

NWP Systems and Use of ATOVS (2010 Questionnaire)

Table 1: Overview

Institute	Data Assimilation System		Radiative Transfer Model	ATTOVS assimilated			Bias Correction Scheme	Monitoring Web Page
	Global	Regional or Km Scale		Radiances	Retrievals	RARS		
EC	4DVAR & EnKF	3DVAR	RTTOV8.7	YES	NO	NO	off-line	YES
ECMWF	4DVAR		RTTOV9.2	YES	NO	YES	VAR	YES
NMI		3DVAR	RTTOV7	YES	NO	YES	off-line	NO
US-FNMOC/NRL	4DVAR	3DVAR	CRTM	YES	YES (RD)	NO	off-line	NO
DWD	3DVAR	nudging	RTTOV7	YES	NO	NO	off-line	YES
Met Office	4DVAR	4DVAR	RTTOV7	YES	NO	YES	off-line	YES
DMI		3DVAR	RTTOV8.5	YES	NO	YES	off-line	YES
JMA	4DVAR	4DVAR	RTTOV9.3	YES	YES (RD)	YES	VAR	YES
Meteo-France	4DVAR+ Ens	3DVAR	RTTOV8.5,9	YES	NO	YES	VAR	YES
US-NCEP	A-VAR	A-VAR	CRTM	YES	NO	YES	VAR	YES
BoM	4DVAR	4DVAR	RTTOV7	YES	NO	NO	off-line	NO
CPTEC/INPE	LETKF	LETKF	N/A	NO	YES	N/A	N/A	NO

G global

R regional

GD global deterministic

RD regional deterministic

Table prepared by ITWG/NWP WG

Table 2 NWP Systems and Use of ATOVS (2010 Questionnaire)

Table prepared by ITWG/NWP WG

Institute	Global		Regional		Data Assimilation	Radiative Transfer Model	ATOVS Radiance Assim (Level)	ATOVS Retrievals Assim	RARS
	Deterministic	Ensemble	Deterministic	Ensemble					
EC (Canada)	35 km L80 (10d)	100 km L58 (20m) (16d)	15 km L80 (2d) 2.5 km L58		GD: 4D-Var 180 km L80 GE: EnKF 100 km (96m) R15km: 3D-Var 55 km L80	RTTOV 8.7	Level 1b processed to 1c with AAPP	NO	NO
ECMWF (Europe)	T799 L91 (10d)	T399/T255 L62 (51m) (15d: 9d at T399)			4D-Var T799 L91 with T255 final inner loop	RTTOV 9.2	Level 1c (after antenna pattern correction)	NO	EARS AP-RARS
NMI (Norway)			8 km L60 (2.75d) 12 km L60		3D-Var	RTTOV 7	Level 1c	NO	EARS
FNOC/NRL (USA)	T239 L42 (7.5d)	T119 L30 (24m) (10d)			GD: 4D-Var-AR T119 L42 GE: 4D-Var-AR T119 L30 RD: 3D-Var 27/9/ 3 km	CRTM	Level 1b	YES (RD)	coming soon
DWD (Germany)	30 km L60 (7d)	<i>(perhaps in 2011)</i>	7 km L40 2.8 km L50	<i>(perhaps in 2012)</i>	GD: 3D-Var RD: nudging	RTTOV 7	Level 1b/1c preproc AAPP	NO	NO
Met Office (UK)	25 km L70 (6d)	60 km L70 (24m) (3d)	12 km L38 1.5 km L70	16 km (24m) (2d)	G: 4D-Var 75 km L70 R12km: 4D-Var 24 km R1.5km: 3D-Var + Latent Heat nudging 1.5 km	RTTOV 7	Level 1b/1c	NO	EARS AP-RARS SA-RARS
DMI (Denmark)			0.15 deg (16 km) L40 0.09 deg (10 km) L40 0.03 deg (3.3 km) L40 0.05 deg (5.6 km) L40		3D-Var 0.15 deg L40 3D-Var 0.09 deg L40 3D-Var 0.03 deg L40 incremental	RTTOV 8.5	Level 1c from AAPP	NO	EARS
JMA (Japan)	T959 L60 (9d)	T319 L60 (51m) (9d)	5 km L50	T319 L60 (11m) (5d)	G: 4D-Var T159 L60 R: 4D-Var 15 km	RTTOV 9.3	Level 1c	YES (RD)	EARS AP-RARS
Météo France (France)	T799 L70 (4d)	T358 L65 (30m) (4d)	2.5 km L60	25 km (30m) (4d)	G: 4D-Var+ensemble T350 L70 R: 3D-Var 2.5 km	RTTOV 8.5 RTTOV 9 in e-suite	Level 1c	NO	EARS
NCEP (USA)	T574 L64 (7.5d) T190 L64 (16d)	T190 L28 (88m) (16d)	12 km L60 4 km L50	32 km (21m) (3.6d)	G: Advanced-Var T382 L64 R: Advanced-Var 12 km	CRTM	Level 1b	NO	YES (G)
BoM (Australia)	80 km L 50 (10d)	T119 L19 (33m)	37.5 km L50		G: 4D-Var 100 km L50 R: 4D-Var 75 km L50	RTTOV 7	Level-1d from AAPP from Met Office	NO	NO
CPTEC/INPE (Brazil)	20 km L96 (7d)	50 km L42 (40m) (15d)	10 km L50	20 km (21m) (10d)	G: LETKF 40 km R: LETKF 20 km	n/a	NO	YES	n/a

