-03	640
108	2.94851399839021E+01	8.53260467772811E-03	640
109	2.89235184159896E+01	8.57948553632125E-03	640
110	2.83618968384127E+01	8.62554206426676E-03	640
111	2.78002752514945E+01	8.67076983638001E-03	640
112	2.72386536555477E+01	8.71516450710455E-03	640
113	2.66770320508754E+01	8.75872181092963E-03	640
114	2.61154104377713E+01	8.80143756280006E-03	640
115	2.55537888165200E+01	8.84330765851829E-03	640
116	2.49921671873976E+01	8.88432807513879E-03	640
117	2.44305455506723E+01	8.92449487135452E-03	640
118	2.38689239066043E+01	8.96380418787565E-03	640
119	2.33073022554465E+01	9.00225224780040E-03	640
120	2.27456805974447E+01	9.03983535697787E-03	640

Table 6-4 Latitudes of the model grid and the number of grid points along each parallel (#121-160).

#	(±) Latitude	Weight	Points
121	2.21840589328380E+01	9.07654990436300E-03	640
122	2.16224372618593E+01	9.11239236236356E-03	640
123	2.10608155847349E+01	9.14735928717903E-03	640
124	2.04991939016857E+01	9.18144731913153E-03	640
125	1.99375722129269E+01	9.21465318298861E-03	640
126	1.93759505186682E+01	9.24697368827792E-03	640
127	1.88143288191145E+01	9.27840572959380E-03	640
128	1.82527071144658E+01	9.30894628689559E-03	640
129	1.76910854049175E+01	9.33859242579788E-03	640
130	1.71294636906605E+01	9.36734129785236E-03	640
131	1.65678419718816E+01	9.39519014082157E-03	640
132	1.60062202487636E+01	9.42213627894429E-03	640
133	1.54445985214858E+01	9.44817712319260E-03	640
134	1.48829767902235E+01	9.47331017152068E-03	640
135	1.43213550551487E+01	9.49753300910516E-03	640
136	1.37597333164304E+01	9.52084330857721E-03	640
137	1.31981115742342E+01	9.54323883024608E-03	640
138	1.26364898287229E+01	9.56471742231435E-03	640
139	1.20748680800568E+01	9.58527702108464E-03	640
140	1.15132463283931E+01	9.60491565115794E-03	640
141	1.09516245738869E+01	9.62363142562335E-03	640
142	1.03900028166909E+01	9.64142254623943E-03	640
143	9.82838105695560E+00	9.65828730360694E-03	640
144	9.26675929482938E+00	9.67422407733312E-03	640
145	8.70513753045879E+00	9.68923133618732E-03	640
146	8.14351576398856E+00	9.70330763824821E-03	640
147	7.58189399556175E+00	9.71645163104223E-03	640
148	7.02027222531985E+00	9.72866205167360E-03	640
149	6.45865045340296E+00	9.73993772694564E-03	640
150	5.89702867994979E+00	9.75027757347349E-03	640
151	5.33540690509796E+00	9.75968059778822E-03	640
152	4.77378512898387E+00	9.76814589643226E-03	640
153	4.21216335174302E+00	9.77567265604622E-03	640
154	3.65054157350999E+00	9.78226015344704E-03	640
155	3.08891979441865E+00	9.78790775569746E-03	640
156	2.52729801460213E+00	9.79261492016686E-03	640
157	1.96567623419308E+00	9.79638119458336E-03	640
158	1.40405445332361E+00	9.79920621707733E-03	640
159	8.42432672125539E-01	9.80108971621609E-03	640
160	2.80810890730407E-01	9.80203151103004E-03	640

