Meteorologische Zeitschrift, Vol. 27, No. 6, 433–434

Editorial

Editorial: Forecast verification methods across time and space scales – Part I

Manfred Dorninger[1*], Petra Friederichs[2], Sabrina Wahl[2,3], Marion P. Mittermaier[4,7], Chiara Marsigli[5,7] and Barbara G. Brown[6,7]

[1]University of Vienna, Austria
[2]University of Bonn, Germany
[3]Hans Ertel Centre for Weather Research, Germany
[4]MetOffice, United Kingdom
[5]Deutscher Wetterdienst, Germany
[6]National Center for Atmospheric Research, United States
[7]Members of the JWGFVR

Abstract

The 7th International Verification Methods Workshop – with a theme of "*forecast verification methods across time and space scales*" – was held in Berlin between 3 and 11 May 2017. The workshop and associated training tutorial represent two flagship activities of the World Meteorological Organization's (WMO's) Joint Working Group on Forecast Verification Research (JWGFVR) which falls under the World Weather Research Programme (WWRP) and the Working Group for Numerical Experimentation (WGNE).

1 Editorial

The JWGFVR serves as a focal point for the development and dissemination of new verification methods and has a major goal to facilitate and encourage training and dissemination of information on verification methodologies. More specific aims pursued through JWGFVR activities include promoting consideration of the needs of users in verification practices, to improve its relevance; encouraging the sharing of observational data for verification purposes; and motivating the research community to incorporate verification efforts as a vital part of numerical and field experiments. A specific effort is focused on facilitating the development and application of improved diagnostic verification methods, aimed at assessing and enabling the improvement of the quality of weather and climate forecasts on a wide range of spatial and temporal scales.

In this context, with support from the WMO's WWRP, the JWGFVR organizes periodic international scientific workshops where the state-of-the-art in the field is illustrated and the main development lines are outlined. These workshops have become a reference point for researchers in verification as well as those who apply verification methods in operational and research contexts. The workshops also incorporate a training component via a multi-day tutorial aimed at developing verification knowledge and skills in researchers, operational meteorologists and climatologists, and others working in the forecasting arena.

For the 7th International Verification Methods Workshop, the science programme organising committee, led by Barbara Casati (ECCC) and also including Caio Augusto dos Santos Coelho (CPTEC), Yuejian Zhu (NCEP/NOAA), Chiara Marsigli (ARPA), Thomas Haiden (ECMWF) and Barbara Brown (NCAR), structured the event in two parts: a tutorial (3–6 May 2017) and a science conference (8–11 May 2017). The entire workshop was hosted in Berlin, Germany, jointly by the Free University of Berlin, the Max-Planck-Institute for Human Development, the Hans-Ertel-Centre for Weather Research (HErZ) and the German Weather Service DWD.

The tutorial included the participation of about 30 students, including Masters and PhD students, post-doctoral researchers, and operational meteorologists from 22 different countries. A series of lectures covered basics (including the statistical basis) of forecast verification as well as advanced methodologies (e.g., spatial approaches) and several aspects under development in the verification field, such as observation uncertainty, evaluation from a value-chain perspective, and user-oriented approaches. Intensive hands-on laboratory sessions using the R statistical language provided the students with the tools to face a real forecast verification problem; the students presented the results of the problem evaluations the following week during a focused session in the workshop.

The workshop included sessions on the verification of high-impact weather and extremes, user-oriented verification and estimation of forecast value, properties of verification methods, methods for probabilistic and ensemble forecasts, spatial methods, observation uncertainty, and, for the first time, climate and sub-seasonal to seasonal applications. Six keynote speakers presented talks on specific topics: Beth Ebert from the Bureau of Meteorology in Australia discussed the verification of high impact weather; Jeff Lazo from the National

*Corresponding author: Manfred Dorninger, Institut für Meteorologie und Geophysik, Fakultät für Geowissenschaften, Geographie und Astronomie, Universität Wien, Althanstraße 14, 1090 Wien, Austria, e-mail: manfred.dorninger@univie.ac.at

DOI 10.1127/metz/2018/0955
Gebrüder Borntraeger Science Publishers, Stuttgart, www.borntraeger-cramer.com

Center for Atmospheric Research discussed the "Economic assessment of Hydro-Met services and products: A value chain approach"; Chris Ferro from Exeter University presented a talk on "Forecast verification using scoring rules"; Prof. Henning Rust from Free University of Berlin presented a keynote on "Drift in decadal predictions – A particular challenge for verification"; and Frederic Vitart from the European Center for Medium-range Weather Forecasts presented a keynote on "Sub-seasonal to seasonal forecast Verification". Last but not least, the winner of the "WMO Challenge to Develop and Demonstrate the Best New User-Oriented Forecast Verification Metric", Helge Goessling from the Alfred-Wegener Institute presented a keynote talk on his winning entry, "Verification of user-relevant contours with the Integrated Ice Edge Error and the Spatial Probability Score". Presentations and posters are available from the workshop website https://www.7thverificationworkshop.de/News/Tutorial-and-conference-presentations.html.

