



Twelfth Steering Committee

29 October 2025

SOFF Impact Experiments Phase III

Decision 12.4

Systematic Observations
Financing Facility

**Weather
and climate
data for
resilience**



Decision 12.4: SOFF Impact Experiments Phase III

The SOFF Steering Committee

Recalls [Decision 11.2](#): ECMWF SOFF Impact Experiments: A scientific case for scaled-up SOFF investments; undertaken by European Centre for Medium Range Weather Forecasts (ECMWF) in collaboration with the World Meteorological Organization (WMO) to quantify how new Global Basic Observing Network (GBON) observations reduce uncertainty in short-range weather forecasts.

Acknowledges that in Decision 11.2, the Steering Committee requested the SOFF Secretariat to:

- Reach out to potential public and private partners and philanthropies, in collaboration with ECMWF and WMO, and jointly prepare a proposal for a potential third phase of SOFF Impact Experiments with a focus on the importance of SOFF-supported data for Artificial Intelligence forecasting.
- Present this proposal for consideration at the 12th Steering Committee meeting.

Endorses to advance SOFF impact work in 3 areas:

- Extend results of Phase II into the medium-range (1–5-day forecasts, if feasible and at no additional costs up to 10-day forecasts) and assess impact of observation gaps on tropical cyclone forecasts.
- Explore SOFF and AI forecasting
- Assess socioeconomic benefits of SOFF investments using results from ECMWF Phase II to quantify avoided asset and well-being losses resulting from additional observations and improved early warning systems.

Approves 100,000 USD funding for the first area of work to extend results of Phase II into the medium-range.

Requests

- The UNMPTF Office to disburse the above stated amount to WMO.
- WMO to partner with ECMWF, to contract ECMWF to undertake the work, and to coordinate the production of extending results of Phase II.
- The SOFF Secretariat
 - to engage with GFDRR for the finalization of the socio-economic benefits working paper, in collaboration with WMO and ECMWF,
 - to finalize and prepare a proposal for SOFF and AI forecasting for consideration at the 14 Steering Committee meeting

Purpose of this Document

This document presents a proposal for a third phase of the Impact Experiments to expand the initial scope in 3 areas in a sequenced manner.

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SOFF Impact Experiments Phase III

1. Context

The work completed through the SOFF Impact Experiments to date has provided the scientific basis quantifying the impact of SOFF investments. The results of the first two phases of work demonstrated the strongest scientific evidence to date showcasing that GBON infrastructure and data sharing in under-observed regions dramatically improve forecast accuracy, both locally and globally. The impact work so far has provided rigorous, comparable metrics for demonstrating SOFF's impact, providing a strong evidence base for the need for scaled-up SOFF investments.

Impact is defined as the impact of improved observations in forecast skill. The measurement of the impact of an observation in a numerical weather prediction (NWP) system is a critical part of defining observational requirements and strategies, where feasibility and impact are balanced (analogous to studying cost and benefit). Estimates of the improvement of forecast skill for global NWP were a central part of the motivation for the design of GBON and SOFF.

The SOFF Steering Committee, through [Decision 6.8](#), endorsed and approved funding SOFF Impact Reports based on scenarios of GBON implementation. The study was conducted in two phases. The first phase ([Decision 9.2](#)) provided a literature review and assessment of the state of knowledge on forecast skill improvement and established the importance of surface and upper-air observations. In the second phase ([Decision 11.2](#)), targeted experiments used synthetic data to assess the impact of Global Basic Observing Network (GBON) infrastructure in under-observed regions. The results of the experiments quantified the forecast skill improvements from expanded GBON coverage, with results showing up to 30% uncertainty reduction in Africa and significant global benefits.

The SOFF Steering Committee, through Decision 11.2, welcomed these results and requested the Secretariat, in collaboration with ECMWF and partners, to prepare a proposal for a third phase with a focus on the importance of SOFF-supported data for Artificial Intelligence forecasting. This document outlines the proposed study phase for 3 areas of work of Phase III of SOFF Impact Experiments.

2. Proposed study plan

For the period of the extended SOFF work programme until June 2027, it is proposed that SOFF Secretariat and WMO continue engagement with ECMWF to extend the results of the first two phases of impact studies and expand the scope of the impact studies to investment potential for AI applications and assessment of socio-economic impacts through engagement with additional partners. These three areas are outlined as follows:

2.1. Work Area 1: Extend results of Phase II into the medium-range (1-5 day forecasts)

In part II of the SOFF impact studies, an ensemble of data assimilation (EDA) system was used to estimate the *theoretical* improvement in Numerical Weather Prediction (NWP) analysis and short-range (12 hour) forecast uncertainty, for eight, new surface-based observing network *scenarios*. In common with previous EDA observation impact studies to date, these experiments were run for just one month (June, 2023). Most of the scenarios suggested large improvements in short-range forecast accuracy in Africa for both surface and upper-air parameters, and for this short-term forecast horizon the largest impact was found where the new simulated observations were most dense. Some improvements in the Tropical North Atlantic area, referred to as the “main development region” for Tropical Cyclone genesis, were noted. The proposed extension of this work in Phase III is as follows:

- Extend the results of the EDA experiments into the medium-range (1 day, 2 days and 5 days). This will represent the first use of the EDA method to assess a medium-range observation impact.
- Extend two of the eight EDA scenario experiments from one month to five months, spanning June 1 to October 31, 2023. This will enable a more complete and robust assessment of how the uncertainty improvements propagate spatially beyond the regions where the new observations are introduced, when the forecast-range is extended out to day 5. It will require the generation of new simulated data for the four-month extension period for the two selected scenarios.
- Tropical Cyclone Genesis: Phase II experiments demonstrated that additional observations in Africa showed improvements in the tropical North Atlantic “main development region” for hurricanes. Phase III will investigate this link further by:
 - Assessing the impact of observation gaps on tropical cyclone forecasts.
 - Evaluate the effect of additional observations on full-season Tropical Cyclone prediction skill into the medium-range.