CODES

G global
R regional
GD global deterministic
RD regional deterministic
GE global ensemble
RE regional ensemble

T_n truncation wavenumber
L_n number of levels
(nd) number of days
(nm) number of members

Table 3

Use of ATOVS Radiances in NWP (2010 Questionnaire)

Table prepared by ITWG/NWP WG

Centre	NWP Systems using ATOVS	Thinning	Bias Corr.	Other Preproc	AMSU-A									AMSU-B/MHS									HIRS								
					Satellites					Channels				Satellites					Channels				Satellites					Channels			
					N	N	N	N	A	M	land/	sea/lo	sea	1	1	1	1	A	M	land/	sea/lo	sea	1	1	1	1	A	M	land/	sea/lo	sea
					5	6	7	8	9	Q	MO	sea	topo	5	6	7	8	9	Q	O	sea	topo	5	6	7	8	9	Q	O	sea	topo
EC (Canada)	GD, RD, GE	G=250 km ¹ R=250 km ¹	HK off-line dynamic ²	screen for CLW and precip.	X	X	X	X	X	X	7-14	6	4-5	X	X	X	X	X	3-4	2,5											
ECMWF (Europe)	GD, GE	125 km	variational		X		X	X	X	X	7-14	5-6				X	X	3-4	5			X	X	X		12	4-7, 11, 14, 15				
NMI (Norway)	RD (HIRLAM)	50 km	before assim.	cloud-clearing	X	X							4-10																		
FNMO/NRL (USA)	GD	140 km ⁴	HK off-line dynamic ⁵	screen for high CLW	X	X	X	X	X	X	6-10		4-5	See Note 3																	
DWD (Germany)	GD	200 km	off-line static ⁶	cloud-clearing	X	X	X	X	X			6-15																			
Met Office (UK)	GD, RD	G=154 km R=80 km	off-line	Calibration. Remap to HIRS	X		X	X	X	6-14		4-5	X		X	X	X		3-5					G	G		4-7, 11, 12, 15				
DMI (Denmark)	RD (HIRLAM)	0.9 deg (100 km)	HK off-line static		X	X	X	X	X			4-10 ⁷			X	X	X		3-5												
JMA (Japan)	GD, GE	AMSU-A 200 km AMSU-B 180 km	off-line for scan bias, remainder with variational	cloud/rain classification	X	X	X	X	X	6-13		4-5	X		X	X	X		3-5												
Météo France (France)	GD, RD	250 km 125 km e-suite	variational		X	X	X	X	X	5-13 ^{8,9}					X	X	3-4	5			X			X	12	4-7, 11, 14, 15					
NCEP (USA)	GD, RD	G=145 km R=120 km IR, 60 km MW	variational	See Note 10	X		X	G	X	X	1-13, 15			X		X	X	1-5				X	G	X	2-15						
BoM (Australia)	GD, RD	G=154 km R=80 km	HK off-line ¹¹	See Note 12			X		X	7-14	6	4-5			X	X		3-5			X			X		4-7, 11, 12, 15					
CPTEC/INPE (Brazil)	See Table 3 (retrievals)																														

