JRA-55 Product Users' Handbook

1.25-degree latitude/longitude grid data

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September 2013

Change record

Version	Date	Remarks
1.0	30 September 2013	First version
2.0	3 March 2014	Corrected Table 4-1 Added a note to Table 4-2 and Table 4-8 Added B004 to Table 9-1
3.0	20 May 2014	Corrected Table 9-1 Linguistic corrections
4.0	22 May 2015	Added the comprehensive report on JRA-55 (Kobayashi et al. 2015) to References
5.0	14 Oct 2015	Added notes to advise not to use cloud work function and upward mass flux at cloud base in Table 4-12 Parameters of isobaric average diagnostic fields (fcst_phy3m125).
6.0	11 Oct 2018	Added B005 and BR05 to Table 9-1

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 naming 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. 1.25-degree latitude/longitude grid data

4.1.1. Constant fields (LL125)

Table 4-1 shows the parameters of constant fields.

Table 4-1 Parameters of constant fields (LL125).

Code figure	Field parameter	Unit
6	Geopotential	$m^2\ s^{-2}$
81	Land cover (1=land, 0=sea)	Proportion

4.1.2. Total column analysis fields (anl_column125)

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_column125).

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 10.3 “Parameter additions and changes”
Note: Precipitable water contains water vapour only.

4.1.3. Isentropic analysis fields (anl_isentrop125)

The parameters shown in Table 4-3 are vertically interpolated to the isentropic surfaces listed in Section 5.2 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_isentrop125).

Code figure	Field parameter	Unit	Filename
1	Pressure+	Pa	anl_isentrop125_pres
4	Potential vorticity	$K\ m^2\ kg^{-1}\ s^{-1}$	anl_isentrop125_pvor
7	Geopotential height	gpm	anl_isentrop125_hgt
33	u-component of wind	$m\ s^{-1}$	anl_isentrop125_ugrd
34	v-component of wind	$m\ s^{-1}$	anl_isentrop125_vgrd
37	Montgomery stream function	$m^2\ s^{-2}$	anl_isentrop125_mntsf
39	Vertical velocity	$Pa\ s^{-1}$	anl_isentrop125_vvel
51	Specific humidity	$kg\ kg^{-1}$	anl_isentrop125_spfh
132	Square of Brunt-Vaisala frequency	s^{-2}	anl_isentrop125_bvf2

+ See Section 10.3 “Parameter additions and changes”

4.1.4. Land surface analysis fields (anl_land125)

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_land125).

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. Isobaric analysis fields (anl_p125)

The parameters shown in Table 4-5 are vertically interpolated to the isobaric surfaces listed in Section 5.1 except dew-point depression (or deficit), specific humidity and relative humidity, which are interpolated to 27 levels from 1000 to 100 hPa only. These fields are produced every six hours at 00, 06, 12 and 18 UTC.

Table 4-5 Parameters of isobaric analysis fields (anl_p125).

Code figure	Field parameter	Unit	Filename
7	Geopotential height	gpm	anl_p125_hgt
11	Temperature	K	anl_p125_tmp
18	Dew-point depression (or deficit)	K	anl_p125_depr
33	u-component of wind	$m\ s^{-1}$	anl_p125_ugrd
34	v-component of wind	$m\ s^{-1}$	anl_p125_vgrd
35	Stream function	$m^2\ s^{-1}$	anl_p125_strm
36	Velocity potential	$m^2\ s^{-1}$	anl_p125_vpot
39	Vertical velocity	$Pa\ s^{-1}$	anl_p125_vvel
43	Ralative vorticity	s^{-1}	anl_p125_relv
44	Relative divergence	s^{-1}	anl_p125_reld
51	Specific humidity	$kg\ kg^{-1}$	anl_p125_spfh
52	Relative humidity[+]	%	anl_p125_rh

[+] See Section 10.3 “Parameter additions and changes”

4.1.6. Snow depth analysis fields (anl_snow125)

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_snow125).

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

4.1.7. Surface analysis fields (anl_surf125)

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_surf125).