The articles are published in a series of two special issues. This issue of the Meteorologische Zeitschrift contains six papers based on contributions to the workshop. One of the papers describes "The WMO Challenge to Develop and Demonstrate the Best New User-Oriented Forecast Verification Metric" by Ebert et al. (2018). This challenge has been initiated to encourage the development of verification approaches from a user perspective. Ebert et al. (2018) describe the specific features of user-oriented forecast verification, shortly describes the winners of the challenge, and critically discuss the rules in order to improve the next Verification Challenge.

A user-centric verification measure is proposed in Brunet et al. (2018). They address a common problem in spatio-temporal prediction, namely that forecasts of localized weather generally miss the event in terms of exact localization and timing. Their user-centric score measure is based on a generalized distance transform of a user to an alert region and of the same user to a set of observed events. The score is rigorous and shares the robustness and resilience characteristics of categorical scores. The spatio-temporal user-centric distance of Brunet et al. (2018) won the second prize of the WMO challenge (Ebert et al., 2018).

Crocker (2018) evaluates the benefit of citizen weather observations – notably reports on impacts of hazardous weather – for a quality assessment of severe weather warnings. Although citizen observations provide useful information particularly for case studies, they are not yet suitable for an objective verification, most importantly due to the sporadic nature of the information and the missing reports on non-events.

Kapp et al. (2018) apply a wavelet approach to an ensemble of high-resolution precipitation forecasts. They aim at assessing the quality of the structure of spatial precipitation forecasts without relying on an object identification algorithm. The method compares the spatial covariance structure of forecasts and reanalysis (used as verifying dataset) by estimating an averaged wavelet spectrum for each spatial field. Singular vectors are determined to reduce the dimensionality in order to assess skill. Implications of this strategy are discussed in the paper.

The effect of model domain size and native resolution variation on the contiguous rain area (CRA) analysis on quantitative precipitation forecasts has been studied by Mariani and Casaioli (2018). Their paper contributes to the Mesoscale Verification Inter-Comparison over Complex Terrain (MesoVICT) project, a project of the JWGFVR. They state that some care has to be taken when evaluating the best pattern matches achieved with the CRA analysis in order to distinguish reliable results from the suspicious, unphysical ones. The authors propose to use the 2-D CRA shift analysis plot together with the CRA matching path to identify the more physically realistic forecast shift especially in complex terrain. The sensitivity of the CRA analysis on model resolution and event characteristics is shown.

Coelho et al. (2018) propose an attribute-based verification framework for South American sub-seasonal precipitation forecasts. They assess the one to four weeks forecast quality for 3 information levels from target week hindcast, all season hindcast to all season near real time forecast verification using attributes such as reliability, accuracy or resolution. The ECMWF forecasts provide reasonable hindcast/forecast quality for sub-seasonal precipitation with ENSO and MJO likely playing a substantial role in determining the performance of the predictions.

References

Brunet, D., D. Sills, B. Casati, 2018: A Spatio-Temporal User-Centric Distance for Forecast Verification – Meteorol. Z. **27**, 439–451, DOI:10.1127/metz/2018/0883.

Coelho, A.S., M.A.F. Firpo, F.M. de Andrade, 2018: A verification framework for South American sub-seasonal precipitation predictions – Meteorol. Z. **27**, 501–518, DOI:10.1127/metz/2018/0898.

Crocker, R., 2018: Can ad-hoc citizen observations be used to verify weather warnings? – Meteorol. Z. **27**, 453–463, DOI:10.1127/metz/2018/0879.

Ebert, E.E., B. Brown, M. Göber, T. Haiden, M. Mittermaier, P. Nurmi, L. Wilson, S. Jackson, P. Johnston, D. Schuster, 2018:The WMO Challenge to Develop and Demonstrate the Best New User-Oriented Forecast Verification Metric – Meteorol. Z. **27**, 433–438, DOI:10.1127/metz/2018/0892.

Kapp, F., P. Friederichs, S. Brune, M. Weniger, 2018: Spatial verification of high-resolution ensemble precipitation forecasts using local wavelet spectra. – Meteorol. Z. **27**, 465–478, DOI:10.1127/metz/2018/0903.

Mariani, S., M. Casaioli, 2018: Effects of model domain extent and horizontal grid size on contiguous rain area 1 (CRA) analysis: A MesoVICT study. – Meteorol. Z. **27**, 479–500, DOI:10.1127/metz/2018/0897.