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## Model info: global model history

This page lists the full operational history of the Met Office deterministic global model since the introduction of the UM in 1991. Whilst other sources (elsewhere in nwpscience and on OPCHANGE) will contain more detailed information, this page highlights the most significant changes all in one place.

Suite/Cycle No. (link to model info)	Implementation Date	Main Changes	Science results
<a href="#">OS39</a>	11 Jul 2017	Increase horizontal resolution to N1280 (10km) Replace RTTOV9 by RTTOV11 New ground GPS observation operator Improved snow analysis reconfiguration Upgrade to UM10.6	<a href="#">Summary</a> (Met Office internal link)
<a href="#">OS38</a>	8 Nov 2016	Use ATOVS, and AIRS and CrIS surface channels over land Satwind inversion correction and dry layer QC Use of geostationary (SEVIRI, MVIRI and AHI) WV channels over low cloud Introduction of FY-3B microwave humidity data Upgrade to UM10.4	<a href="#">Summary</a> (Met Office internal link)
<a href="#">OS37</a>	15 Mar 2016	Variational bias control (VarBC) for satellite radiances. CVT covariances and swapped vertical and horizontal transforms New ASCAT soil wetness climatology Assimilation of aircraft RH observations. Upgrade to UM10.2	<a href="#">Summary</a> (Met Office internal link)
<a href="#">OS36</a>	25 Aug 2015	Migration to Cray XC40 Supercomputer. Upgrade to UM 10.1 Minor package of changes to improve robustness: 1. Reduce solver tolerance ( <a href="#">also part of GA7</a> ) 2. Fix errors in ENDGame global orography ( <a href="#">also part of GA7</a> ) 3. Improved advection of theta in the 4D-Var PF model	<a href="#">Discussion of results</a> (Met Office internal link)
<a href="#">OS35</a>	3 Feb 2015	DA/SA changes: 1. Package of satellite changes 2. Tropical cyclone central pressure assimilation Model: 1. Prognostic dust set to interact with radiation	<a href="#">Report</a> (Met Office internal link)
<a href="#">OS34</a>	15 Jul 2014	Major UM upgrade - implementation of <a href="#">Global Atmosphere 6.1</a> and <a href="#">Global Land 6.1</a> : 1. ENDGame dynamical core 2. Radiation: Wenyi-Zhong LW, 1hr radiation ts, updated albedos and solar constant 3. BL: Reduced turbulent mixing and revised stability functions, revised diagnosis of shear-dominated boundary layers 4. Cloud: Improved cloud erosion, improved treatment of cirrus and smoother phase change for condensate detrained from convection 5. Precip: Abel and Boutle drizzle PSD, improved substepping 6. Convection: 5A convection scheme, increased deep entrainment rate, smoothed adaptive detrainment 7. GWD: 5A GWD scheme 8. Aerosols: 3D speciated climatologies used for indirect effects (replacing land/sea split) 9. Land Surface: LSH hydrology, updated thermal and momentum roughness lengths, tiled emissivity. Increase in model resolution 25 km to 17 km. Increase in assimilation resolution from 60 km km to 40 km	<a href="#">Report</a> (Met Office internal link)
<a href="#">OS33</a>	4 Feb 2014	Migration of operational suite to Rose. Upgrade to UM8.5	<a href="#">Emailed proposal</a> (Met Office internal link)
<a href="#">OS32</a>	30 Apr 2013	Introduction of NPP instruments CRIS & ATMS. AMDAR temperature bias correction. Introduce Dust assimilation. Replace Soil moisture nudging with EKF scheme	<a href="#">Report</a> (Met Office internal link)
<a href="#">OS31</a>	16 January 2013	Hybrid DA upgraded to use 44 member N400 MOGREPS-G data. Use of correlated IASI data and variable SatRad errors. Use more AMV and scatwind data.	<a href="#">Report</a> (Met Office internal link)
<a href="#">OS30</a>	17 September 2012	Migration to IBM P7. Upgrade to RTTOV9. Upgrade to UM8.2	-
<a href="#">OS29</a>	28 March 2012	Hybrid DA upgraded to use 6hrly MOGREPS-G cycle. Assimilate GroundGPS. Use more data in screen analysis.	<a href="#">Report</a> (Met Office internal link)
<a href="#">OS28</a>	17 January 2012	DA changes postponed to PS29, otherwise minor.	<a href="#">Report</a>

