



Current practice, tools, and users for observations feedback at JMA

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Outline

- Observational data sources for JRA-55
- The major components of the JRA-55 data assimilation system and the data flow
- Database for feedback information
 - Data format
 - Library and tools
 - Examples
- Observation feedback archive
- Data policy



Observational data sources for JRA-55 (Conventional data)

Data supplier	Data type and suppliers' identifiers	Period	Note
Conventional data			
ECMWF		Jan 1958 – Aug 2002	Uppala et al. (2005)
JMA		Jan 1961 –	
	GAME and SCSMEX	Apr 1998 – Oct 1998	
NCEP/NCAR	SYNOP and upper-level observations	Jan 1979 – Dec 1979	Kalnay et al. (1996) Kistler et al. (2001)
M. Yamanaka	Radiosondes from Indonesia	Nov 1991 – May 1999	N. Okamoto et al. (2003)
M. Fiorino	TCRs	Jan 1958 –	Fiorino (2002)
RIHMI	Snow depths from Russia	Jan 1958 – Dec 2008	http://meteo.ru/english/climate/snow.php
UCAR	Snow depths from USA	Jan 1958 – Aug 2011	NCDC et al. (1981)
Monthly Surface Meteorological Data in China	Snow depths from China	Jan 1971 – Dec 2006	Digitized from printed matters
IMH	Snow depths from Mongolia	Jan 1975 – Dec 2007	

Observations shown in plain cells were added or reprocessed after JRA-25, whereas those in shaded cells are the same as used in JRA-25.

From Kobayashi et al. 2015, *J. Meteor. Soc. Japan*, 93.



Observational data sources for JRA-55 (Satellite radiances)

Satellite radiances			
ECMWF	VTPR	Jan 1973 – Feb 1979	Uppala et al. (2005)
	HIRS and SSU	Nov 1978 – Dec 2000	
	MSU and AMSU	Nov 1978 – May 2003	
NOAA/NCDC	SSM/I	Jun 1987 – Dec 2004	
NOAA/CLASS	AMSU and MHS	Aug 1998 –	
	SSM/I	Jul 1987 –	
JMA	AMSU and MHS	Jun 2003 –	
	SSM/I and SSMIS	Mar 2006 –	
	TMI	Dec 2011 –	
	CSR	Jun 2005 –	
JMA/MSC	Reprocessed CSRs from <i>GMS-5</i> , <i>GOES 9</i> and <i>MTSAT-1R</i>	Jul 1995 – Dec 2009	
JAXA, NASA	Reprocessed TMI Version 7	Feb 1998 – Dec 2011	
JAXA	Reprocessed AMSR-E Version 3	Jun 2002 – Oct 2011	
EUMETSAT	CSRs from the Meteosat series	Jan 2001 – Aug 2009	

Observations shown in plain cells were added or reprocessed after JRA-25, whereas those in shaded cells are the same as used in JRA-25.

[From Kobayashi et al. 2015, *J. Meteor. Soc. Japan*, 93.](#)



Observational data sources for JRA-55 (AMVs, scatterometer and GNSS-RO)