Code figure	Field parameter	Unit	Level
1	Pressure	Pa	Ground or water surface
2	Pressure reduced to MSL	Pa	Mean sea level
11	Temperature	K	2m
13	Potential temperature	K	Ground or water surface
18	Dew-point depression (or deficit)	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

Note: The order of the parameters in monthly statistics and climatological normal files differs from that in daily files (Table 4-7), 1, 13, 2, 11, 18, 51, 52, 33 and 34.

4.1.8. Total column forecast fields (fcst_column125)

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_column125).

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 10.3 "Parameter additions and changes"
Note: Precipitable water contains water vapour only.

4.1.9. Land surface forecast fields (fcst_land125)

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_land125).

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 10.3 "Parameter additions and changes"

4.1.10. Isobaric forecast fields (fcst_p125)

The parameters shown in Table 4-10 are vertically interpolated to the isobaric surfaces listed in Section 5.1 except cloud cover, cloud water, cloud liquid water and cloud ice, which are interpolated to 27 levels from 1000 to 100 hPa only. These fields are output every six hours at 00, 06, 12 and 18 UTC.

Table 4-10 Parameters of isobaric forecast fields (fcst_p125).

Code figure	Field parameter	Unit	Filename
71	Cloud cover+	%	fcst_p125_tcdc
221	Cloud water	kg kg^{-1}	fcst_p125_cwat
228	Cloud liquid water+	kg kg^{-1}	fcst_p125_clwc
229	Cloud ice+	kg kg^{-1}	fcst_p125_ciwc
237	Ozone mixing ratio+	mg kg^{-1}	fcst_p125_ozone

+ See Section 10.3 “Parameter additions and changes”

4.1.11. Two-dimensional average diagnostic fields (fcst_phy2m125)

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_phy2m125).

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
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 10.3 “Parameter additions and changes”

4.1.12. Isobaric average diagnostic fields (fcst_phy3m125)

Isobaric 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 vertically interpolated to the isobaric surfaces listed in Section 5.1.

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

Table 4-12 Parameters of isobaric average diagnostic fields (fcst_phy3m125).

Code figure	Field parameter	Unit	Filename
146	Cloud work function#	J kg^{-1}	fcst_phy3m125_cwork
151	Adiabatic zonal acceleration	m s^{-1} day^{-1}	fcst_phy3m125_adua
165	Adiabatic meridional acceleration	m s^{-1} day^{-1}	fcst_phy3m125_adva
173	Gravity wave zonal acceleration	m s^{-1} day^{-1}	fcst_phy3m125_gwdua
174	Gravity wave meridional acceleration	m s^{-1} day^{-1}	fcst_phy3m125_gwdva
222	Adiabatic heating rate	K day^{-1}	fcst_phy3m125_adhr
230	Upward mass flux at cloud base##	kg m^{-2} s^{-1}	fcst_phy3m125_mflxb
231	Upward mass flux	kg m^{-2} s^{-1}	fcst_phy3m125_mflux
236	Adiabatic moistening rate	kg kg^{-1} day^{-1}	fcst_phy3m125_admr
239	Convective zonal acceleration	m s^{-1} day^{-1}	fcst_phy3m125_cnvua
240	Convective meridional acceleration	m s^{-1} day^{-1}	fcst_phy3m125_cnvva
241	Large scale condensation heating rate	K day^{-1}	fcst_phy3m125_lrghr
242	Convective heating rate	K day^{-1}	fcst_phy3m125_cnvhr
243	Convective moistening rate	kg kg^{-1} day^{-1}	fcst_phy3m125_cnvmr
246	Vertical diffusion heating rate	K day^{-1}	fcst_phy3m125_vdfhr
247	Vertical diffusion zonal acceleration	m s^{-1} day^{-1}	fcst_phy3m125_vdfua
248	Vertical diffusion meridional acceleration	m s^{-1} day^{-1}	fcst_phy3m125_vdfva
249	Vertical diffusion moistening rate	kg kg^{-1} day^{-1}	fcst_phy3m125_vdfmr
250	Solar radiative heating rate	K day^{-1}	fcst_phy3m125_swhr
251	Longwave radiative heating rate	K day^{-1}	fcst_phy3m125_lwhr
253	Large scale moistening rate	kg kg^{-1} day^{-1}	fcst_phy3m125_lrgmr

#, ## Cloud work function and upward mass flux at cloud base are variables that are used for computation in the cumulus convection scheme, and does not represent the atmospheric state. Therefore, when vertically interpolated to the isobaric surfaces, those variables lose their physical meaning. Please discard those data.