7. Vertical coordinates

7.1. Hybrid coordinates

Model level fields are produced for 60 hybrid levels. Each hybrid level is defined with half-levels $p_{k+\frac{1}{2}}$ as the boundary;

$$p_{k+\frac{1}{2}} = A_{k+\frac{1}{2}} + B_{k+\frac{1}{2}} p_s ,$$

where p_s is the surface pressure. Coefficients A and B are given in Table 7-1 and Table 7-2 for k = 0, 1, 2, …, 60. The following equation by Simmons and Burridge (1981) gives full-levels, i.e. the pressures that represent each hybrid level except for the uppermost level (k = 60);

$$p_k = \exp\left[\frac{1}{\Delta p_k} \left(p_{k-\frac{1}{2}} \ln p_{k-\frac{1}{2}} - p_{k+\frac{1}{2}} \ln p_{k+\frac{1}{2}} \right) - C \right],$$

where C = 1 and k = 1, 2, …, 59. The full-level pressure for the uppermost level (k = 60) is given by

$$p_{60} = \frac{1}{2} p_{59.5} .$$

Table 7-1 and Table 7-2 also give half-level and full-level pressures with a surface pressure of 1000 hPa.

Table 7-1 Model levels from 1 to 39.

Half level				Full level	
A (Pa)	B	p (Pa)	#	p (Pa)	#
0.00000000000000E+00	1.00000000000000E+00	100000	0.5	100000.0	Surface
0.00000000000000E+00	9.97000000000000E-01	99700	1.5	99850.0	1
0.00000000000000E+00	9.94000000000000E-01	99400	2.5	99550.0	2
0.00000000000000E+00	9.89000000000000E-01	98900	3.5	99149.9	3
0.00000000000000E+00	9.82000000000000E-01	98200	4.5	98549.8	4
0.00000000000000E+00	9.72000000000000E-01	97200	5.5	97699.6	5
0.00000000000000E+00	9.60000000000000E-01	96000	6.5	96599.4	6
0.00000000000000E+00	9.46000000000000E-01	94600	7.5	95299.1	7
1.33051011276943E+02	9.26669489887231E-01	92800	8.5	93698.6	8
3.64904148871589E+02	9.04350958511284E-01	90800	9.5	91798.2	9
6.34602716447362E+02	8.79653972835526E-01	88600	10.5	89697.8	10
9.59797167291774E+02	8.51402028327082E-01	86100	11.5	87347.0	11
1.34768004165515E+03	8.19523199583449E-01	83300	12.5	84696.1	12
1.79090739595110E+03	7.85090926040489E-01	80300	13.5	81795.4	13
2.29484168994850E+03	7.48051583100515E-01	77100	14.5	78694.6	14
2.84748477771176E+03	7.09525152222882E-01	73800	15.5	75444.0	15
3.46887148811864E+03	6.68311285118814E-01	70300	16.5	72042.9	16
4.16295646296916E+03	6.24370435370308E-01	66600	17.5	68441.7	17
4.89188083250491E+03	5.80081191674951E-01	62900	18.5	64741.2	18
5.67182423980408E+03	5.34281757601959E-01	59100	19.5	60990.1	19
6.47671299638532E+03	4.88232870036147E-01	55300	20.5	57189.5	20
7.29746989472049E+03	4.42025301052795E-01	51500	21.5	53388.7	21
8.12215979124915E+03	3.95778402087509E-01	47700	22.5	49587.9	22
8.91408220106234E+03	3.50859177989377E-01	44000	23.5	45837.6	23
9.65618191050164E+03	3.07438180894984E-01	40400	24.5	42187.2	24
1.03294361777746E+04	2.65705638222254E-01	36900	25.5	38636.8	25
1.09126384442387E+04	2.25873615557613E-01	33500	26.5	35186.3	26
1.13696478308432E+04	1.89303521691568E-01	30300	27.5	31886.6	27
1.16953715974700E+04	1.55046284025300E-01	27200	28.5	28736.1	28
1.18612530873948E+04	1.24387469126052E-01	24300	29.5	25736.4	29
1.18554343163493E+04	9.64456568365075E-02	21500	30.5	22885.7	30
1.16633553655803E+04	7.23664463441966E-02	18900	31.5	20186.0	31
1.12854040644942E+04	5.21459593550578E-02	16500	32.5	17686.4	32
1.07299494055679E+04	3.57005059443214E-02	14300	33.5	15386.9	33
1.00146150535107E+04	2.28538494648935E-02	12300	34.5	13287.5	34
9.16724703583310E+03	1.33275296416689E-02	10500	35.5	11388.1	35
8.22624490770442E+03	6.73755092295582E-03	8900	36.5	9689.0	36
7.20156898029828E+03	2.48431019701722E-03	7450	37.5	8164.3	37
6.08867300853392E+03	1.13269914660783E-04	6100	38.5	6763.8	38
4.95000000000000E+03	0.00000000000000E+00	4950	39.5	5515.0	39