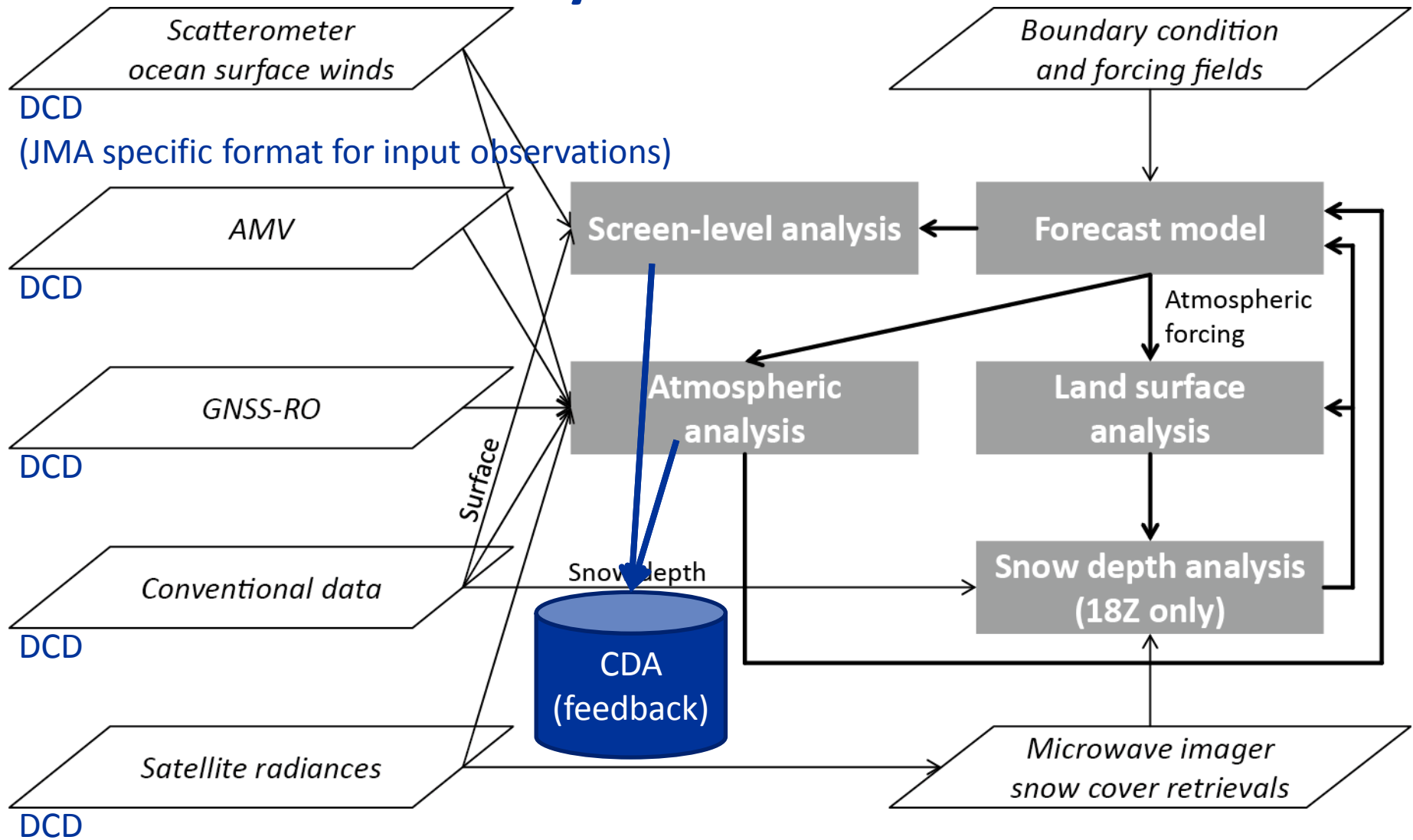
AMVs			
ECMWF	GMS, Meteosat and GOES	Jan 1979 – Dec 1997	Uppala et al. (2005)
JMA	GMS, MTSAT, Meteosat and GOES	Dec 1979 – Dec 1980 Jan 1998 –	
	MODIS	Jun 2004 –	
JMA/MSR	Reprocessed GMS, <i>GOES 9</i> and <i>MTSAT-1R</i>	Jan 1979 – Nov 1979 Mar 1987 – Sep 2009	
EUMETSAT	Reprocessed <i>Meteosat-2</i>	May 1982 – Aug 1988	van de Berg et al. (2002)
	Reprocessed <i>Meteosat-3</i> to <i>-7</i>	Aug 1988 – Nov 1988 Jan 1989 – Dec 2000	
		<i>Meteosat-5</i> and <i>-7</i>	Jan 2001 – Feb 2001
Scatterometer ocean surface winds			
ESA	Reprocessed AMI (ERS.ASPS20.N)	May 1997 – Jan 2001	De Chiara et al. (2007) Hersbach (2008)
JPL	Reprocessed SeaWinds from <i>QuikSCAT</i> (QSCAT_LEVEL_2B_V2)	Jul 1999 – Nov 2009	Dunbar et al. (2006)
JMA	ASCAT	Jan 2008 –	
GNSS-RO refractivities			
CDAAC	Reprocessed CHAMP, SAC-C, COSMIC, GRACE, Metop-A, TerraSAR-X and C/NOFS	Jul 2006 – Jun 2012	
JMA	COSMIC, GRACE, Metop, TerraSAR-X and C/NOFS	Jun 2012 –	

Observations shown in plain cells were added or reprocessed after JRA-25, whereas those in shaded cells are the same as used in JRA-25.

