OUTLINE

OF

THE OPERATIONAL NUMERICAL WEATHER PREDICTION

AT

THE JAPAN METEOROLOGICAL AGENCY

January 2024

JAPAN METEOROLOGICAL AGENCY

Contents

Preface

The Japan Meteorological Agency (JMA) began numerical weather prediction (NWP) in June 1959 after years of extensive research by Japan's Numerical Weather Prediction Group, following on from similar pioneering efforts by the Swedish Meteorological and Hydrological Institute (SMHI) in September 1954 and the US Weather Bureau in May 1955. Subsequent NWP development has advanced well, with JMA and other operational NWP centers benefitting from enhanced comprehension of meteorological phenomena, improved modeling, increased computing capacity, efficient telecommunications, and better observing systems (especially in the fields of meteorology and satellite-based earth observation). NWP leads itself to a wide range of applications within JMA's scope of operation.

The report prior to this one served as an appendix to the WMO Technical Progress Report on the Global Data-processing and Forecasting System (GDPFS) and Numerical Weather Prediction (NWP) Research, work covering the period from 2002 to 2022, and was published in 2023 as independent content with the cessation of WMO Technical Progress Report provision. The current report covers the main content of the WMO Technical Progress Report, and is up to date as of March 2023 (or more recent where noted).

The first chapter summarizes the configurations and specifications of the current JMA computer system, followed a description of the related operational suite and job management system.

The second chapter describes Global Analysis, Meso-scale Analysis and Local Analysis as major data assimilation systems for atmospheric fields incorporating observation data, along with data assimilation systems for snow depth and soil moisture, the JMA Climate Data Assimilation System and other related considerations.

The third chapter describes NWP models used for very short-range prediction of meso-scale disturbances and short-/medium-range prediction of synoptic-scale disturbances. The regional deterministic and ensemble prediction system is used especially for heavy rainfall associated with mesoscale convective system, which causes extreme disaster conditions in Japan. The global model is used in ensemble prediction systems for typhoon forecasts and weekly/monthly predictions, and the coupled ocean-atmosphere model is employed for seasonal and El Niño forecasts. Atmospheric transport models are applied to prediction for transport of trace elements such as radioactive materials, Kosa (Aeolian Dust), ozone and volcanic ash for the output of environmental information.

The fourth chapter outlines various applications for NWP products such as weather charts, gridded data, very-short-range precipitation forecasting, half-hourly analysis of wind and temperature, guidance for short-range forecasting, and data relating to aviation services, ensemble prediction and atmospheric angular momentum functions.

The final chapter discusses modeling for ocean waves, storm surges and oil spill prediction along with systems for sea surface temperature analysis and ocean data assimilation.

JMA remains committed to its efforts for enhanced NWP accuracy. Against this background, the Numerical Prediction Development Center was established in 2020 in Tsukuba (the location of the Meteorological Research Institute) for integrated promotion. JMA's NWP Strategic Plan Toward 2030 (https://www.jma.go.jp/jma/en/Publications/JMA_NWP_Strategic_Plan_Toward_2030.pdf), also promotes NWP technology within the context of a recent intensification of natural disasters and societal requirements, defining the direction of NWP development at JMA over the coming years. Updates are provided at https://www.jma.go.jp/jma/en/Activities/nwp.html.

SATO Yoshiaki

Director
Numerical Prediction Division
Japan Meteorological Agency