OS27	20 July 2011	DA changes - Hybrid Data Assimilation. Non-linear humidity transform. Assimilation of surface-sensitive IASI channels over land UM changes - Dust forecasting included, without radiative interaction or dust data assimilation.	<a href="#">Report</a> (Met Office internal link)
OS26	16 March 2011	UM physics changes - implementation of <a href="#">Global Atmosphere 3.1 and Global Land 3.1</a> : 1. Light rain package: Prognostic rain, 2 min microphysics substepping, Abel-Shipway fallspeeds, revised Cu diagnosis, PC2 bug-fixes 2. Radiation changes: 3Z radiation scheme, McICA cloud inhomogeneity, radiation on orographic slopes, upgraded SW spectral files/trace gasses 3. JULES land surface model (and 9A BL scheme) introduced 4. Opaque lid enhanced launch amplitude in USSP scheme 5. Other minor changes for consistency with climate model (GA3.0)	<a href="#">Report</a> (Met Office internal link)
G54/OS25	02 November 2010	1. Revision of model error covariance statistics, which are now based on ensemble differences rather than lagged forecast differences 2. increase in assimilation grid resolution from 90 km to 60 km 3. extra high-peaking satellite data to constrain mesospheric temperatures and reduce the incidence of upper boundary anomalies	<a href="#">Report</a> (Met Office internal link)
G53/OS24	14 July 2010	UM physics changes: 1. PC2 prognostic cloud scheme 2. 8C Boundary Layer scheme 3. Radiation upgrade: Full radiation calculations (3-hourly) are supplemented by more frequent calculations of the radiative increments due to changes in cloud (hourly) 4. Upgrade to use 3D speciated tropospheric aerosol climatologies DA changes: 1. Assimilation of ASCAT surface soil wetness 2. Upgrade NH snow analysis	<a href="#">UM/DA</a> (Met Office internal links)
G52/OS23	09 March 2010	1. increase in resolutions 40 km to 25 km, and in assimilation from 120 km to 90 km 2. Accompanying revisions to surface properties, with minor changes in physics and dynamics schemes to improve model resilience 3. Introduction of assimilation in cloudy areas through direct use of satellite microwave window channels. 4. Assimilation of GPSRO bending angle directly rather than through processed refractivity data. 5. Extra surface observations and enhanced quality control.	<a href="#">Report</a> (Met Office internal link)
G51/OS22	10 November 2009	1. increase from 50 levels to a new set of 70 levels, with extra levels in the boundary layer and free troposphere, also raising the model lid from 65 km to 80 km 2. revised physics and dynamics schemes, particularly for convection and boundary-layer representation 3. improved humidity analysis	<a href="#">Report</a> (Met Office internal link)
G50/OS21	30 June 2009	Migration to IBM Power6 Supercomputer	-
G49/OS20	25 November 2008	Extensive physics package 1. Vegetative albedos based on MODIS (CLASSIC Product) 2. Fractional snow cover for sublimation and melting aka 'Tibetan snow' 3. Surface emissivity change to 0.97 (consistent with NAE) 4. Radiation: Update CO2 & trace gas concentrations 5. Radiation: Update spectral files for Rayleigh scattering fix 6. Brown and Francis ice particle densities 7. Mitchell's 2nd Re-X relationship 8. droplet settling 9. 3D microphysics scheme 10 Minimum overlap between ice and liquid clouds DA revised cov stats	<a href="#">UM/DA</a> (Met Office internal links) <a href="#">Tech Note</a>
G48/OS19	22 July 2008	DA/SA changes 1. Surface stationlist height corrections (SYNOP). 2. GPSRO: Add CHAMP and GRACE to current set of (6 COSMIC) satellites. 3. Assimilation of cloudy AIRS radiances. 4. Satwind changes: update the observation errors to allow for errors in satellite wind height assignment.	<a href="#">Report</a> (Met Office internal link)
G47/OS18	01 April 2008	DA/SA changes 1. Changes to UM soil properties. Correction of a) UM soil hydraulic properties and b) an improved parameterisation of soil thermal conductivity.	<a href="#">Report</a> (Met Office internal link)