[From Kobayashi et al. 2015, *J. Meteor. Soc. Japan*, 93.](#)



The main components of the JRA-55 data assimilation system and the data flow



From Kobayashi et al. 2015, *J. Meteor. Soc. Japan*, 93.



Comprehensive Database for Assimilation (CDA)

Version 2

- Database of observational data containing various kinds of feedback information
 - Any information concerning observational data can be preserved.
 - Each value can be stored in either format of 2 byte integer or 4 byte real.
 - Observation at one location is managed by one record.
 - CDA makes monitoring works concerning observational data easier.
 - CDA can be handled easily and quickly accessed.
- Version 1 was introduced in March 1996, and upgraded to Version 2 in May 2001.

From Onogi 2002, Comprehensive Database for Assimilation (CDA) version 2 documentation.



Outline of CDA

- Record type
 - Date record (optional)
 - Document record (optional)
 - Data record
- Data record
 - Part 1: index
 - Part 2: information on reporting the data
 - Part 3: characteristics of the data
 - Part 4: data
- CDA files can be combined with the UNIX 'cat' command.



CDA part 1: index

Address	Format	Meaning	Explaining
1	I2	Record Length	The whole length of the record
2	I2	Length of Part 1	=14 (Fixed)
3	I2	Length of Part 2	
4	I2	Length of Part 3	
5	I2	Length of Part 4	
6	I2	Length of Part 5	(= 0)
7	I2	Record type number	It means Stage of CDA record See table 3-1
8	I2	Data type number	It means data type See table 3-2
9	I2	Latitude	Unit 0.01degree, From -9000 (South Pole) to 9000 (North Pole)
10	I2	Longitude	Unit 0.01degree, From -18000 to 17999 From -18000 to 17999 For Western Hemisphere longitude is expressed by minus.
11,12	I4	Observation time	Sequential minutes counted from 1801. 1. 1 00:00
13	I2	CDA version number	200 (means version 2.00)
14	I2	Byte number	Byte number for archived in part 4 2: 2 byte integer 4: 4 byte real



Data type numbers (sample)

Surface Observation 1000-1999	SYNOP	1100	SYNOP outside Japan
		1190	offline snow data(for JRA)
		1200	SYNOP inside Japan
		1250	SYNOP inside Japan (Auto-report)
	AMeDAS	1400	AMeDAS
	METAR	1800	METAR(Japan)
		1810	METAR-AUTO(Japan)
		1820	SCAN(Japan)
		1840	SPECI(Japan)
		1900	METAR(Outside Japan)
		1910	METAR-AUTO(Outside Japan)
		1940	SPECI(Outside Japan)
		1950	SPECI-AUTO(Outside Japan)
Sea Observation 2000-2999	SHIP	2100	moored buoy, platform
		2200	SHIP
		2300	Japanese fishing ship
		2400	BATHY
	BUOY	2800	drifting buoy
Upper Observation (sonde) 3000-3999	TEMP/PILOT (CDA)	3000	TEMP (rawinsonde)
		3010	TEMP+PILOT merged (rawinsonde) (There are some stations which divide one observation into TEMP and PILOT report. Stupid!)
		3020	PILOT (rawin)



CDA part 3: characteristics of the data

Element QC judgment codes

QC judge	meaning
0	Normal data (passed)
1	The element was not reported but newly made by translation from reported element in QC procedure.
2	Observed value is corrected by QC. (ex. bias correction)
3	The element was artificially created. (ex. GMS moisture bogus)
4	The reported value is considered error but corrected by QC.
5	(not defined)
6	Suspect data
7	Rejected data



CDA part 3: characteristics of the data

Element QC event codes (sample)

QC judgment (JEQC) 0,2,4,6,7	QC event (KEQC)	Meaning
	1	Blacklist
	2	Climatorological check
	3	Element consistency check
	4	Observed value correction (bias correction)
	5	Temperature lapse rate check
	6	Temperature interpolation check
	7	Humidity interpolation check
	8	hydrostatic check
	9	icing check
	10	Wind shear check
	11	Wind interpolation check
	12	Decode and observation QC information are given
	13	Sea surface pressure reduction check
	14	QC of SATOB QI (Quality Indicator)
	15	Gross Error check
	16	Space consistency check (correction method)
	17	Space consistency check
	18	Space consistency check (multi-variate optimum interpolation method)
	19	SATOB height reassignment



