



## **Fifth Steering Committee** **20-21 June 2023**

# **European Centre for Medium-Range Weather Forecasts (ECMWF) support to SOFF beneficiary countries**

INF 5.2

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Systematic Observations  
Financing Facility

**Weather  
and climate  
data for  
resilience**



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# European Centre for Medium-Range Weather Forecasts (ECMWF) support to SOFF beneficiary countries

## 1. Introduction

The increased international exchange of GBON (Global Basic Observing Network) observations that will be achieved through SOFF support will contribute to the improvement of the forecasting and climate reanalysis products delivered by Global Producing Centres. The foundation of all-weather and climate monitoring and prediction is global Numerical Weather Prediction (NWP) done by the Global Producing Centres.

The European Centre for Medium-Range Weather Forecasts (ECMWF) is one of the WMO Global Producing Centres, a key partner of SOFF and a Member of the SOFF Advisory Board. This document outlines ECMWF's envisaged areas of support for SOFF beneficiary countries in accessing and using their improved forecast products.

This document has been prepared by ECMWF in collaboration with the SOFF Secretariat and follows up on ECMWF's Council decision in support to SOFF beneficiary countries (see 3.1), the WMO Unified Data Policy<sup>1</sup> and in the SOFF Theory of Change, specifically its Output 8 on free availability of weather and climate analysis products.

## 2. ECMWF and SOFF

Observing the Earth's weather and climate is extremely important as it is a basic ingredient for producing global weather forecasts and monitoring the Earth system, which is ECMWF's mission. Better global forecasts enable better local forecasts, applications, and services that can be used to prepare for extreme events and plan for specific environmental conditions. Better global forecasts benefit everyone. Surface-based observations, which are often the responsibility of national agencies, are an essential factor in improving global weather forecasts. And the most precious surface-based observations are the ones coming from under-observed areas. These areas include the Least Developed Countries and the Small Island Developing States and some middle-income countries in Africa, Asia, and Latin America.

Given the importance of these observations and the internationally agreed GBON technical regulations, ECMWF has substantially contributed to SOFF development, it is a key supporter of SOFF implementation.

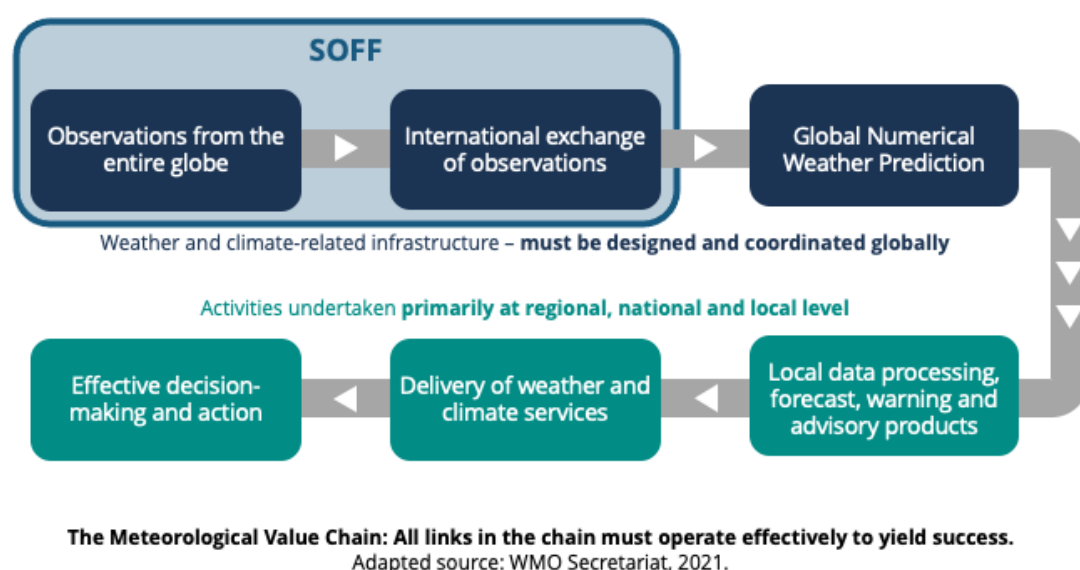
### 2.1. SOFF Theory of Change and ECMWF

According to the SOFF Terms of Reference, SOFF's goal is to "strengthen climate adaption and resilient development through improved weather forecasts, early warning systems and climate

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<sup>1</sup> According to the WMO Unified Data Policy (Extraordinary Session of the World Meteorological Congress, October 2021), these products are to be exchanged on a free and unrestricted basis with **all** WMO Members.

information”. The provision of improved weather forecasts and capacity building to the National Meteorological and Hydrological Services (NMHSs) is a fundamental aspect of the success of SOFF and GBON. To achieve this, SOFF works through its governance and operations with many partners involved in supporting countries in the latter part of the value change, including major climate and development funds, civil society organizations, and specialized technical organizations such as ECMWF. ECMWF support in the context of SOFF focuses on providing access to improved forecast products. It and other global NWP centres have the possibility of additionally providing support for countries to use and transform these products into local-level forecast products (see Figure 1).



**Figure 1.** The Meteorological value chain: All links in the chain must operate effectively to yield success. Adapted source: SOFF and WMO Secretariat, 2023.