Table 7-2 Model levels from 40 to 60.

Half level				Full level	
A (Pa)	*B*	*p* (Pa)	#	*p* (Pa)	#
4.00000000000000E+03	0.00000000000000E+00	4000	40.5	4466.6	40
3.23000000000000E+03	0.00000000000000E+00	3230	41.5	3608.1	41
2.61000000000000E+03	0.00000000000000E+00	2610	42.5	2914.5	42
2.10500000000000E+03	0.00000000000000E+00	2105	43.5	2353.0	43
1.70000000000000E+03	0.00000000000000E+00	1700	44.5	1898.9	44
1.37000000000000E+03	0.00000000000000E+00	1370	45.5	1532.0	45
1.10500000000000E+03	0.00000000000000E+00	1105	46.5	1235.1	46
8.93000000000000E+02	0.00000000000000E+00	893	47.5	997.1	47
7.20000000000000E+02	0.00000000000000E+00	720	48.5	804.9	48
5.81000000000000E+02	0.00000000000000E+00	581	49.5	649.3	49
4.69000000000000E+02	0.00000000000000E+00	469	50.5	524.0	50
3.77000000000000E+02	0.00000000000000E+00	377	51.5	422.2	51
3.01000000000000E+02	0.00000000000000E+00	301	52.5	338.3	52
2.37000000000000E+02	0.00000000000000E+00	237	53.5	268.4	53
1.82000000000000E+02	0.00000000000000E+00	182	54.5	208.9	54
1.36000000000000E+02	0.00000000000000E+00	136	55.5	158.4	55
9.70000000000000E+01	0.00000000000000E+00	97	56.5	116.0	56
6.50000000000000E+01	0.00000000000000E+00	65	57.5	80.5	57
3.90000000000000E+01	0.00000000000000E+00	39	58.5	51.5	58
2.00000000000000E+01	0.00000000000000E+00	20	59.5	29.0	59
0.00000000000000E+00	0.00000000000000E+00	0	60.5	10.0	60

7.2. Isentropic coordinates

Isentropic fields are produced for 21 isentropic surfaces (270, 280, 290, 300, 310, 320, 330, 340, 350, 360, 370, 380, 390, 400, 425, 450, 475, 550, 650, 750 and 850 K) except specific humidity, which is produced for 14 levels from 270 to 400 K only.

7.3. Soil layers of the land surface model

Porosities and thicknesses of soil layers of the land surface model are defined for each type of vegetation shown in Table 7-3 as follows:

Table 7-3 Soil layers of the land surface model.

Code figure	Porosity (m^3 m^{-3})	Thickness (m)		
		Top (#1)	Middle (#2)	Bottom (#3)
0	n/a	n/a	n/a	n/a
1	0.42	0.02	1.48	2
2	0.42	0.02	1.48	2
3	0.42	0.02	1.48	2
4	0.42	0.02	1.48	2
5	0.42	0.02	1.48	2
6	0.42	0.02	0.47	1
7	0.42	0.02	0.47	1
8	0.4352	0.02	0.47	1
9	0.4352	0.02	0.17	0.3
10	0.42	0.02	0.17	1
11	0.4352	0.02	0.17	0.3
12	0.4577	0.02	0.47	1
13	0.4352	1	1	1

8. Physical constants

The fundamental physical constants used in the forecast model are as follows:

Table 8-1 Physical constants.