CDA part 4: data

Element information (1)

Term	Variable name used in QC	Element information code (group)	Element Information code (each)
Element translation; data creation		0 - 9	
Element generated by element translation	ELTR		1
Created element	ELMD		3
Used and Thinning flags		10 - 19	
Used flag (duplicated with IUSE)	IUSE		10
Thinning flags	THIN		11
Reported observation value	OBRP	100 - 199	100
super observation			(110)
averaged observation value for certain period.			(120)
Quality Controlled observation value	OBQC	200 - 299	200
Temporally corrected value in the middle of QC procedure			(201,202,...)
Reliability	RELY	300 - 399	300
Observation error	OBER	400 - 499	400
Departure	DVAL	500 - 599	500
Departure used in space consistency check	DVSC		510



CDA part 4: data

Element information (2)

Term	Variable name used in QC	Element information code (group)	Element Information code (each)
First Guess value	GUES	600 - 699	600
FG corrected by VarBC (first iteration)			601
FG corrected by VarBC (last iteration)			602
Background error (Forecast error)	GSER	700 - 799	
Forecast error in OI			700
Spacial variabilities of First Guess	GSDH	800 - 899	800
Smoothed			810
Temporal variabilities of First Guess	GSDT	900 - 999	900
Smoothed			910
Analysis value	ANAL	1000 - 1099	1000
Threshold value of gross error check and space consistency check		1100 - 1199	
QC final judgement (duplicated to JGQC)	JGQC		1100
Thresholds by spacial variability (pass, spcchk, reject)	THPS THSC THRJ		1111 1121 1131
Thresholds by temporal variability (pass, spcchk, reject)	TTPS TTSC TTRJ		1112 1122 1132



CDA library and tools for UNIX and linux

- CDA library
 - cdard.f: reads a CDA record.
 - cdaunpk.f: decodes the CDA part 4.
 - cdawt.f: writes a CDA record.
 - cdapack.f: encodes the CDA part 4.
- CDA tools
 - cdd: dumps CDA records into ASCII.
 - cdk: counts the number of records in a CDA file.



Example: SYNOP

NAME	YYYY	MO	DD	HH	MN	TYPE	ID	LAT	LON	IBOX	JBOX	LS	ELEV	MDTP	RCQC	VER	BYTE
47662	2014	10	08	00	00	600	1200	3568	13977	249	96	0	37	81	*	2	2

P1: 371 14 10 12 335 0 600 1200 3568 13977
112430880 201 2

P2: 10 1008 0 0 0 249 96 86 AMAD

P3: 1001 -32768 47662 0 37 81 1
12 1

NH = 1 LV X Surface

ELEM	OB RP	OB QC	GUES	DVAL	ANAL	GSDH	GSDT	OBER	GSER	RELY
EW U	0.72	0.72	-0.17	0.88	-0.22	4.68	-9.89	2.10	3.00	x
2819	USE=0	QC=1	0-000	1-001	0-015					
SN V	-1.97	-1.97	-1.31	-0.66	-1.79	14.57	4.59	2.30	3.00	y
2820	USE=0	QC=1	0-000	1-001	0-015					
T	293.30	293.25	290.98	2.27	291.55	58.30	31.62	1.30	3.00	y
3073	USE=0	QC=2	2-026	0-002	0-003	0-015				
RH	64.88	64.88	65.88	-1.00	65.03	81.70	-104.66	6.40	10.00	x
3331	USE=1	QC=2	2-026	2-000	1-014	0-015				
PS	1018.9	1018.9	1019.1	-0.22	1018.9	x	x	x	x	x
2564	USE=0	QC=0	0-002	0-013	0-003	1-007				

Temperature
BUFR: 0-12-001
CDA: 3073
(=12x256+1)



Example: TEMP

NAME	YYYY	MO	DD	HH	MN	TYPE	ID	LAT	LON	IBOX	JBOX	LS	ELEV	MDTP	RCQC	VER	BYTE
47646	2014	10	08	00	00	600	3000	3605	14013	250	96	0	27	31	*	2	2

