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Green OAT – Evaluation report

Public subsidies to weather forecast and Earth observation activities

Impacts assessment on climate change mitigation and adaptation, pollution and biodiversity

March 2022

The Green OAT Evaluation Council

- In January 2017, France issued its first sovereign green bond (OAT 1.75% 25 June 2039) and committed to publishing several reports to the benefit of citizens, investors and the civil society:
  - An annual allocation and performance report (June 2018, July 2019 and July 2020);
  - Impact reports assessing the ex-post environmental benefits of expenditures associated to the Green OAT. The Evaluation Council of the Green OAT is in charge of supervising and publishing the latter reports.
- The Council is chaired by Mr. Manuel Pulgar-Vidal, former Minister of Environment of Peru, president of the COP20 and head of the WWF Climate and Energy Practice, with eight other independent members, experts in green finance or public policies evaluation.
- The French ministry of Ecological Transition and that of Economy, Finance and the Recovery are jointly in charge of the Council's secretariat.
- The first report (2018) evaluated the Energy Transition Tax Credit (CITE), the second one (2019) focused on the French Waterways, the third one (2020) on the National Forestry Commission of France and the fourth one (2021) on the « Investments for the Future » Programme.
- The present report, which deals with weather forecasting and Earth observation activities, is the fifth report submitted to the Council.

Evaluation process and evaluation team

- The evaluation of weather and Earth observation activities had to comply with the specifications set out by the Council, in March 2021, with the support of the Secretariat. These terms of reference are available for consultations on the AFT website. The Council discussed interim reports in September 2021 and November 2021.

- Citizing, an independent research and consultancy agency specialized in investment project and policy evaluation, was commissioned to carry out the evaluation study. It received the support of Michel Jarraud, an expert consultant in meteorology.
- The evaluation team:

Citizing
Challenge. Search. Solve.

Julie de Brux
Managing partner and founder of the agency
Economist specialized in project and policy evaluation

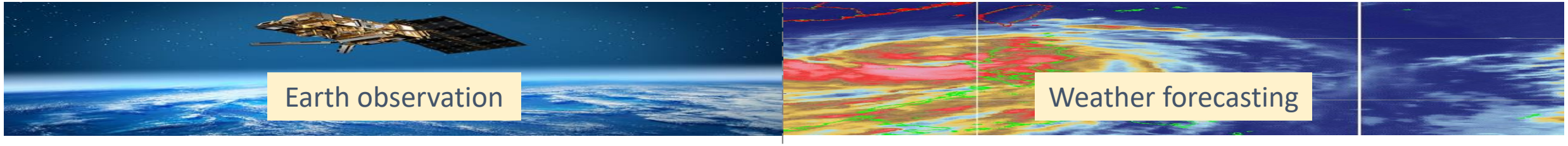
Damien Bescheron
Project manager
Expertise in marketing studies and sustainable development in companies

Dorian Pinsault
Operational analyst
Economist specialized in environmental policy

Michel Jarraud
External consultant in meteorology
Secretary-General at the World Meteorological Organization from 2004 to 2015

Weather forecast and Earth observation activities

- French public expenditures for weather forecasting and Earth observation eligible for the Green OAT of France partly fund two national organizations (Météo-France, CNES) and French contributions to three European organizations (ESA, ECMWF, EUMETSAT).



esa

cnes
CENTRE NATIONAL D'ÉTUDES SPATIALES

EUMETSAT

METEO FRANCE

ECMWF
EUROPEAN CENTRE FOR MEDIUM RANGE WEATHER FORECASTS

- Promotion of cooperation between European countries for space policy
- Implementation of space programmes and missions
- Coordination of European space projects (tenders selection…)

