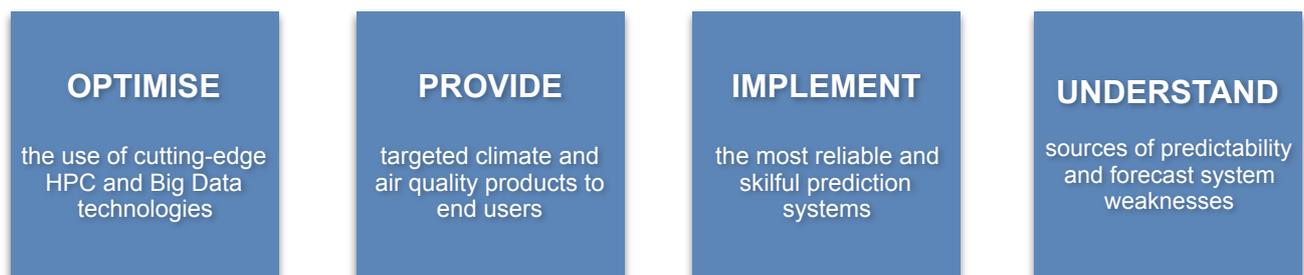


# Strategic Plan for the BSC-CNS Earth Sciences Department (2016-2019)

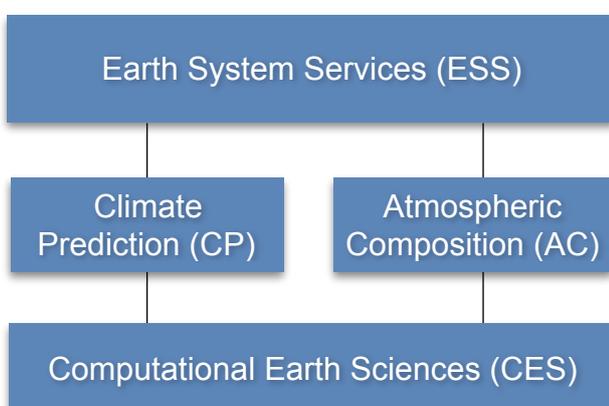
The Department of Earth Sciences of the Barcelona Supercomputing Centre-Centro Nacional de Supercomputación (BSC-CNS), BSC-ES henceforth ([bsc.es/earth-sciences](http://bsc.es/earth-sciences)), has become from its creation in 2006 a reference in the field of air quality and atmospheric composition modelling. The merging of the Climate Forecast Unit of the Institut Català de Ciències del Clima (IC3) into the BSC-ES has led the department to be a reference also in climate prediction and climate services.

The BSC-ES mission is to perform research on and develop methods for environmental forecasting, with a particular focus on the atmosphere-ocean-biosphere system. This includes managing and transferring technology to support the main societal challenges through the use of models and data applications in HPC and Big Data infrastructures. It also includes the dissemination of real-time air quality and climate information based on its research expertise in collaboration with the Spanish authorities and the World Meteorological Organisation (WMO).

The BSC-ES strategic plan aims at clarifying the goals of each research group, identifying the sources of funding, defining a sustainable growth rate, and fostering the collaboration both within and outside the BSC-ES department. Making it public should also help attracting the much-needed young talent to contribute to its excellence.



The BSC-ES is structured in four research groups, as illustrated in the diagram below. The department strategy includes a management layer made of the department director and the group leaders/coordinators that ensures the consistency of the activities with the strategic plan and that implements initiatives to facilitate an adequate communication at all levels.



A crucial task will consist in finding a balance between the research inspired by the scientific questions discussed by the community and the commitment to respond to social challenges and needs. It is expected that this will create a tension between the application-oriented and research-based groups that might trigger new opportunities for interdisciplinary research in a unique environment.

## Climate prediction

Aims at developing a climate prediction capability for time scales ranging from a few weeks to a few decades (sub-seasonal to decadal climate prediction) and from regional to global scales. The objective is to improve understanding of the climate processes and drivers of predictability, from the stratosphere down to the deep ocean and from tropical to polar latitudes, through the analysis of the state-of-the-art climate forecast systems in comparison with the most up-to-date observational datasets. The main research tool in this activity will be the EC-EARTH model.