P1: 11244 14 14 14 11202 0 600 3000 3605 14013

112430880 201 2

P2: 24 1008 0 0 0 250 96

2023 34765 3756 34777

P3: 3001 -32768 47646 0 27 31 7

7 22 8 -30

NH = 27 LV 500.0 hPa Standard

ELEM	OBRP	OBQC	GUES	DVAL	ANAL	GSDH	GSDT	OBER	GSER	RELY
Z	5770.	5770.	5766.	4.2	5771.	181.47	-44.03	12.9	15.0	x

2567 USE=0 QC=0 0-012 0-002 0-008 0-015

EW U	21.02	21.02	20.77	0.25	21.27	45.24	23.75	2.80	3.00	x
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2819 USE=1 QC=1 0-000 1-001 0-015

SN V	-1.84	-1.84	-0.71	-1.13	-1.72	12.99	3.79	2.80	3.00	x
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2820 USE=1 QC=1 0-000 1-001 0-015

T	258.70	258.65	258.56	0.09	258.49	11.01	-2.80	1.00	2.50	x
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3073 USE=1 QC=2 2-026 0-012 0-002 0-008 0-015



Example: AMDAR

NAME	YYYY	MO	DD	HH	MN	TYPE	ID	LAT	LON	IBOX	JBOX	LS	RCQC	VER	BYTE
JP9ZXYU9	2014	10	08	01	04	600	4200	4302	14185	253	83	0	0	2	2

P1: 177 14 10 11 142 0 600 4200 4302 14185
112430944 201 2

P2: 10 1008 104 0 15 253 83 840 ACRS

P3: 4001 1 JP9ZXYU9 0 -32768 -32768 -32768
61

NH = 1 LV 848.8 hPa (REPORT : 1520.0 M)

ELEM	OBRP	OBQC	GUES	DVAL	ANAL	GSDH	GSDT	OBER	GSER	RELY
EW U	6.21	6.21	9.12	-2.91	8.58	15.98	0.83	2.70	3.00	x
2819	USE=0	QC=1	0-000	1-001	0-015					
SN V	2.51	2.51	-2.97	5.47	-3.48	11.47	-5.24	2.60	3.00	x
2820	USE=0	QC=1	0-000	1-001	0-015					
T	275.20	275.27	274.78	0.49	274.69	12.81	6.86	1.30	2.50	x
3073	USE=0	QC=6	2-026	6-001	0-002	2-004	0-015			
DD	248.0	248.0	288.0	-40.01	292.1	x	x	x	x	x
2817	USE=0	QC=0	0-002	1-001						
FF	6.70	6.70	9.59	-2.89	9.26	x	x	x	x	x
2818	USE=0	QC=0	0-002	1-001						



Example: MTSAT visible wind

NAME	YYYY	MO	DD	HH	MN	TYPE	ID	LAT	LON	IBOX	JBOX	LS	RCQC	VER	BYTE
0172-034	2014	10	07	23	31	600	10321	5150	16900	301	68	1	*	2	2

P1: 182 14 10 15 143 0 600 10321 5150 16900
112430851 201 2

P2: 10 1007 2331 0 15 301 68 0 MSC

P3: 10005 -32768 0172-034 1 2 89 88
0 70 24671 6306 -32768

NH = 1 LV 851.1 hPa Cloud-Top

ELEM	OBRP	OBQC	GUES	DVAL	ANAL	GSDH	GSDT	OBER	GSER	RELY
EW U	-11.03	-11.03	-11.75	0.72	-12.22	31.93	17.79	4.50	3.00	89
2819	USE=1	QC=1	0-000	1-001	0-015					
SN V	-7.44	-7.44	-6.61	-0.83	-6.60	27.60	1.45	4.50	3.00	89
2820	USE=1	QC=1	0-000	1-001	0-015					
T	273.20	273.20	275.26	-2.06	275.12	4.25	-0.51	1.61	2.50	89
3073	USE=0	QC=0	0-002	0-015						
DD	56.0	56.0	60.6	-4.64	61.6	x	x	x	x	89
2817	USE=0	QC=0	0-002	1-001						
FF	13.30	13.30	13.48	-0.18	13.89	x	x	x	x	89
2818	USE=0	QC=0	0-002	1-001						



Example: GNSS-RO from IGOR

NAME	YYYY	MO	DD	HH	MN	TYPE	ID	LAT	LOX	IBOX	JBOX	LS	RCQC	VER	BYTE
0740-060	2014	10	07	22	12	600	14520	8955	11543	103	0	*	0	2	2