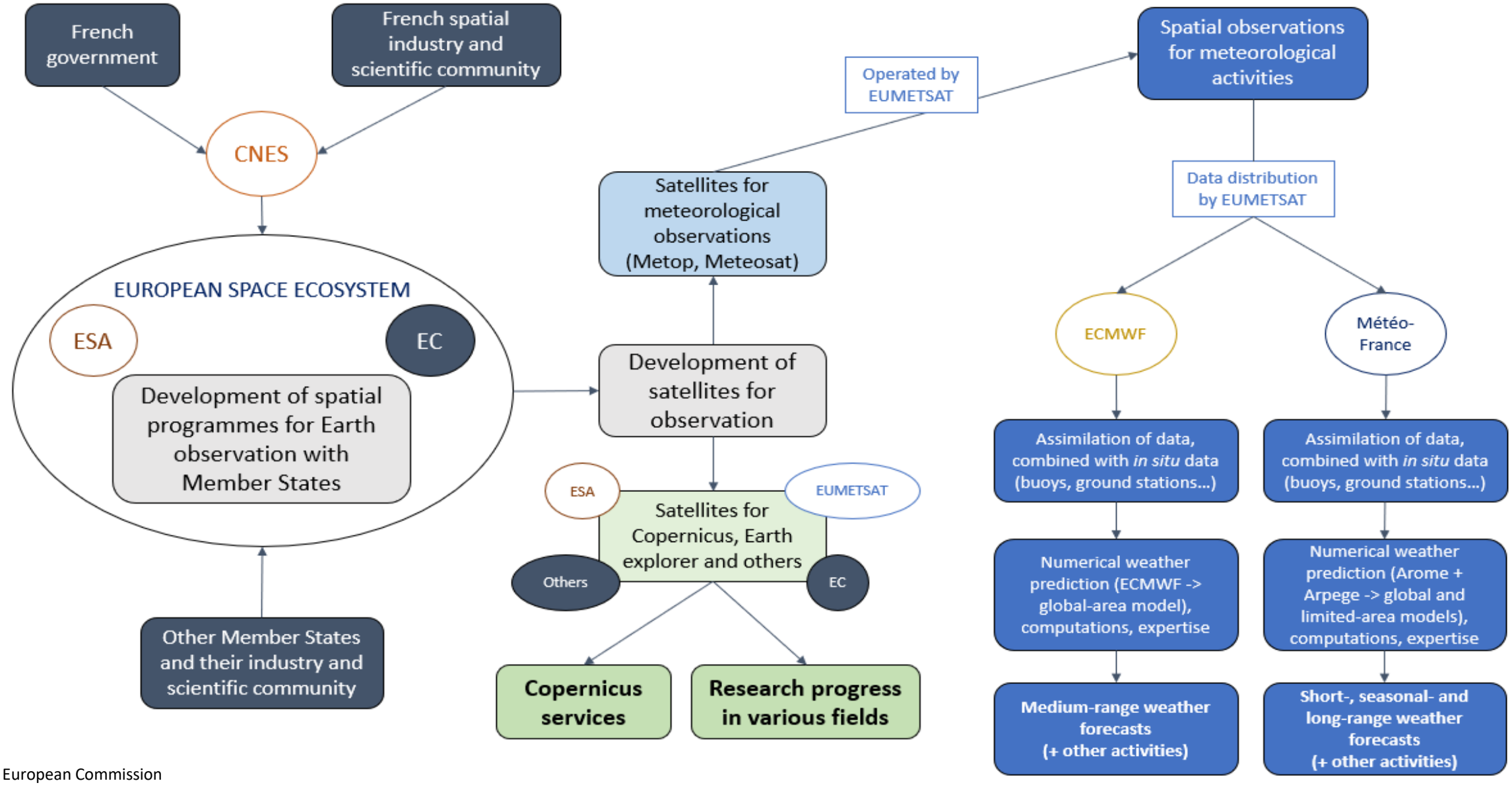
- Promotion and coordination of French space activities
- Possible involvement in research, design, development and operation of missions

- Development strategy of meteorological satellite system
- Satellites operation
- Ground systems development
- Observational data delivery

- Production of short- and seasonal-range weather forecasts in France
- Production of climate forecasts
- Operational services
- Research

- Medium-range weather forecasts (3-4 to 15 days ahead) in Europe
- Boundary conditions for limited-area models of member states
- Climate prediction
- Research

Interactions between organizations



EC = European Commission

Assessment methodology

- **Counterfactual scenario**:
  - **Weather forecasting**: the counterfactual scenario supposes that French subsidies would not be provided to Météo-France, the ECMWF and EUMETSAT. **France would not have any national meteorological service** and **would rely on American services** provided by the NOAA.
  - **Earth observation**: the counterfactual scenario supposes that French subsidies would not be provided to the CNES and ESA. **Earth observation would still be at its beginning in Europe** with some exploratory missions but **without the Copernicus program** that has operational use.
- The identification of environmental impacts is based on **interviews** carried out with the funded organizations, the **literature** and the **expertise provided by Michel Jarraud**, former Secretary-General of the World Meteorological Organization.
- Given the high number of identified impacts, a strategy of **prioritization** is elaborated to guarantee a high level of analysis of selected impacts.
- Quantification of impacts is challenging for several reasons. Yet, **we provide quantitative analyses for some impacts that rely on models with assumptions**. The objective is to provide **orders of magnitude of impacts** with ranges of values showing the sensitivity of the assumptions.
- **Qualitative analyses are favored when uncertainty is too important to quantify** as it is for Earth observation. Those rely on interviews with the organizations, the academic literature and case studies to demonstrate the contribution of studied activities to environmental impacts.
- The geographical scope of the study is
  - **Limited to France and international areas overseen by Météo-France** for weather forecasting activities
  - **Europe and beyond** for Earth observation activities