Output 8 of the SOFF Theory of Change “*Weather and climate analysis products are freely available*” focuses on ensuring that the improved forecast products reach the beneficiary countries. These products are generated by the WMO Global Producing Centres, incl. ECMWF and are exchanged internationally via the WMO Integrated Processing and Prediction System (WIPPS). According to the WMO Unified Data Policy (Extraordinary Session of the World Meteorological Congress, October 2021), *core data* products are to be exchanged on a free and unrestricted basis with all WMO Members.

## 2.2. SOFF Advisory Board and ECMWF

ECMWF is a Member of the SOFF Advisory Board and strives to bring its expertise and knowledge on observations, forecast and GBON into the discussions and contributions of the Advisory Board to SOFF direction.

### **3. ECMWF support to SOFF beneficiary countries**

To respond to the ECMWF's commitment to SOFF, ECMWF envisages the following key areas of support to SOFF beneficiary countries:

#### **3.1. Free and unrestricted access to improved forecast data and graphical products**

The ECMWF Council has agreed at its 104th session, 28–29 June 2022 that the beneficiary countries targeted and actively supported by SOFF should be offered real-time access to ECMWF data, free of cost, under the same conditions as those applied to NMHS non-commercial licenses. These forecast data enable NMHSs to perform their official duties, for example, the initialization of Limited-Area Models (LAM).<sup>2</sup> ECMWF also offers a large catalogue of free of charge and open graphical products for SOFF beneficiary countries.

#### **3.2. ECMWF training**

ECMWF has an extensive education program to assist NMHSs in the training of scientists and forecasters in numerical weather forecasting (NWP), and to help them make use of ECMWF's forecast products and infrastructure, such as the European Weather Cloud. ECMWF also offers training courses for software packages and applications to enable NMHSs to optimize their use of NWP outputs and products. ECMWF could be in a position to organize more in-depth, tailored training programmes for SOFF beneficiary countries in collaboration with ECMWF Member States on a cost-for-service basis.

#### **3.3. Using ECMWF cloud and HPC infrastructure**

As part of its mandate, ECMWF operates a High-Performance Computing (HPC) facility and a federated cloud computing infrastructure - the European Weather Cloud - which is a cloud-based collaboration platform for meteorological applications. This cloud infrastructure reduces the need to transfer large volumes of data. It could be used by SOFF beneficiary countries, on a cost-for-service basis (subject to possible further deliberation by the ECMWF Council on the modality of such use) for data reduction or enhancement tasks such as computing means, developing specialized products, operating LAMs, or machine learning applications.

#### **3.4. Impact assessment of SOFF-supported observations**

ECMWF has significant experience in establishing the value of surface-based observations through Observing System Experiments (OSE). OSEs are designed to use the ECMWF data assimilation to investigate the impact of observations (observation types and deployments) based on existing observation systems using ECMWF's integrated forecasting system. Such assessments can be complemented by an analysis of Forecast Sensitivity to Observation Impact diagnostics and the use of an ensemble of data assimilation to predict the impact of future observations.

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<sup>2</sup> Weather forecasts for many countries do not rely only on global predictions, such as those produced by ECMWF's Integrated Forecasting System (IFS). Instead, they are produced using special high-resolution models to make more detailed predictions for specific regions. These limited-area models (LAMs) use global model output as boundary conditions.

As part of SOFF monitoring, evaluation, and reporting, the SOFF Annual Reports will include an assessment of the impact of observations in forecast skill, drawing from the SOFF impact reports prepared by WMO in collaboration with selected WMO Global Producing Centers. This analysis is expected to assess the contribution of increased observations sharing to the improvement of weather forecast quality. The report will also provide feedback on the quality of observations. As a key SOFF partner, ECMWF is one of the Global Producing Centers contributing to the assessments.

## 4. Funding for ECMWF support

- **Access to ECMWF forecast data.** As outlined in section 3.1, ECMWF Council has decided to provide these data cost-free to SOFF-supported countries. ECMWF is in the process of defining technical solutions to optimize data accessibility.
- **ECMWF basic training.** The ECMWF basic and standardized training packages are offered free of charge.
- **ECMWF tailored in-depth training and advanced forecast data and graphical products.** The Country Hydromet Diagnostics, undertaken during the Readiness phase, allows SOFF-supported countries to identify their needs related to their capacity to use forecast data products. SOFF Implementing Entities (IEs) are expected to include the identified training, data access, and capacity-building needs in their larger hydromet and climate projects and programs into which SOFF will be embedded. IEs will use their own funds or resources from the major multilateral climate funds as part of the SOFF collaboration arrangements with these funds (see SOFF Decision 5.5 on “SOFF within the Multilateral Climate Finance Architecture” and the SOFF collaboration notes with these funds included in this document). These would be provided on a cost-for-service model.
- **Impact assessment of SOFF-supported observations.** SOFF impact assessments are included in the SOFF Theory of Change and SOFF Preliminary Work Programme (see SOFF Steering Committee Decisions 1.6 and 4.5)<sup>3</sup>. Therefore, the costs of the assessments will be covered by SOFF funding.

## 5. Going forward

ECMWF looks forward to working with the SOFF Secretariat in further fleshing out the specific arrangements and business process for potential consideration by the Steering Committee meeting in the future.

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<sup>3</sup> Decision item 1.6 Adoption of preliminary work programme. Available at: <https://alliancehydromet.org/wp-content/uploads/2022/08/Decision-item-1.6-Adoption-of-preliminary-work-programme.pdf>

Decision item 4.5 Adjustments to Steering Committee 2022 decisions. Available at: <https://alliancehydromet.org/wp-content/uploads/2023/04/Decision-4.5.-Adjustments-to-Steering-Committee-2022-decisions.pdf>