P1: 78 14 16 20 28 0 600 14520 8955 11543
112430772 201 2

P2: 12 1007 2212 0 15 103 0 8915 WTB
3000000 89558660 115437930

P3: 14002 0 0740-060 1241 120 -32768 -32768
-32768 -32768 -32768 -32768 -32768 -32768 -32768 -32768 -32768 -32768

NH = 1 LV 14482.0 M

ELEM	OBRP	OBQC	GUES	DVAL	ANAL	GSDH	GSDT	OBER	GSER	RELY
15619	44.2	44.2	44.2	-0.05	44.2	x	x	0.61	x	100
USE=1 QC=0 0-002										



Example: AMSU-A

NAME	YYYY	MO	DD	HH	MN	TYPE	ID	LAT	LON	IBOX	JBOX	LS	RCQC	VER	BYTE
0209-160	2014	10	07	21	54	600	15310	8922	-2528	298	1	2	0	2	2

P1: 767 14 10 50 693 0 600 15310 8922 -2528
112430754 201 2

P2: 10 1007 2154 0 0 298 1 -2147450880 GTS

P3: 20000 1 0209-160 2 -9999 141 30
5810 32692 9604 30635 2 -32768 0 0 -32768 -32768
-32768 -32768 17287 -21278 -32768 -32768 16613 -5869 -32768 -32768
16515 25109 -32768 -32768 -32768 -32768 -32768 -32768 0 -17189
-32768 -32768 -32768 3 -32768 -32768 -32768 -32768 -32768 -32768

NH = 9 CH 9 CH

ELEM	OBRP	OBQC	GUES	DVAL	ANAL	GSDH	GSDT	OBER	GSER	RELY
TBB	211.96	211.96	211.65	-0.60	211.78	x	x	0.48	x	x
3134	USE=1	QC=2	0-100	2-105						
3825	x	90.0	x	x	x	x	x	x	x	x
	USE=1	QC=0	0-100							



Example: ASCAT wind vector

NAME	YYYY	MO	DD	HH	MN	TYPE	ID	LAT	LON	IBOX	JBOX	LS	RCQC	VER	BYTE
0004-099	2014	10	08	01	07	600	16510	8005	13212	235	17	1	0	2	2

P1: 262 14 10 16 222 0 600 16510 8005 13212
112430947 201 2

P2: 10 1008 107 0 15 235 17 0 FTP

P3: 16001 1 0004-099 1 610 40 0
0 0 0 -24189 0 21

NH = 1 LV X Surface

ELEM	OB RP	OB QC	GUES	DVAL	ANAL	GSDH	GSDT	OBER	GSER	RELY
EW U	-0.59	-0.59	-0.66	0.06	-1.60	x	x	4.00	3.00	x
2819	USE=1	QC=0	0-021							
SN V	-5.54	-5.54	-4.94	-0.59	-5.59	x	x	4.00	3.00	x
2820	USE=1	QC=0	0-021							

NH = 2 LV 1020.3 hPa Free

ELEM	OB RP	OB QC	GUES	DVAL	ANAL	GSDH	GSDT	OBER	GSER	RELY
EW U	-0.59	-0.59	-0.66	0.06	-1.33	x	x	4.00	3.00	x
2819	USE=1	QC=0	0-021							
SN V	-5.54	-5.54	-4.94	-0.59	-5.51	x	x	4.00	3.00	x
2820	USE=1	QC=0	0-021							