		2. Assimilation of surface T, RH and winds over land 3. Removal of RH boost for sondes. 4. GPSRO. Increase vertical range over which COSMIC refractivity data is assimilated from 4-27km to 0-40 km	
G46/OS17	27 November 2007	DA changes: 1. PF model: fuller implementation of PF physics convection. 2. Within UM. Switching off soil moisture nudging where there is snow cover (threshold > 0.05 kgm <sup>-2</sup> [same as switching off soil T nudging under snow]) to avoid potentially erroneous results. SA Changes : 1. IASI (METOP). 2. ASCAT (METOP). Wind scatterometer. Main benefit to surface fields. 3. GPSRO. Increase from 4 to 6 COSMIC satellites.	DA (Met Office internal link)
G45/OS16	14 August 2007	1. UM 6.4 2. Improved use of GPSRO, AIRS/ATOVS Update 3. Increased frequency of SYNOPs (hourly) 4. Extra PF model physics (convection)	Report (Met Office internal link)
G44/OS15	15 May 2007	1. Global Model physics 1.1 Introduce biogenic aerosols climatology 1.2 bare soil albedo based on MODIS 1.3 moisture flows into level below saturated or frozen soil rather than lost as run-off 1.4 seasonal varying leaf area index (LAI) 2. Assimilation of COSMIC GPS radio occultation data	UM (Met Office internal link)
G43/OS14	06 March 2007	1. Introduce METOP data to replace NOAA15 data (early introduction 16th Jan) 2. DA/SA package 3. Retune 10m gust	Report (Met Office internal link)
G42/OS13	05 December 2006	DA/Sat upgrade 1. Increased use of ATOVS 2. Introduction of GPSRO Model 1. Statospheric stability package 1.1 Spectral Gravity wave drag 1.2 Increased N-S halo 1.3 Removal of ramped upper diffusion 2. Convective cloud decay 3. PMSL correction 4. Surface/soil diagnostics 5. 10m wind gust	UM stability CCA decay PMSL GPSRO (Met Office internal links)
G41/OS12	25 September 2006	Satellite changes - SSMIS and GPSRO IGBP land use	Report (Met Office internal link)
G40/OS11	14 June 2006	1. Data assimilation upgrade ( <i>NB CovStats not changed</i> ) 2. Improved soil moisture nudging 3. Boundary layer bugfixes (vn6.1 BL)	DA
G39/OS10	14 March 2006	1. Re-introduce AIRS and ERS-2 Scat. Replace Met-7 Satwinds with Met-8 satwinds. 2. Tropical improvements - Physics upgrade, Valley cooling fix	UM/SA (Met Office internal links)
G38/OS9	13 December 2005	Resolution upgrade - 60km to 40km (N216 to N320) , 50 levels	Report (Met Office internal link)
G37/OS7	17 August 2005	1. Implementation of soil moisture nudging scheme which replaces current weekly resetting to climatology 2. Upgrade UM to vn6.1 3. Switch processing of ATOVS to SatRad code 4. Introduction of NOAA18 data and withdrawal of Aqua AMSU data	
G36/OS6	14 June 2005	Global DA and Satellite upgrade, new SST data and local I/O	Report (Met Office internal link)
G35/OS4	08 February 2005	Data assimilation upgrade	Report (Met Office internal link)
G34/OS3	18 January 2005	Model (HadGEM) physics upgrade	Report Note on Iraq cloud (Met Office internal links) Tech Report
G33/OS1	05 October 2004	Introduction of 4D-VAR	Report (Met Office internal link)
G32	26 May 2004	Additional/better use of satellite data 1. High spectral resolution IR sounder data (AIRS) on Aqua 2. 30 minute locally received ATOVS data (EARS) 3. ATOVS over land where elevation > 1000m 4. AMSU-A from Aqua (redundancy with NOAA-16) 5. Improved RTM (RTTOV-7) in 3D-VAR 6. Improved bias correction (model predictor)	Report (Met Office internal link)

G31_6.1	27 April 2004	Upgrade to UM6.0	-
G31	11 March 2003	1. Change to shallow convection diagnosis (only shallow convection where vertical velocities <0) 2. Numerical limiter for the orography - prevent instabilities. 3. Targeted diffusion for control of grid point storms (GPS) - conservative del**2 diffusion of moisture operates when vertical velocity exceed a threshold (currently 0.2 m/s)	Report (Met Office internal link)
G30	11 December 2002	MOSES II - single tile Data assimilation upgrade: 1. Quikscat (SEAWINDS) 2. Meteosat SATOB=>BUFR winds 3. correction of time interpolation for pressure pre-processing	UM DA (joint w/ G29) (Met Office internal links)
G29	03 December 2002	Merge of global and preliminary core suites. Global model data cut-off now 1h 50min for all runs. UM version 5.3. Digital filter to initialise model at T+0, rather than incremental analysis update to T+3	Report (joint w/ G30) (Met Office internal link)
G28	01 October 2002	Include NOAA-17	Report (Met Office internal link)
G27	07 August 2002	New Dynamics. Introduction of semi-implicit non-hydrostatic dynamical formulation using HADAM4 physics	Report (Met Office internal link)
G26	16 October 2001	Data assimilation upgrade: 1. Increase Observation errors for AMVs 2. Revise thinning of ATOVS to give preference to MW-clear over IR-clear 3. Use of fractional sea-ice in ATOVS processing	Report (Met Office internal link)
G25	18 April 2001	Data assimilation upgrade: 1. Stop using NOAA14 TOVS data 2. Start using NOAA16 ATOVS data 3. Start using data from the AMSU-B instrument on NOAA15 and NOAA16	Report (Met Office internal link)
G24	13 February 2001	Data assimilation upgrade 1. Use of scatterometer winds from ERS using variational dealiasing and quality control 2. Improved humidity error correlations 3. Increased use of AMSU-A radiances (ch 5) in cloudy areas 4. Introduction of surface wind speeds from a second (F15) SSM/I satellite 5. Introduction of wind profiler information <i>NB: the ERS-2 satellite suffered a failure shortly before the change date and ERS-2 scatterometers winds are therefore currently blacklisted.</i>	Report (Met Office internal link)
G23	27 June 2000	MOSES I surface scheme implemented with weekly reset to climatology for soil moisture	-
G22	17 May 2000	3d variational assimilation upgrade: 1. Use of Observed rather than retrieved radiance from TOVS/ATOVS 2. Revised background error covariance model 3. Use of model background at correct observation time	Report (Met Office internal link)
G21	19 October 1999	3d variational assimilation upgrade: 1. revised reconfiguration for var 2. SSMI windspeeds 3. TOVS & ATOVS radiances in VAR 4. Improved processing of PMSL - greater use of P_surface 5. Use of Antarctic obs + Use of winds at pole 6. Improved Covariance model 7. Improved descent algorithm for nearly quadratic J 8. Aircraft thinning & revised obs errors	Report (Met Office internal link)
G20	13 October 1999	Convective Momentum transport "correction" - Cu=0.5	
G20	20 July 1999	3d variational assimilation retune: 1. Revised covariances 2. Use of ATOVS over Siberia (Note there was an error in OBS processing such from 20-26 July no ATOVS data was being used over any land area- so only effective from 27 July) 3. Thinned scatwinds to one per analysis grid	
G19	06 July 1999	Sea-ice analysis from SSM/I installed	
G19	29 March 1999	1. 3d variational assimilation introduced 2. Use of ATOVS soundings from the AMSU instrument on NOAA15 commenced	
G18	09 February 1999	New mean sea level pressure diagnostic	
G18	22 September 1998 (Originally 25-28 August with 2h)	1. GWD constant= 6600 2. reduced correlation scale in Tropics 3. CAPE closure convection (1h adjustment scale)	