Quantity	Value
Stefan-Boltzmann constant σ	5.67 x 10^{-8} W m^{-2} K^{-4}
Earth's radius	6.371 x 10^{6} m
Angular speed of Earth's rotation	7.29245 x 10^{-5} rad s^{-1}
Gravitational acceleration	9.80665 m s^{-2}
Gas constant for dry air	287.04 J K^{-1} kg^{-1}
Specific heat of dry air at constant pressure c_p	1004.6 J K^{-1} kg^{-1}
Latent heat of vaporization	2.507 x 10^{6} J kg^{-1}
Solar constant	1365 W m^{-2}

9. Monthly statistics

9.1. Monthly statistics for fixed hours (Monthly_diurnal)

Monthly averages and variances are produced for each of the output hours at 00, 06, 12 and 18 UTC (and 03, 09, 15 and 21 UTC when available), and are referred to as monthly statistics for fixed hours (Monthly_diurnal).

Table 9-1 shows the meanings of the time range indicator encoded in Octet 21 of Section 1.

9.2. Monthly statistics (Monthly)

Averages and variances for the whole month are also produced using only six-hourly data for analyzed and instantaneous forecast fields and averages from the beginning of forecasts up to six hours for average diagnostic fields. These statistics are referred to as monthly statistics (Monthly).

Table 9-1 shows the meanings of the time range indicator encoded in Octet 21 of Section 1.

Table 9-1 Time range indicator for monthly statistics.

Code figure	Meaning
113	Average of N forecasts (or initialized analyses); each product has forecast period of P1 (P1 = 0 for initialized analyses); products have reference times at intervals of P2, beginning at the given reference time
123	Average of N uninitialized analyses, starting at the reference time, at intervals of P2
128	Average of N forecast products with a valid time ranging between reference time + P1 and reference time + P2; products have reference times at Intervals of 24 hours, beginning at the given reference time
129	Temporal variance of N forecasts; each product has valid time ranging between reference time + P1 and reference time + P2; products have reference times at intervals of 24 hours, beginning at the given reference time; unit of measurement is square of that in Code Table 2
130	Average of N forecast products; each product has a forecast period from P1 to P2; products have reference times at intervals of P2 - P1, beginning at the given reference time; thus the N products cover a continuous time span.
131	Temporal variance of N forecasts; valid time of the first product ranges between R + P1 and R + P2, where R is reference time given in octets 13 to 17, then subsequent products have valid time range at interval of P2 – P1; thus all N products cover continuous time span; products have reference times at intervals of P2 - P1, beginning at the given reference time; unit of measurement is square of that in Code Table 2
132	Temporal variance of N uninitialized analyses (P1 = 0) or instantaneous forecasts (P1 > 0); each product has valid time at the reference time + P1; products have reference times at intervals of P2, beginning at the given reference time; unit of measurement is square of that in Code Table 2

10. Climatological normals

Climatological normals have been calculated for the period from 1981 to 2010 using the methods described below.

10.1. Daily mean smooth climatological normals

This calculation involves two steps. In the first, daily values are computed using six-hourly values for analysis and instantaneous forecast fields and averages from the beginning of forecasts up to six hours for average diagnostic fields, and a simple average is then taken for the base period for each day of the year except leap days. In the second, Lanzcos low-pass filtering (Duchon 1979) with 121-term weight factors and a 60-day cutoff is applied to the time sequence of daily values to treat the high-frequency variation remaining in the daily values calculated in the first step. Climatological normals for leap days are derived by averaging the smooth climatological normals for 28th February and 1st March.

The concept of this method is quite simple. It should be noted that monthly means calculated from daily means do not coincide with those outlined above due to the difference in treatment for leap days and with the presence or absence of filtering.