2.2. Work Area 2: Exploring SOFF and AI Forecasting

Artificial Intelligence (AI) and Machine Learning have played a role in weather and climate science for many years, with postprocessing being a prominent and valuable example. In the last few years, first in nowcasting and then in medium-range forecasting, using AI for Machine Learning has emerged as a tool for making forecasts. The technology is new and fast evolving, but meteorological organisations are embracing developments to ensure all avenues are explored in creating the best possible forecasts.

The SOFF Secretariat and WMO have organized a series of consultations with leaders in the AI community, including the private sector to identify the most impactful area to use AI Machine Learning applications in the SOFF context. It is proposed to tap into the SOFF

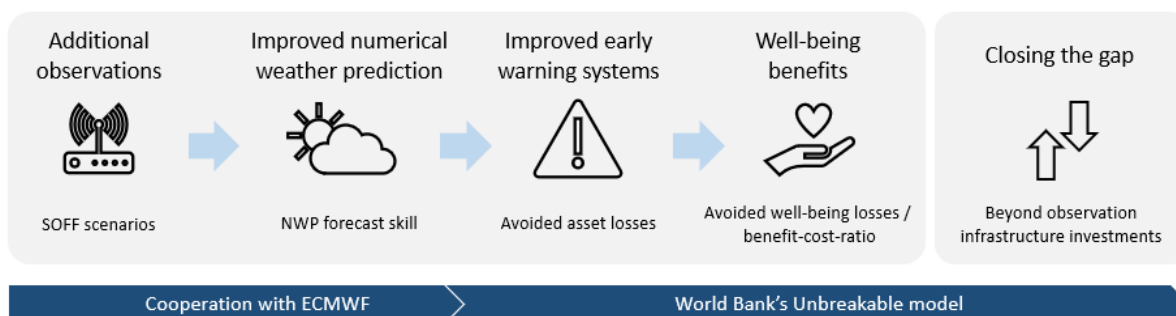
community of countries and Peer Advisors to train AI models through country applications. The SOFF Secretariat together with WMO, ECMWF and other partners will prepare a proposal outlining how to best use AI Machine Learning applications in selected SOFF countries while contributing with SOFF supported data.

2.3. Work Area 3: GFDRR Socioeconomic Benefits Assessment

To extend the assessment of SOFF impacts beyond forecasts, SOFF and ECMWF are partnering with experts in the field to assess socioeconomic benefits of additional observations and improved early warning systems. SOFF helped to mobilize financial resources for GFDRR from the Austrian Government, to assess the socioeconomic benefits of better weather and climate observations. SOFF has connected the GFDRR team with ECMWF to incorporate the results of the SOFF Impact Experiments in the World Bank's [Unbreakable Model](#).

Applying this methodology, the study will demonstrate the avoided asset and well-being losses resulting from additional observations and improved early warning systems. It will also calculate the benefit-cost ratio, comparing the avoided losses with the required upfront investment.

The process is outlined in the diagram below:



The use of the ECMWF scenarios allows for an assessment of benefit-cost ratio. The cost of the investment in additional observations is compared to the benefits quantified by avoided losses of assets and well-being. The outputs of this study will provide high-level messages on the value chain of benefits directly link to SOFF investments.

3. Approach and Methodology

3.1. Expected Outputs

Work Area 1:

- **Scientific Report** quantifying medium- and longer-range forecast improvements (including Tropical Cyclone analysis) published by ECMWF.

Work Area 2:

- **Expert group established** to prepare a proposal for SOFF and AI forecasting for consideration at the 14th Steering Committee meeting.

Work Area 3:

- **Working paper** quantifying benefits of ECMWF SOFF Impact scenarios through the World Bank Unbreakable model.
- **Policy Briefs and Communication Materials** for donors and Steering Committee deliberations.

3.2. Timeline

- **January 2026:** ECMWF to prepare and run additional EDA experiments and control
- **March 2026:** ECMWF to analyze medium range diagnostics on hurricane genesis
- **April 2026:** ECMWF to prepare draft write up of results and present to SOFF Advisory Board
- **May 2026:** 14th Steering Committee meeting
 - Final ECMWF report on Work Area 1 presented for consideration
 - Proposal for SOFF and AI forecasting for consideration
 - Socioeconomic benefits analysis finalized and working paper by GFDRR presented

4. Resource Requirements

- **Work Area 1:** USD 100,000
- **Work Area 2:** Budget to be determined, including in-kind support from ECMWF, Met Norway, and a private sector partner with expertise in AI/ML (e.g. Microsoft AI for Good team)
- **Work Area 3:** Fully funded by the Austrian government