	<i>adjustment scale)</i>		
G17	12 May 1998	New global orography. Corrected over Antarctica	
G16	22 April 1998	Convective momentum transport reinstated (removed 27 March 1998) with flux limiter	
G16	15 April 1998	1. Preliminary runs introduced in place of LAM 2. version 4.4 MPP on Cray T3E	
G15	28 January 1998	1. Enhanced resolution (90km to 60km), 30 levels 2. version 4.3 MPP on Cray T3E	
G14	05 November 1996	1. 4th order advection 2. convective momentum transport 3. revised Gravity wave drag 4. Include assimilation of GLOSS humidities	
G13	16 April 1996	Introduce GLObal Sounding System (GLOSS - 1DVAR assimilation of TOVS radiances for temperatures)	
G12	16 January 1996	3rd Climate Version Physics (HADAM2b) introduced into the global model 1. Mixed phase cloud now -9 to 0 degC compared to -15 to 0 degC 2. More accurate qsat 3. Cloud water distribution used for precipitation formation 4. Modified ice-fallout 5. Correct boundary layer height and double asymptotic mixing length (global & LAM) 6. MRF/UMIST effective radius water drops (global) New orographic roughness fields (global & LAM)	
G11	20 June 1995	Switch off of horizontal diffusion over steep orography	
G10	10 January 1995	Part HADAM2b New Gravity wave drag and orographic roughness in global and LAM models.	
G9	13 December 1994	1. Long physics timesteps for both global and LAM models - global model has 3 physics timesteps per hour compared with 6 for the dynamics 2. Code in both models to prevent superadiabatic profiles from being generated	
G8	29 November 1994	Humidity fix to radiosondes in LAM and global models 1. Revised processing of radiosonde humidity (replacing vertical by interpolation to midpoint and introducing a boost near saturation) 2. Revised humidity assimilation (to conserve RH during T update)	
G7	12 April 1994	Change to global assimilation to balance surface pressure and temperature increments using wind increments (WINDBAL)	
G6	11 January 1994	2nd Climate Version Physics (HADAM2a) introduced into the global model 1. Include downdraughts in convection scheme 2. Introduce rapidly mixing boundary layer 3. Layer clouds in 3 layers for SW 4. Random overlap replaced by Max/Random overlap in LW 5. Revision of evaporation rates for snow 6. Threshold for precipitation over sea reduced	
G5	09 March 1993	1. Horizontal diffusion of humidity changed from 2nd to 4th order 2. Correct error in position of orographic standard deviation for GWD calculation 3. Correct 2nd order term in vertical advection calculation	
G4	06 October 1992	Change from 20 levels to 19	
G3	07 April 1992	Introduce ECMWF-like LW transmissivities	
G2	24 March 1992	Implement vertical diffusion in tropics	
G1	12 November 1991	Horizontal diffusion of humidity changed from 4th to 2nd order	
G0	12 June 1991	Unified Model introduced at 90km (N144) resolution	

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