Main conclusions of the report – meteorological activities

Based on the above-mentioned methodology, it was possible to find that **meteorological** activities have a positive effect on:

- **Climate change mitigation**
  - Weather forecasts are associated to better use of phytosanitary products and fertilizers for farming, leading to lower required volumes of products at constant efficiency. We estimate the contribution of weather forecasting to the reduction of GHG emissions from products' production and consumption to range between 746 and 18,000 ktCO2-eq per year.
  - Weather forecasts are essential support to the Civil Security in the prevention and control of forest fires, enabling to avoid between 1,084 and 1,952 ktCO2 emissions per year from these fires.
  - Weather forecasts are crucial to anticipate the production of solar and wind farms and avoid adjustments in energy supply with fossil fuels to match the demand. The quality of prediction in wind energy production is estimated to have prevented between 18 and 40 ktCO2-eq emissions in 2019.
  - Weather forecasts contribute to optimizing ship routing, which led to at least 1,500 to 3,000 ktCO2-eq emissions avoided from heavy fuel oil consumption in 2018.

- **Climate change adaptation**
  - Météo-France provides climate projections and services to accompany various actors in making territories more resilient against global warming and increasing heat waves.

- **Biodiversity protection**
  - The optimization of farming treatments with weather forecasts also reduced damages on the biodiversity, especially through eutrophication. We estimate that each year, they avoid for 11 to 54 km^3 of water (freshwater, coastal water, ground water) to lose all its species for a year.
  - The role of weather forecasts in forest fires control and oil spills management is determinant to limit the consequences of those events on the biodiversity.

- **Pollution reduction**
  - The optimization of farming treatments, fires control, and oil spills countermeasures, as well as the monitoring of atmospheric pollution enabled by Météo-France with ECMWF and EUMETSAT contribute to the reduction in air, soil and water pollution.

Main conclusions of the report – Earth observation activities

Based on the above-mentioned methodology, it was possible to find that **Earth observation** activities have a positive effect on:

- **Climate change mitigation**
  - Earth observation, through the Copernicus program and the provision of spatial data, contributes to the optimization of farming treatment (precision farming), and thus the limitation of products' production and consumption that emit GHG.
  - Earth observation provides rapid fire detection and mapping, that proved to be useful to reduce burned areas and CO2 emissions
  - Earth observation acts as an informative support to authorities for more efficient wetlands management, essential to preserve these carbon sinks.

- **Climate change adaptation**
  - Earth observation has proved to be valuable for monitoring coastal erosion and sea level rise, essential for policy-makers to make territories more resilient.

- **Biodiversity protection**
  - The role of Earth observation to optimize farming treatments and to map forest fires and their consequences contributes to the biodiversity protection.
  - Earth observation shows promising results for monitoring land use, forests status, wetlands, and coastal areas to detect and map human and natural stresses on ecosystems and the biodiversity and to guide protective and restoration measures.

- **Pollution reduction**
  - The optimization of farming treatments and fires control, as well as post-fire ecological restoration measures enabled by Earth observation contribute to the reduction in air, soil and water pollution.

Main conclusions of the report – meteorological and Earth observation activities

- Meteorological and Earth observation activities are also important contributors to the scientific knowledge in environmental fields, especially on climate change, which is an essential tool to political actors to implement relevant measures.

- Activities carried out by the studied organizations have direct impacts on the environment, through energy consumption required for their infrastructures and technological resources. Météo-France emitted around 6.6 ktCO2eq in 2019, which is more than compensated by all the estimated indirect environmental benefits generated by those activities.

- **Analysis of organizations' activities regarding the European Taxonomy**
  - Weather forecasting activity and Earth observation activity are not eligible*, as enabling activities, to the criteria of the delegated act of the European Taxonomy for climate change.
  - Operational climate services provided by Météo-France meet eligibility criteria and could also meet alignment** criteria, provided that sufficient information is collected to prove it.
  - The study identifies 2 areas for improvement for the European Taxonomy:
    - Including more enabling activities, e.g. activities not specifically dedicated to the environmental objective but having an indirect contribution as weather forecasting and Earth observation.
    - Including fundamental research, in particular meteorology and climate research that can be of essential use in public policy decisions for mitigation of and adaptation to climate change.

- *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

Opinion of the Evaluation Council

- 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 Jarraud 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. 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.