*Development of climate forecast systems*

- Towards more realistic model processes
- Data assimilation, initialisation and ensemble generation

*Forecast quality assessment*

- Addressing uncertainty
- Attribution of errors and sources of predictability
- Diagnosis of climate forecast weaknesses



## Computational Earth Sciences

Aims at providing help and guidance on the technical aspects of the department's scientific activities and is in charge of developing a framework that ensures an efficient use of high-performance computing (HPC) resources. In order to keep an efficient use of the variety of computing resources available at the BSC and at other HPC institutions, a solid software development, profiling and optimisation area has been created to provide feedback to Earth system modellers around Europe on how to improve their codes in the race towards exascale computing.

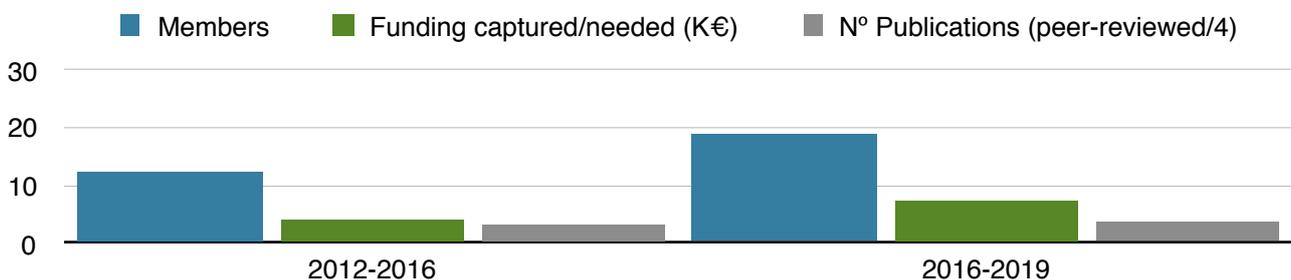
*Contribute to the development & maintenance of Earth system research software*

*Provide HPC expertise for the performance of Earth system models*

*Develop, manage and maintain a common data service framework*

*Maintain and improve operational systems*

*Research on new and more efficient computational approaches to apply on Earth system models*

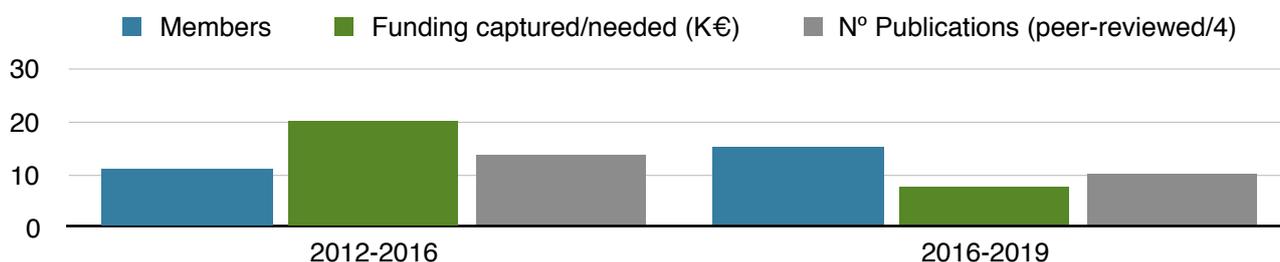


## Atmospheric composition

Aims at better understanding and predicting the spatio-temporal variations of atmospheric pollutants along with their effects upon air quality, weather and climate. It contributes to a variety of forecasting activities. The group also develops and maintains the CALIOPE air quality system ("CALIdad del aire Operacional Para España"), which provides high-resolution air quality forecasts over Europe and Spain using the in-house emission model HERMES.

### *Development and optimization of the NMMB/BSC-Dust model*

- Refinement and tuning of model schemes
- Development and implementation of currently missing species and processes



## Earth System Services

Aims at developing tailored services on weather forecasting, atmospheric composition and climate predictions. The group facilitates the interpretation and application of research coming from the BSC-ES through targeted tools and also carries out applied research to demonstrate the ongoing value of these services to advance sustainable development in key sectors of society and economy such as renewable energy, urban development, insurance, agriculture, water management or health.

### *Identification of user needs to influence the BSC-ES department research*

- Ensure adequate co-production of climate prediction services
- Explore the air quality information needs

### *Make full use of both forecast systems including post-processing.*

- Evaluate renewable energy
- Develop methods to provide predictions and projections