4.1.13. Land surface average diagnostic fields (fcst_phyland125)

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_phyland125).

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 10.3 “Parameter additions and changes”

4.1.14. Two-dimensional instantaneous diagnostic fields (fcst_surf125)

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_surf125).

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
18	Dew-point depression (or deficit)	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 10.3 “Parameter additions and changes”

4.1.15. Sea ice fields (ice125)

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

Table 4-15 Parameter of sea ice fields (ice125).

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

5. Vertical coordinates

5.1. Isobaric coordinates

Isobaric fields are produced for 37 isobaric surfaces (1000, 975, 950, 925, 900, 875, 850, 825, 800, 775, 750, 700, 650, 600, 550, 500, 450, 400, 350, 300, 250, 225, 200, 175, 150, 125, 100, 70, 50, 30, 20, 10, 7, 5, 3, 2 and 1 hPa) except dew-point depression (or deficit), specific humidity, relative humidity, cloud cover, cloud water, cloud liquid water and cloud ice, which are produced for 27 levels from 1000 to 100 hPa only.

5.2. 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.

6. Physical constants

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

Table 6-1 Physical constants.

Quantity	Value
Stefan-Boltzmann constant σ	5.67×10^{-8} W m^{-2} K^{-4}
Earth's radius	6.371×10^{6} m
Angular speed of Earth's rotation	7.29245×10^{-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	2.507×10^{6} J kg^{-1}
Solar constant	1365 W m^{-2}

7. Monthly statistics

7.1. 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 7-1 shows the meanings of the time range indicator encoded in Octet 21 of Section 1.

7.2. 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 7-1 shows the meanings of the time range indicator encoded in Octet 21 of Section 1.

Table 7-1 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

8. Climatological normals

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

8.1. 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 the presence or absence of filtering.

8.2. Monthly mean climatological normals

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

9. Production streams

The JRA-55 production was organized into several streams as shown in Table 9-1 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 9-1 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 9-1 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

10. Differences from JRA-25 products

10.1. Parameter classification

JRA-25 products contained categories in which two- and three-dimensional fields were put together. These 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 10-1　Example of category change (for anl_p).

JRA-25	JRA-55
anl_p	*Isobaric analysis fields*
	anl_p125_hgt (geopotential height)
	anl_p125_tmp (temperature)
	…
	Surface analysis fields
	anl_surf125

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 10-2　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.

10.2. 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 10-3　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

10.3. 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 *.

10.4. Discontinued parameters

Table 10-4 Discontinued parameters in isobaric analysis fields (anl_chipsi).

Code figure	Field parameter	Unit	Level
35	Stream function	$m^2 s^{-1}$	10m
36	Velocity potential	$m^2 s^{-1}$	10m
43	Ralative vorticity	s^{-1}	10m
44	Relative divergence	s^{-1}	10m

Table 10-5 Discontinued parameter in isentropic analysis fields (anl_isentrop).

Code figure	Field parameter	Unit
11	Temperature	K

Table 10-6 Discontinued parameters intwo-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_surf125).

Table 10-7 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 10-8 Discontinued parameter in land surface diagnostic fields (fcst_phyland).

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

10.5. 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.

10.6. Vertical coordinates

10.6.1. Isobaric coordinates

In JRA-25 products, isobaric fields were produced for 23 isobaric surfaces (1000, 925, 850, 700, 600, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, 10, 7, 5, 3, 2, 1 and 0.4 hPa). In JRA-55 products, they are produced for the 37 isobaric surfaces listed in Section 5.1 (975, 950, 900, 875, 825, 800, 775, 750, 650, 550, 450, 350, 225, 175 and 125 hPa have been added, and 0.4 hPa has been omitted).

10.6.2. 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 5.2 (850 K has been added).

10.7. 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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