10.2. Monthly mean climatological normals

Monthly mean climatological normals are calculated by simply averaging historical monthly mean values.

11. Production streams

The JRA-55 production was organized into several streams as shown in Table 11-1 in order to shorten the time taken. Separate stream names are also assigned for cases in which data assimilation cycles were rerun or secondary products were recalculated. These stream names are encoded in Octets 46 - 49 of Section 1.

There are three discontinuities among the streams in Table 11-1 at 00 UTC on 1 July 1958 (A003/A002), 00 UTC on 1 September 1980 (A004/B002) and 00 UTC on 1 October 1992 (B003/B002). For other stream changeovers, subsequent streams were initiated from the last data of the preceding streams.

Table 11-1 Production streams of JRA-55.

Stream	Period	Section 1 Octets 46-49	Note
A003	until 30 Jun 1958	AE03	fcst_column125 (thermal energy fluxes) fcst_p125 (cloud liquid water, cloud ice, ozone mixing ratio) fcst_phy3m125
		AR03	anl_isentrop125 fcst_column125 (other than thermal energy fluxes) fcst_phy2m125 fcst_surf125 (surface roughness, brightness temperature)
		A003	other parameters
A002	1 Jul 1958 to 30 Nov 1974	AE02	same as AE03
		AR02	same as AR03, and anl_isentrop (until 31 Dec 1972)
		A002	other parameters
A004	1 Dec 1974 to 31 Aug 1980	AE04	same as AE03
		AR04	same as AR03
		A004	other parameters
B002	1 Sep 1980 to 31 May 1987	BE02	same as AE03
		BR02	same as AR03, and anl_isentrop
		B002	other parameters
B003	1 Jun 1987 to 30 Sep 1992	BE03	same as AE03
		BR03	same as AR03
		B003	other parameters
B002	1 Oct 1992 to 31 Dec 2013	BE02	same as AE03, but until 31 Dec 2012
		BR02	same as AR03, but until 31 Dec 2012, and anl_isentrop (until 31 Jan 2000)
		B002	other parameters
B004	1 Jan 2014 to 3 Jun 2018 18UTC	B004	
B005	3 Jun 2018 21UTC onward	BR05	fcst_surf125 (from 4 Jun 2018 to 7 Oct 2018)
		B005	other parameters

12. Differences from JRA-25 products

12.1. Parameter classification

JRA-25 products contained categories in which two- and three-dimensional fields were put together. They are output into separate categories in JRA-55 products, and files of three-dimensional fields are divided into individual parameters except land surface fields.

Table 12-1 Example of category change (for anl_mdl).

JRA-25	JRA-55
anl_mdl	*Model level analysis fields*
	anl_mdl_hgt (geopotential height)
	anl_mdl_tmp (temperature)
	…
	Surface analysis fields
	anl_surf

JRA-25 products contained categories in which instantaneous, average and extreme fields were put together. These are output into separate categories in JRA-55 products.

Table 12-2 Example of category change (for fcst_phy2m).

JRA-25	JRA-55
fcst_phy2m	*2-dimensional average diagnostic fields*
	fcst_phy2m
	2-dimensional instantaneous diagnostic fields
	fcst_surf
	2-dimensional extreme fields [1]
	minmax_surf

[1]Extreme fields are produced for daily model grid data only; they are not produced for monthly statistics or latitude/longitude grid data.

12.2. Dates in file names

In JRA-25 products, dates in file names indicated valid times for instantaneous fields and the end of the averaging period for average diagnostic fields. In JRA-55 products, dates in file names indicate the beginning of the averaging period.

Table 12-3 Example of file name date change (for fcst_phy2m.1981010100).

	Valid time
JRA-25	from 18UTC on 31 Dec 1980 to 00UTC 1 Jan 1981
JRA-55	from 00 to 03UTC on 1 Jan 1981

12.3. Parameter additions and changes

Parameters added to JRA-55 products are indicated by a superscript $^{+}$ in the parameter tables of Chapter 4.