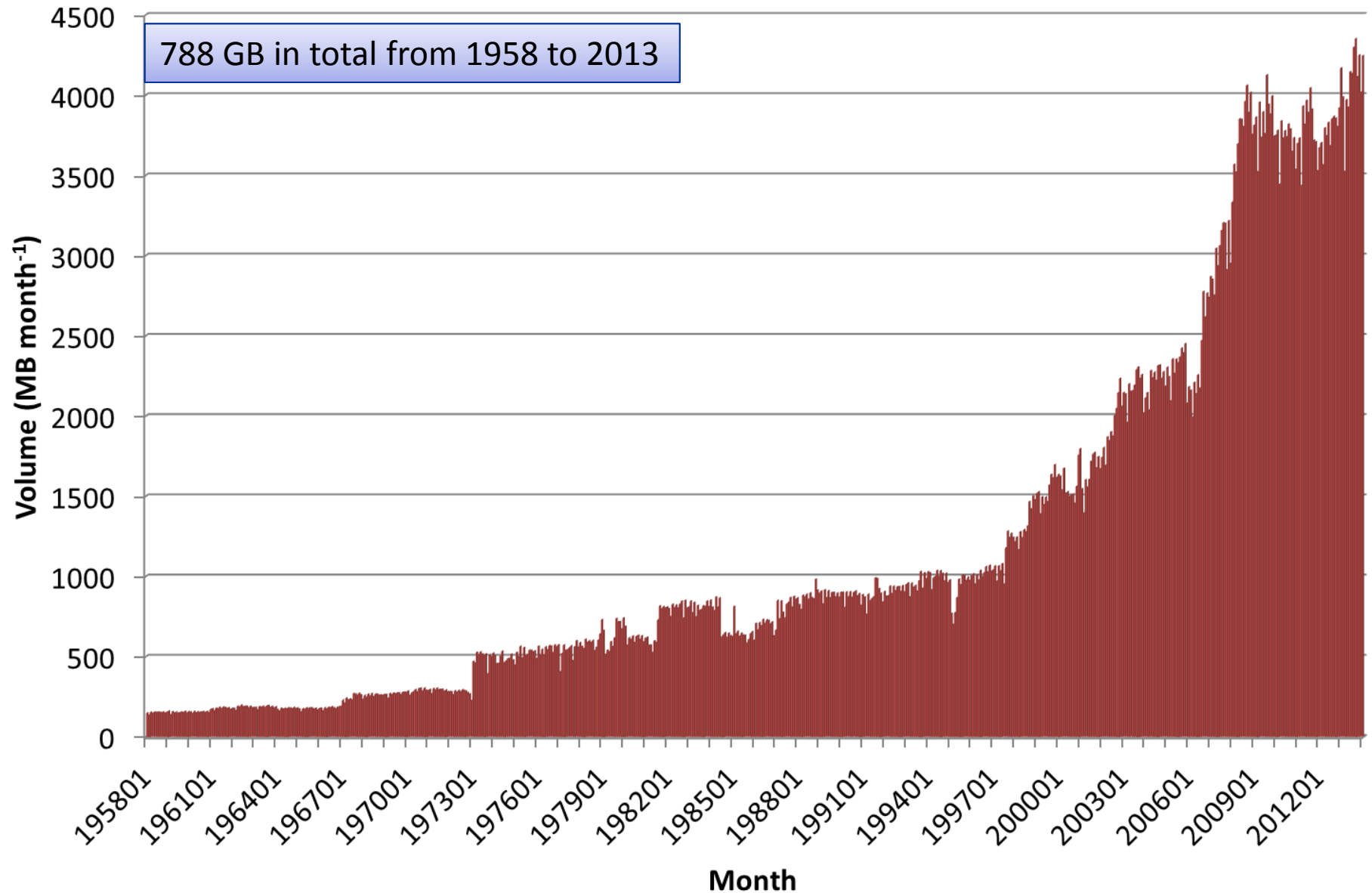


Observation feedback archive

- JRA feedback data are archived in the mass storage system
 - Accessible to internal users of the JMA super computer system.
 - Used for non-real time quality monitoring, forecast verification, input for data assimilation experiments, and so on.
- Not provided to external users so far
 - If that is realised, the same terms and conditions as for the JRA product would apply.



Data volume (bzipped)





Terms and conditions for JRA products (as of Oct 2014)

http://jra.kishou.go.jp/comm/application_en.html

a. Conditions of use

1. Individual users must register their name, affiliation, email address and purpose of use with JMA before access to datasets will be permitted.
2. Individual users should not redistribute datasets to any third party without JMA's prior consent. The use of datasets for commercial purposes is also prohibited.
3. The source of the datasets should be duly acknowledged in scientific and technical papers, publications, press releases and other communications involving the data.
4. Individual users should provide JMA with a copy of their scientific or technical papers, publications, press releases or other communications involving the data.

b. Disclaimer

- Although JMA has taken the utmost care in creating the datasets, it assumes no responsibility regarding their reliability. JMA is not responsible for any damage that may result from their use.

c. Intellectual property

- The intellectual property rights of the datasets belong exclusively to JMA.