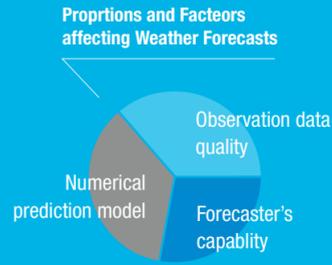


Became one of the front runners with our in-house developed Korean Integrated Model(KIM)

The Korea Meteorological Administration (KMA) launched the Korean Integrated Model (KIM) as an operational Numerical Weather Prediction (NWP) model in 2020, enabling Korea to lead the field of NWP.



Growing need for rapid response to various meteorological disasters and climate change on the Korean Peninsula

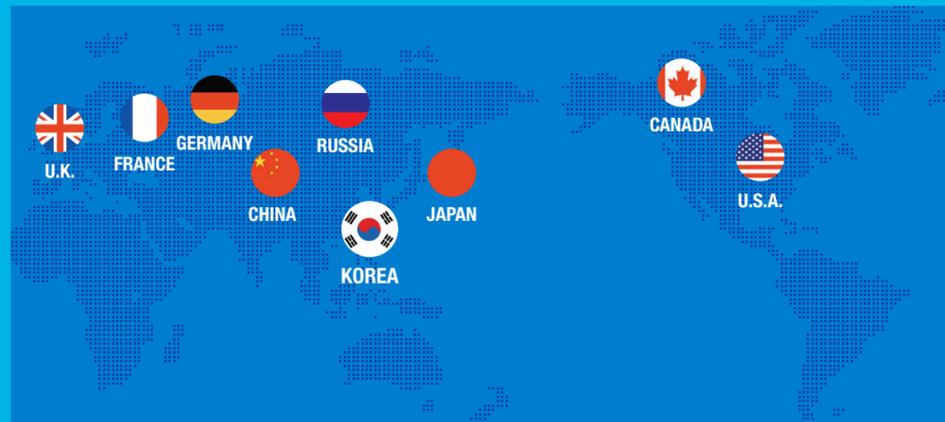
Dependency on foreign NWP models limited adaptability of both forecasters and models to ever-changing weather and climate conditions

NWP plays a key role in enhancing weather forecast accuracy, along with observations and forecasters' capability

Developing a Korean numerical model tailored to the country's meteorological and climate conditions, leading to independence in NWP technology

KOREAN INTEGRATED MODEL

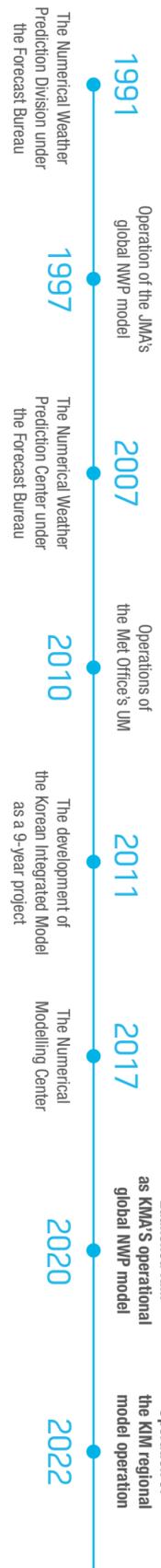
Strengthening KMA's role in protecting people from natural disasters as the 9th country to develop an in-house NWP model



KIM benefits the world by sharing its achievements. Since the launch of the global model in 2020, KIM has proactively responded to extreme weather and abnormal climate conditions worldwide, striving to fulfill its role as a leader in the field of NWP

The History of Numerical Weather Prediction at KMA

KMA's mission has been to protect people's safety and well-being from meteorological hazards and the climate crisis, with the Numerical Modelling Center at the core of this effort.



Shaping the Future of Numerical Weather Prediction with KIM

KOREA METEOROLOGICAL ADMINISTRATION

NUMERICAL MODELING CENTER



NMC
NUMERICAL MODELING CENTER

Government Complex Daejeon Bldg. 1 11F, 189 Cheongsa-ro, Seo-gu, Daejeon, Republic of Korea

Issue date: 2024. 10. 31.



NMC webpage



KMA webpage

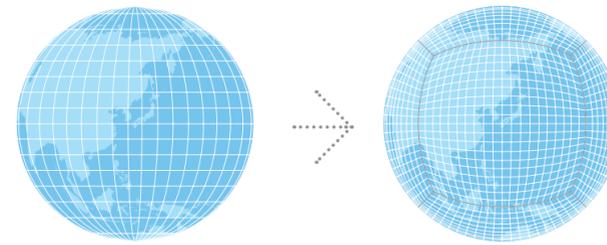
Korean Integrated Model (KIM)

The Korean Integrated Model (KIM) system, consisting of a spectral-element non-hydrostatic dynamical core on a cubed-sphere grid and a state-of-the-art physics parameterization package, was launched within a real-time forecast framework in 2020.

Initial conditions are obtained via advanced hybrid four-dimensional ensemble variational data assimilation (4DnEnVar) over its native grid.

KIM's Grid System

KIM employs a cubed-sphere grid system based on a decomposition of the sphere into six coordinate systems, resolving the singularity problems at the poles.

