

Fifth impact evaluation of the Green OAT Evaluation Council: Public Subsidies to Weather Forecast and Earth Observation activities

The Green OAT Evaluation Council is in charge of evaluating the environmental impact of the green eligible expenditure financed by the Green OAT, the French sovereign green bond. This document sums up the opinion of the Green OAT Evaluation Council¹ on the environmental impact of the public subsidies to weather forecast and earth observation activities. This opinion has been informed by an evaluation of the environmental impact of the weather forecast and earth observation activities, provided to the Council and published along with this opinion's publication.

Main observations:

- ➔ *The Green OAT Evaluation Council welcomes the evaluation provided, notably the **quantitative estimate** of the some indirect contributions of weather forecast and earth observation activities to climate change mitigation and the **qualitative assessment** conducted regarding other indirect contributions to climate change mitigations, as well as climate change adaptation, biodiversity protection and pollution reduction of weather forecast and earth observation activities.*
- ➔ *This evaluation provides a major contribution to the development of impact reporting in the green bond market, as it presents a methodology to prioritize impacts and develops specific methodologies for the main impacts to evaluate. Furthermore, it provides a preliminary analysis of the eligibility and alignment of Météo France activities (in particular operational climate services) with the European Taxonomy on the "climate change mitigation" and "climate change adaptation" objectives.*
- ➔ *The quality of the evaluation meets high academic standards. Quantitative assessments are in line with recent academic literature and based on the expertise of Michel Jarraud² on weather forecasting, and qualitative elements are robust.*
- ➔ *The Green OAT Evaluation Council endorses the main results of the evaluation of weather forecast activities; in particular that the expenditures associated with this agency contribute to meet France's objectives in terms of climate change mitigation, biodiversity protection, reduction pollution and climate change adaptation.*

1. Introductory remarks

The Council notes that France aims to reduce emissions by at least 40% by 2030 as compared with 1990 levels, and achieve carbon neutrality by 2050 to contribute to the objectives set out in the Paris Agreement. In line with these objectives, France will have to implement the necessary actions to mitigate climate change, and to adapt, by 2050, the

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² Michel Jarraud was Secretary-General of the WMO from 2004 to 2015. He is a specialist in numerical weather prediction and had high-level operational responsibilities at Météo-France and ECMWF before joining WMO.

territories to the expected regional climate changes, given the emissions of greenhouse gases already accumulated in the atmosphere. These demanding objectives require ambitious policies to reduce greenhouse gas emissions and to anticipate the expected impacts of climate change and limit their possible damage.

Earth observation programs help to improve understanding of climate change by providing researchers with dynamic data that are essential to validate climate change models. With a view to adapt to climate change, knowledge of past and prediction of future climate is one of the strategic priorities of Météo-France. Thanks to its high-performance climate models and computing centers, Météo-France contributes to predict the impacts of climate change and plays a decisive role in assisting public policy-making as regards climate change adaptation, in an environment that is increasingly dependent on weather conditions.

Weather forecasting and earth observation activities account for 7.1% of the total amount of green OATs issued between 2017 and 2020.

2. Main results of the evaluation provided to the Council

This report assesses the environmental impact of meteorological and Earth observation activities carried out by Météo-France, the European Centre for Medium-Range Weather Forecasts (ECMWF), European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), the European Space Agency (ESA) and the French national center for space studies (CNES). These five organizations are partly financed by French public expenditures eligible for the Green OAT of France launched in 2017 by *Agence France Trésor*. The evaluation is based on the four environmental objectives defined in the Green OAT framework document: climate change mitigation, climate change adaptation, biodiversity protection and pollution reduction.

