Specifications (as of 31 December 2020) – an excerpt from the Joint WMO Technical Progress Report on the Global Data Processing and Forecasting System and Numerical Weather Prediction Research Activities for 2020

Specifications of 4D-Var in Global Analysis

Analysis scheme	Incremental hybrid 4D-Var using LETKF
Data cut-off time	2 hours and 20 minutes for early run analysis at 00, 06, 12 and 18 UTC 11 hours and 50 minutes for cycle run analysis at 00 and 12 UTC 7 hours and 50 minutes for cycle run analysis at 06 and 18 UTC
First guess	6-hour forecast by the GSM
Domain configuration (Outer step)	Globe TL959, Reduced Gaussian grid, roughly equivalent to 0.1875° (20 km) [1920 (tropic) – 60 (polar)] x 960
(Inner step)	TL319, Reduced Gaussian grid, roughly equivalent to 0.5625° (55 km) [640 (tropic) – 60 (polar)] x 960
Vertical coordinates	σ-p hybrid
Vertical levels	100 forecast model levels up to 0.01 hPa + surface
Outer-loop iterations	2
Inner-loop iterations	Approx. 35
Control variables for climatological background error covariance	Relative vorticity, unbalanced divergence, unbalanced temperature, unbalanced surface pressure and natural logarithm of specific humidity
Covariance inflation for ensemble covariance	Adaptive multiplicative covariance inflation (as per LETKF application) Additional covariance inflation is applied to create vertical profiles for the horizontal global mean of standard deviation from ensemble covariances consistent with those from climatological background error covariances.
Localization for ensemble covariance	Gaussian function. The localization scale for which the localization function is $1/\sqrt{e}$ is set to 800 km in the horizontal domain and a 0.8-scale height in the vertical domain.
Weighting for hybrid covariance	0.85 for climatological covariance and 0.15 for ensemble covariance under 50 hPa. Values approach 1 and 0 above 50 hPa, respectively.
Analysis variables	Wind, surface pressure, specific humidity and temperature
Observations (as of 31 December 2020)	SYNOP, METAR, SHIP, BUOY, TEMP, PILOT, Wind Profiler, AIREP, AMDAR, Typhoon Bogus; atmospheric motion vectors (AMVs) from Himawari-8, GOES-16, Meteosat-8, 11; MODIS polar AMVs from Terra and Aqua satellites; AVHRR polar AMVs from NOAA and Metop satellites; LEO-GEO AMVs; ocean surface wind from Metop-A, B, C/ASCAT, ScatSat-1/OSCAT; radiances from NOAA-15, 18, 19/ATOVS, Metop-A, B, C/ATOVS, Aqua/AMSU-A, DMSP-F17, 18/SSMIS, Suomi-NPP, NOAA-20/ATMS, GCOM-W/AMSR2, GPM-core/GMI, Coriolis/WindSat, FY-3C/MWRI, Megha-Tropiques/SAPHIR, Aqua/AIRS, Metop-A,B/IASI, Suomi-NPP, NOAA-20/CrIS, clear sky radiances from the water vapor channels (WV-CSRs) of Himawari-8, GOES-15, 16, Meteosat-8, 11; GNSS RO bending angle data from Metop-A, B/GRAS, COSMIC/IGOR, TerraSAR-X/IGOR; zenith total delay data from ground-based GNSS
Assimilation window	6 hours

Specifications of the LETKF in Global Analysis

Data cut-off time	As per 4D-Var
First guess	Own 6-hour forecast
Domain configuration	As per 4D-Var inner step
Vertical coordinates	As per 4D-Var
Vertical levels	As per 4D-Var
Ensemble size	50 members

Perturbations to model physics	Stochastic perturbation of physics tendency
Initialization	Horizontal divergence adjustment based on analysis of surface pressure tendency (Hamrud et al., 2015)
Covariance inflation	Adaptive multiplicative covariance inflation
Localization	Gaussian function. The localization scale for which the localization function is $1/\sqrt{e}$ is set to 400 km in the horizontal domain (300 km for humidity-sensitive observations), a 0.4 scale height in the vertical domain (0.8 for surface pressure and ground-based GNSS zenith total-delay observations) and three hours in the temporal domain. For satellite radiance observations, the maximum of the square of the weighting function divided by its peak value and the Gaussian function with a $0.4\sqrt{2}$ scale height centered at the peak of the weighting function is used as the vertical localization function.
Re-centering	Ensemble analysis is re-centered so that the ensemble mean is consistent with 4D-Var.
Analysis variables	As per 4D-Var
Observation	As per 4D-Var, but without the use of Aqua/AIRS, Metop-A, B/IASI and Suomi-NPP, and NOAA-20/CrIS data
Assimilation window	As per 4D-Var

Specifications of snow depth analysis in Global Analysis

Methodology	Two-dimensional Optimal Interpolation scheme
Domain and grids	Global, $1^\circ \times 1^\circ$ equal latitude-longitude grids
First guess	Derived from previous snow depth analysis and USAF/ETAC Global Snow Depth climatology (Foster and Davy, 1988)
Data used	SYNOP snow depth data
Frequency	Daily

Reference:

Foster, D. J., and R. D. Davy, 1988: Global Snow Depth Climatology. USAF-ETAC/TN-88/006. Scott Air Force Base, Illinois, p. 48.