Verification and intercomparison of quantitative precipitation forecasts from operational NWP models

The Working Group on Numerical Experimentation (WGNE) began verifying quantitative precipitation forecasts (QPFs) in the mid 1990s. The purpose was to assess the ability of operational numerical weather prediction (NWP) models to accurately predict rainfall, which is a quantity of great interest and importance to both the forecasting and user communities. Many countries have national rain gauge networks that provide observations that can be used to verify the model QPFs. Since rainfall depends strongly on atmospheric motion, moisture content, and physical processes, the quality of a model's rainfall prediction is often used as an indicator of overall model health.

In 1995, NCEP and DWD began verifying QPFs from a number of global and regional operational NWP models against data from their national rain gauge networks. BOM joined in 1997, followed by UKMO in 2000, Météo-France in 2001, JMA in 2002 and CMA in 2013. Other centers, for instance ECMWF and HMC recently, provide also interesting contributions on QPF verification in several WGNE meetings.

The results of the WGNE QPF verification from 1997 through 2000 were summarized in a paper by Ebert et al. (2003).

Ebert, E.E., U. Damrath, W. Wergen and M.E. Baldwin, 2003: The WGNE assessment of short-term quantitative precipitation forecasts. Bull. Amer. Met. Soc., 84, 481-492.

In a report to WGNE, Bougeault (2002) reviewed "standard" and emerging verification techniques with an emphasis on their application to mesoscale model forecasts. He concluded with several recommendations including (a) user-oriented and model-oriented verification may require different methodologies; (b) care is needed in handling the scale differences between model output and observations; (c) probabilistic methods may be more appropriate than the usual deterministic methods for verifying severe weather elements; (d) standard methodologies should be specified for weather elements from NWP; and (e) verification results should be accompanied by uncertainty measures.

Bougeault, P., 2002: WGNE survey of verification methods for numerical prediction of weather elements and severe weather events. CAS/JSC WGNE Report No. 18, Annex C. Available at http://www.cawcr.gov.au/projects/verification/Bougeault/Bougeault_Verification-methods.htm

In order to maximize the usefulness of the precipitation verification (e.g., in a model intercomparison), the approach used should be as similar as possible across all regions. The WWRP/WGNE Joint Working Group on Verification recommends a standard methodology for verification and intercomparison of QPFs and PQPFs from NWP models.

WMO/WWRP 2009 – 1 Recommendations for the verification and intercomparison of QPFS and PQPFS from operational NWP models. Revision 2. October 2008. WWRP/WGNE Joint Working Group on Verification

A precipitation verification guidelines document entitled "Suggested methods for the verification of precipitation forecasts against high resolution limited area observations" has been proposed by Laurie Wilson in November 2013, after circulated around the JWGFVR, in response to a WGNE desire for a rather small number of scores in order to optimize and standardize our approach for quantitative precipitation forecast (QPF) verification. "High resolution limited area observations" stands typically, but not only, for high resolution non-standard gauge datasets that are available in National Meteorological Services and/or radar precipitations estimates. Three scores have been kept for deterministic models (ETS, EDI, FSS) and three for ensembles (BSS, ROCA, CRPSS), which is

thought to be a minimum number of scores that would be necessary to evaluate most of the attributes of the forecasts. The move towards these approaches in all centers has been recommended by WGNE.

WGNE QPF verification against high resolution national observation network has been very useful to evaluate QPF improvements of operational global NWP models over the last 20 years. These intercomparisons have evolved regularly to take into account increased spatial resolution of NWP models and research advances on QPF verification methods.

A report on QPF verification activities has been regularly presented at WGNE physical meetings:
2017: http://wgne.meteoinfo.ru/wp-content/uploads/2017/11/WGNE32_QPF.pdf
2016: http://wgne.meteoinfo.ru/wp-content/uploads/2017/05/WGNE31_Bouyssel_QPF.pdf
2015: http://wgne.meteoinfo.ru/wp-content/uploads/2018/03/WGNE30_Bouyssel_qpf_ver.pdf

A survey has been completed in 2016:
i) to have an overview of QPF methods used in NWP centers (part I)
ii) to summarize the current characteristics of the WGNE QPF verification (part II)
(see http://wgne.meteoinfo.ru/wp-content/uploads/2018/03/wgne_QPF_20160421.xls)

QPF intercomparison websites :
(to be updated)

NCEP:
http://www.emc.ncep.noaa.gov/mmb/ylin/pcpverif/wgne/

Météo-France:
http://www.meteo.fr/extranets/
user: WGNE
password: WGNEmto!

Contact person and URL of the data server with QPF files :
(to be updated)

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