The study uses a counterfactual scenario based on the following rationale: at the national level, public subsidies given to Météo-France and the CNES are the main sources of these two organizations' budgets. If such subsidies had not been given for decades, the two organizations could not have run their activities. At the European level, public subsidies of France finance the annual contributions of the country to ESA, EUMETSAT and the ECMWF. In the absence of those contributions for decades, implying the absence of technological and scientific knowledge of France as well, the quality of the service provided by European meteorological organizations would be lower and Earth observation development would not be at its current level. Hence, the counterfactual scenario relies on two assumptions: **i)** we suppose the absence of weather and climate forecasting activities provided by France and the use, instead, of the American services provided by the NOAA and **ii)** we assume that Earth observation is still at its beginning in Europe, with some exploratory missions but without the Copernicus program that has operational use.

The study finds that **meteorological and earth observation activities analyzed in this evaluation have a positive effect on:**

Climate change mitigation:

- Under well-identified assumptions, weather forecasts provided by Météo-France (with the support of ECMWF and EUMETSAT) have enabled to avoid between 0.8 and 3.7 MtCO₂-eq (in the most pessimistic scenario) or between 3.7 and 18.3 MtCO₂-eq (in the most optimistic scenario) per year due to the fabrication and use of phytosanitary products and fertilizers, in comparison to the chosen counterfactual scenario. This reduction of greenhouse gas (GHG) emissions is obtained thanks to treatment optimizations allowed by weather forecasting and lower **losses** of plant protection products (PPP) and fertilizers. Earth observation provided by the European Copernicus program (Sentinel missions) also contributes to the optimization of farming treatments by providing data for precision farming services.
- It is estimated that weather forecasting services provided by Météo-France may have prevented between 23,000 and 41,000 hectares per year of forest from burning, resulting in avoided CO₂ emissions ranging from 1.1 to 2.0 MtCO₂-eq per year compared to the counterfactual scenario. Earth observation also features promising results for the provision of rapid fire detection and mapping, contributing to reduce burned areas and CO₂ emissions.
- Renewable wind and solar energies rely on the weather and weather forecasting services, as offered by Météo-France and the ECMWF, which have contributed to optimizing their development and their market penetration, allowing in particular to replace more CO₂ intensive electricity generation sources.
- It is estimated that Météo-France has contributed to avoid between 1.5 and 3 MtCO₂-eq in 2018 (0.2 to 0.4% of total maritime transport emissions) by supporting ships to optimize their routes on maritime areas overseen by the French institution.
- Earth observation acts as a crucial informative support to authorities for more efficient wetland management and conservation, that require monitoring over large areas of wetlands, sometimes difficult to access.

Climate change adaptation:

- Météo-France provides predictions on the future evolution of climate at local levels and specific climate services such as the provision of predictions on forest fire risk evolution in France, evaluations of local projects' effectiveness to face urban heat islands. These predictions are determinant for managing authorities to choose the appropriate climate change risks mitigation measures and make territories more resilient against global warming and increasing heat waves.
- Earth observation allows the detection and the monitoring of coastal erosion through time which is an essential information to policy and decision-makers on local, regional and national levels for optimal climate change adaptation measures, specifically to make territories more resilient against sea rise and increasing flood risks. Earth observation through the Copernicus program is a significant contributor to the improvement of coastal erosion monitoring.

Biodiversity protection:

- Weather forecasts **at the field-scale** provided by Météo-France enable to limit wasted amounts of farming fertilizers lost in nature (*e.g.* because of unanticipated rain or wind before the spreading), reducing water eutrophication and thus protecting aquatic biodiversity from asphyxia. It was estimated that each year, weather forecasts provided by Météo-France could help avoiding 11 to 54 km³ of water to lose all its species for one year, compared to the counterfactual scenario. Earth observation also contributes to the optimization of farming treatments for the development of precision farming services, limiting the overuse of products and reducing eutrophication risks.
- Services provided by Météo-France contribute to reduce the consequences of forest fires and oil spills on biodiversity by providing forecasts helping authorities for optimized and rapid actions. The Copernicus program provides data for rapid fire detection as well as for developing fire damage assessment maps that are essential to foresters to identify affected areas and undertake optimal measures for ecological restoration.
- The forecast of local and reliable meteorological conditions provided by Météo-France are determinant to guarantee the safety of dams and nuclear power plants to prevent accidents that would have disastrous impacts on the biodiversity around.
- Earth observation shows promising results for monitoring land use and status of forests, wetlands, and coastal areas. Such monitoring is essential to detect and map human and natural stresses on ecosystems and on the biodiversity.