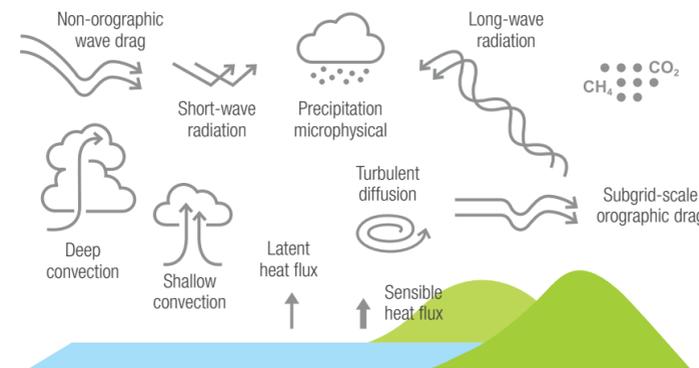


Latitude-Longitude Grid

Cubed-Sphere Grid System

KIM Physics package

The Korean numerical forecasting model can more accurately predict various weather phenomena using the advanced physics schemes considering consistency between processes and scale awareness



	Scheme	Reference
Radiation	Revised RRTMG (RRTMK)	Iacono et al. 2008, Beak et al. (2019)
Land surface	Modified LSM based on Noah LS	Ek et al. 2003, Koo et al. 2016
Ocean surface layer	Diurnal SST	Kim and Hong 2010
Boundary layer	Scale-aware non-local PBL	Hong et al. 2006, Shin and Hong 2015, Lee et al. 2016
Orographic drag & Gravity wave drag	Sub-grid orographic GWD Low-level wave breaking drag Flow blocking drag	Kim and Arakawa 1995, Hong et al. 2008, Choi and Hong 2015
	Convective & frontal non-orographic GWD	Choi et al. 2018
Deep & Shallow convection	Scale-aware mass-flux CPS	Han and Pan 2011, Lim et al. 2014, Han et al. 2016, Kwon and Hong 2017
Microphysics	Single moment 5-class (WSM5)	Hong et al. 2004, Bae et al. 2016
Cloudiness	Prognostic CLD	Tiedtke(1993), Park et al. 2016

KIM Data Assimilation

KIM's data assimilation (DA) system consists of 4DnEnVar (4D ensemble variational data assimilation), LETKF (Local Ensemble Transformation Kalman Filter), and KPOP (Package for Observation Preprocessing system)

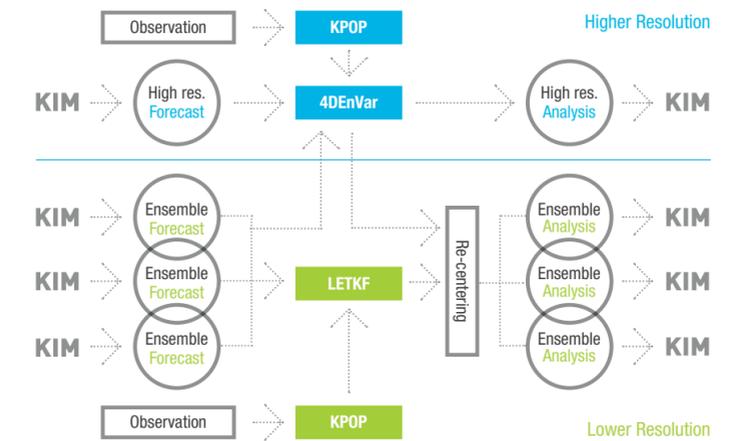
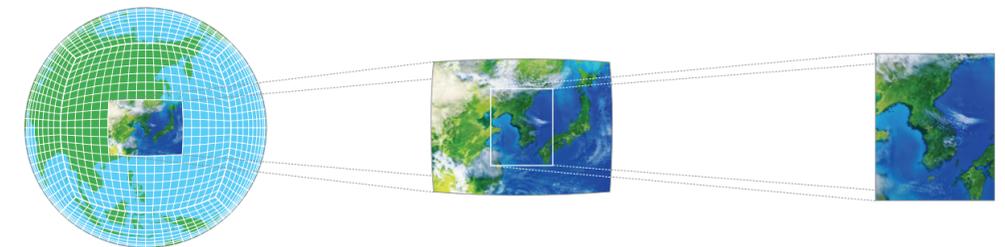


Diagram of KIM's DA System

Operational Systems in KIM(2024)



Global 8km / top : 80km Prediction Period : 12 days	Global Ensemble 8km / top : 80km Prediction Period : 12 days	Regional 3km / top : 18km Prediction Period : 5 days	Local Ensemble 3km / top : 18km Prediction Period : 5 days	Very Short Range 5km / top : 18km Prediction Period : 12 hours
Ocean Wave(Global) 25km Prediction Period : 12 days	Ocean Wave(Regional) 4km Prediction Period : 5 days	Storm Surge(Regional) 8km / 1km Prediction Period : 5 / 3 days		

Next-generation KIM

A new NWP system for various applications, ranging from short- to extended-range predictions based on KIM

- High-resolution atmospheric models with globally variable grids, and for a limited-area (Korea) domain with scale-aware physics parameterization (convection, boundary layer, gravity wave drag, etc.) for short-term forecasting

- A coupled system (atmosphere, ocean, sea ice, and waves) that incorporates the latest advances in coupled modeling and data assimilation for extended-range forecasting



2019	2020	2021	2022	2023	2024	2025	2026	2027
	Global 12km	Global Ensemble 32km	Regional 3km	Very-Short Range 5km	Global 8km	Local Ensemble 3km	Extended range 10 → 14 days	Global/variable-grid/coupled