NOTE: All centers reject some channels from certain satellites for which the radiance data are known to be bad. These details are not provided here.

CODES

- G global
- R regional
- GD global deterministic
- RD regional deterministic
- GE global ensemble
- RE regional ensemble

- Nxx, xx NOAA xx
- MO Metop-A
- AQ Aqua

- off-line dynamic bias corrections updated and applied to data before each analysis
- variational e.g. VarBC where bias corrections are computed during variational analysis as part of minimization
- HK Harris Kelly type bias correction (thickness predictors)
- sea/lo topo assimilated over ocean and low topography land
- CLW cloud liquid water

NOTES

- 1 Thinning to be reduced to 150 km (currently being tested)
- 2 Bias correction is off-line static for AMSU-A channels 11-14
- 3 AMSU-B/MHS assimilation is being tested
- 4 Start with taking every 4th point along scan, from every other scan line (skipping pattern to sample every scan point), then further reduce to approximately 140 km.
- 5 VarBC code developed, to be tested this spring.
- 6 Switch to an online bias correction scheme soon
- 7 Channels 4-5 not assimilated over sea ice
- 8 AMSU-A ch. 5-6 not assimilated over sea ice
- 9 AMSU-A channels in range 5-13 not assimilated. N15 (6,11) N16 (5-10,12) AQ (5-7) MO (7)
- 10 Calibration and for RARS data removal of antenna correction (G), Calibration (R)
- 11 Bias correction soon to become offline adaptive
- 12 Calibration and pre-processing via AAPP at Met Office.
Cloud detection, land/sea/ice determination in OPS pre-processor as part of Met Office UM suite

Table 4: Use of ATOVS Retrievals (2010 Questionnaire)

Centre	ATOVS Retrievals								
	Used in radiance assimilation (e.g. QC)	Assimilated	NWP System	Scheme / Product	Variable(s)	Vertical Resolution	Horizontal Sampling	Excluded	Bias Correction
EC (Canada)	NO	NO							
ECMWF (Europe)	NO	NO							
NMI (Norway)	NO	NO							
FNMO/NRL (USA)	NO	YES	RD (COAMPS, NAVDAS)	NESDIS	Temperature	Full to 10 mb	1.5 degrees (167 km)	over land	NO
DWD (Germany)	YES (1D-Var)	NO							
Met Office (UK)	YES ¹ (in GD)	NO							
DMI (Denmark)	NO	NO							
JMA (Japan)	NO	YES	RD	NESDIS and locally produced	Temperature	13 pressure levels (1000 to 50 mb)	50 km	over land	NO
Météo France (France)	NO	NO							
NCEP (USA)	NO	NO							
BoM (Australia)	YES	NO							
CPTEC/INPE (Brazil)	N/A	YES	GD	NESDIS	Thickness	Standard levels	100 km		NO

Table prepared by ITWG/NWP WG

NOTES

- Run 1D-var prior to assimilation which analyses skin temperature and for advanced IR sounders cloud cover which is used in the forward calculations 4D-var. Soon this will also be used to analyse emissivity.