Pollution reduction:

- Earth observation and Météo-France contribute to the optimization of farming treatments, fires control and oil spills countermeasures, as well as the monitoring of atmospheric pollution, reducing air, soil and water pollution compared to the counterfactual scenario.

Moreover, the added value of Earth observation lies in its capacity to produce data to enhance the scientific knowledge on environmental fields, especially on climate change science. Meteorological organizations, including Météo-France, are also important contributors to research aiming to improve our understanding of climate and its evolution. The scientific knowledge is then an essential tool to political actors to implement relevant measures for climate change mitigation, climate change adaptation, biodiversity protection and pollution reduction.

Activities carried out by the studied organizations have direct impacts on the environment, through energy consumption required for their infrastructures and technological resources. Earth observation also contributes to the space pollution with an increasing number of unused objects floating through space. However, we can reasonably argue that such impacts are more than compensated by all the indirect environmental benefits generated by those activities.

Finally, the weather forecasting activity and the Earth observation activity are not eligible³ to the criteria of the delegated act of the European Taxonomy for climate change, as it is not specifically dedicated to solve an environmental problem (e.g. reducing emissions) for the former and given the very indirect contribution to climate change mitigation and adaptation for the latter. However, **operational climate services** provided by Météo-France could meet both eligibility and alignment criteria, provided that sufficient information is collected to prove it.

3. Quality of the evaluation

The Council then endorsed the final version of the report. The impact assessment study has been conducted by Citizing, an independent consultant.

The Council underlines that the study meets its objectives as defined by the terms of reference. In particular, the Council is satisfied about how the evaluation team handled the counterfactual that could serve as a template for other studies and causal chain issues. The Council pointed out the importance of this study, a key to raise awareness about climate change adaptation among political leaders.

The Council stresses the innovative aspect of the study, as it contributes to the development of multi-sectoral (agriculture, forest management, maritime transport, electricity production, etc.) impact reporting methodologies, in particular regarding **climate change adaptation**. This study is indeed among the first impact evaluation that has been conducted on a green bond in relation to this objective. Moreover, the Council points out the preliminary evaluation of some related activities in keeping with the criteria of the European Taxonomy.

The Council also notices some areas of potential improvements for future studies, whenever possible and appropriate: quantify all of the impacts identified, which is nonetheless an ambitious target as each impact requires a specific methodology.

4. Conclusion and way forward

The Evaluation Council welcomes the results of the study on public subsidies to weather forecast and earth observation activities, as this innovative study lays ground for impact reporting on climate change mitigation and adaptation, biodiversity protection and reduction pollution for weather forecasting and earth observation sectors.

The Evaluation Council underlines the high quality of the evaluation process. The study meets high academic standards.

The Council is confident that this fifth impact evaluation will be useful to other green bond issuers and offers a contribution to the development of best practices for evaluation on the market. This study could in particular be of use for sovereign issuers focusing on climate change mitigation, as it develops a methodology of impact reporting on this issue. Impact evaluation and transparency are indeed key factors to support the scaling up of green finance.

³ Eligibility of activities implies that an activity is included/covered in the delegated act on climate change. Alignment of an activity goes beyond eligibility and implies that an activity complies with the technical criteria designed specifically for this activity in the Taxonomy.

The publication of this study is a major step for the Green OAT as it confirms the important role of the Evaluation Council. This impact reporting ensures the credibility and the transparency of the Green OAT.