ECMWF MS/CS "Green Book" Report 2024

This report relates to Use and Verification of ECMWF products in Member and Co-operating States, since January 2022. Please add your text below under the appropriate headings. Mandatory questions are marked with a ''. Also, **please do include figures/tables wherever you feel they are appropriate**, with figure/table numbers (e.g. "Figure 1") and explanatory captions underneath. You should aim for the finished report to be 8 pages or less. Once completed it would be help us if you could delete all the ECMWF instructions (in grey italics) such as this paragraph.*

Section 1: Background

* 1.1 Country
Netherlands

* 1.2 Author(s)
J. Diepeveen
Please provide your name(s)

* 1.3 Organisation
KNMI
Please provide your organisation

* Section 2: Summary of major highlights
We use the ECMWF model including the ensemble on a daily basis. We use ECMWF in an ongoing comparison with our own fine-scale Harmonie models. It is our experience that ECMWF is still leading in describing the synoptic situation. For the estimation of small-scale phenomena, we often use our own Harmonie (UWC) model

Please detail here major highlights since January 2022. You may wish to complete this section at the end, after completing all others.

Section 3: Forecast Products

3.1. Direct use of ECMWF forecast products

In each of the following 4 categories please outline what direct use you make of standard ECMWF model products (on ecCharts / OpenCharts / own workstation), for operational duties, (noting that new AI model output should be dealt with separately, in Section 3.4).

* a) Medium Range (e.g. for high impact weather forecasting)
We use the model output to create our own visualizations. These include:
-Plotted fields
-Medians, percentiles, exceedance probabilities from ENS
-Plumes, bar charts
-Combined fields of deterministic and ensemble output.

* b) Extended Range (monthly)
We look at EC charts here but also visualize this in our own Geoweb visualization tool

* c) Long Range (seasonal)
EC charts but not usung this in products of advisories

* d) CAMS and Fire-related output (ecCharts mainly)

3.2. Cycle 48r1

ECMWF cycle 48r1 went live at the end of June 2023. Changes included a much higher resolution medium range ensemble, and much more frequent monthly forecasts. In sub-sections a and b below lease detail any positive or negative impacts of this cycle for your organisation.

* a) <u>Positive</u> impacts of model cycle 48r1
We feel that the ensemble is better at describing the extremes p10/p90 for the short term

* b) <u>Negative</u> impacts of model cycle 48r1
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c) Systematic changes in forecast output since model cycle 48r1 was implemented

Please describe any changes you have experienced (if not already covered in your response to questions 3.2a and 3.2b).

3.3: Derived Fields

See above.

Do you modify ECMWF model output to create 'derived fields' (e.g. post-processed output, regimes, probabilities)? If so, please describe what you modify and how.

3.4: Artificial Intelligence (AI) / Machine Learning (ML) techniques
We have the possibility to look at it operationally but wide use is not been done yet
Do you currently use Artificial Intelligence (AI) and/or Machine Learning (ML) techniques in your service, in conjunction with standard ECMWF model output? - Please describe any such techniques and/or any future plans you have in this area.

3.5: Dynamical Adaptation
-
Does your NMHS use ECMWF data for modelling purposes - e.g. by providing initial/boundary conditions for limited area model runs, or for hydrological models, or for dispersion models, etc? – if so please describe these activities.

3.6: Data-driven (AI) models
-
In the last year or so ECMWF has made available, on ecCharts and OpenCharts, selected fields from AI models (e.g. Pangu Weather, AIFS).

* a) ECMWF's real-time AI model initiative

Please describe your views on this initiative, or enter "unaware" if you knew nothing about this.

We want to make the best use of AI, with an eye toward better quality and efficiency

Please describe ways in which you currently use AI forecasts for operational purposes, or "none" if appropriate.

Section 4: Verification

ECMWF does extensive verification of its products in the free atmosphere. However, our verification of surface parameters is more limited and can be constrained to only using synoptic observations. More detailed verification of these surface weather parameters by National Services is always valuable to us. We are most interested in results for the last 1 or 2 years. Also, any verification evidence you have of performance changes since the introduction of cycle 48r1 would be very valuable.

4.1 <u>Raw model output</u> from ECMWF, and other operational models/ensembles

In sub-sections a and b below please describe your verification activities and show and discuss related scores, in the two lead-time categories. This should include, where possible, comparisons between ECMWF and your own models/ensembles, and other models/ensembles.
Ideally focus on surface weather parameters in your own territory. Inclusion of conditional verification results is also strongly encouraged - e.g. stratification by a weather type - as these can provide very useful insights into model weaker points.

a) Short Range and Medium Range

b) Extended Range (Monthly) and Long Range (Seasonal)

4.2 <u>Post-processed</u> products and/or tailored products delivered to users

Please describe verification of such products, and show and discuss related scores.

4.3 <u>Subjective verification</u>

Please describe and illustrate any activities and results the field of subjective verification of forecasts.

4.4 Case Studies

We have weekly model performance talks together with the UWC countries. EC is often being compared with the harmonie models. I can send some presentation examples.

General weaknesses of EC:

-Underestimating low cloud cover
-Negative maximum temperature bias
-(Convective) rainfall in the tropical areas, Caribbean is really bad on a day to day basis, we use ENS info to cover this

-Track and position of Hurricanes and tropical storms is very useful.

Section 5: Output Requests

Please describe, and illustrate if necessary, any particular requests you may have for new or modified ECMWF products. Add more sub-sections manually (c, d etc.) if you need them.

a) Product request 1: *add a title / short-form summary here in bold*

Describe the request here

b) Product request 2: *add a title / short-form summary here in bold*

Describe the request here

Section 6: References

Please list here any recent internal or external publications that relate to the questions in this survey, including the respective link(s). For any publication that cannot be readily downloaded via a link please email a copy of that publication to becky.hemingway@ecmwf.int and to tim.hewson@ecmwf.int.

Section 7: Additional comments and Feedback

Please provide here any additional comments on topics that have not been covered in any of the sections above.