Some parameters have been switched from average forecast fields to instantaneous forecast fields in JRA-55 products. These are indicated by a superscript *.

12.4. Discontinued parameters

Table 12-4 Discontinued parameter in isentropic analysis fields (anl_isentrop).

Code figure	Field parameter	Unit
11	Temperature	K

Table 12-5 Discontinued parameter in model level forecast fields (fcst_mdl).

Code figure	Field parameter	Unit
52	Relative humidity	Proportion

Table 12-6 Discontinued parameters in two-dimensional diagnostic fields (fcst_phy2m).

Code figure	Field parameter	Unit	Level
2	Pressure reduced to MSL (mean)	Pa	Mean sea level
136	u-component of wind (mean, surface)	$m\ s^{-1}$	10m
137	v-component of wind (mean, surface)	$m\ s^{-1}$	10m
138	Temperature (mean, surface)	K	2m
139	Specific humidity (mean, surface)	$kg\ kg^{-1}$	2m
80	Water temperature#	K	Water surface
218	Moist process heating rate	$W\ m^{-2}$	Entire atmosphere (considered as a single layer)
168	Frequency of precipitation	%	Ground or water surface
169	Frequency of cumulus precipitation	%	Ground or water surface
200	Zonal temperature flux	$K\ Pa\ m\ s^{-1}$	Entire atmosphere (considered as a single layer)
201	Meridional temperature flux	$K\ Pa\ m\ s^{-1}$	Entire atmosphere (considered as a single layer)
219	Maximum wind speed	$m\ s^{-1}$	Lowermost hyblid level
220	Maximum hourly precipitation	$mm\ hour^{-1}$	Ground or water surface
76	Cloud water	$kg\ m^{-2}$	Entire atmosphere (considered as a single layer)

In JRA-55 products, SST is output as brightness temperature in the Two-dimensional instantaneous diagnostic fields (fcst_surf).

Table 12-7 Discontinued parameters in three-dimensional diagnostic fields (fcst_phy3m).

Code figure	Field parameter	Unit
76	Cloud water	$kg\ m^{-2}$
175	Geopotential height (mean)	gpm
176	u-component of wind (mean)	$m\ s^{-1}$
177	v-component of wind (mean)	$m\ s^{-1}$
178	Vertical velocity (mean)	$Pa\ s^{-1}$
179	Temperature (mean)	K
180	Specific humidity (mean)	$kg\ kg^{-1}$

Table 12-8 Discontinued parameter in land surface diagnostic fields (fcst_phyland).

Code figure	Field parameter	Unit	Level
86	Soil moisture content	Proportion	Underground layers

12.5. Output interval

Most JRA-25 products were output at six-hourly intervals. In JRA-55 products, land surface and two-dimensional forecast fields are output at three-hourly intervals.

12.6. Vertical coordinates

12.6.1. Hybrid coordinates

In JRA-25 products, model level fields were produced for 40 hybrid levels. In JRA-55 products, they are produced for the 60 hybrid levels listed in Section 7.1.

12.6.2. Isentropic coordinates

In JRA-25 products, isentropic fields were produced for 20 isentropic surfaces (270, 280, 290, 300, 310, 320, 330, 340, 350, 360, 370, 380, 390, 400, 425, 450, 475, 550, 650 and 750 K). In JRA-55 products, they are produced for the 21 isentropic surfaces listed in Section 7.2 (850 K has been added).

12.7. Monthly statistics

Monthly statistics for JRA-25 products were saved in 4-byte big-endian floating point format. For JRA-55 products, they are saved in GRIB Edition 1 format (WMO 2011) in the same way as daily data.

While only monthly averages were produced in JRA-25 products, variances are also produced in JRA-55 products except for land surface and two-dimensional average diagnostic fields. Variance files are indicated by "_var" at the end of file names (Table 3-1).

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