



MAKE OUR
PLANET
GREAT AGAIN

CLIMATOLOGY RESEARCH IN FRANCE

France, a signatory to the Kyoto Protocol, hosted and led the 2015 Conference of Parties of the United Nations Framework Convention on Climate Change (COP21/CMP11). The objective was to forge a commitment by the international community to preventing the earth from warming more than 2°C. Within the European Union, France has taken an ambitious stance. It aims to reduce greenhouse gas emissions by 40% by 2030 and by 60% by 2040 (compared to 1990 levels). France is supporting priority areas of research in light of warnings from the Intergovernmental Panel on Climate Change (IPCC) and the role humankind plays in climate change.



CLIMATE CHANGE

The study of today's climate and its evolution depends on the study of past climates – those of the distant past (the subject of paleoclimatology) or of the recent past. It also requires global and regional climate models and an appreciation of the limits of climate simulations. Past climates are reconstructed by collecting evidence (from ice, marine environments, continental environments, and old weather reports) and by modeling natural changes in the climate during the Quaternary and pre-Quaternary periods as well as more recent changes caused by human activity. These research efforts have benefitted from the development and use of cutting-edge scientific

equipment such as spectrometers, magnetometers, chromatographs, lasers, and so on, and primarily from digital modeling technologies.

Another reason to study climate change is to understand its effects in different domains – health, water, biodiversity, natural risks, agriculture, forests, fisheries, energy, manufacturing, infrastructure, transportation services, city planning, coastal management, and mountains – so as to conceive and plan adaptive measures at the national and local levels. Several French research programs involve the implementation of the ecological transition, the prevention of health and environmental risks, the engagement against climate change, and management of its impact.

“Several research programs involve the implementation of the ecological transition.”

France began its ecological and energy transition with the goal of substantially reducing its carbon emissions. The nation's per capita emissions of greenhouse gases are already among the lowest in the industrialized world. France also works closely with developing countries to encourage the transition to a low-carbon economy. Within the European Union, France has taken an ambitious position centered on a goal of achieving a 40 percent reduction in greenhouse gas emissions by 2030 and 60 percent by 2040 (compared with 1990 levels). To respond to warnings from scientists on the Intergovernmental Panel on Climate Change and human responsibility for global warming, France is supporting research in several priority areas at a level that reflects the urgent need for action.



STRATEGY FOR THE ENVIRONMENT AND ENGAGEMENT AGAINST CLIMATE CHANGE

REDUCTION OF EMISSIONS OF GREENHOUSE GASES

The engagement against climate change is inseparable from the effort to reduce greenhouse gas emissions. The very active research program in this area includes, within the realm of technology, carbon capture and storage, particularly underground.

France reduced its greenhouse gas emissions by more than 10 percent over the commitment period (2008-2012) of the Kyoto protocol thanks to improvements in the energy efficiency of products, engines, and industrial processes. Innovations for the production of low-carbon technologies have improved agricultural techniques, transportation, and land-use planning (housing, urban planning, roads and railways, rivers and maritime activities, air traffic). Similarly, the priorities of new-construction design are exterior insulation, use of wood products (which trap carbon), and alternative energy for heating. Within the framework of environmental approaches to the design and construction of green buildings, the concept of the “positive energy building” achieved through insulation remains a critical preoccupation.

AGRICULTURE AND SUSTAINABLE DEVELOPMENT

Climate change has permanently altered global agriculture, threatening food security. Population growth and the emergence of new countries that are high energy consumers (Brazil, China, India) have intensified the cultivation of land and increased industrial production, creating growing amounts of pollution that further affect agriculture. The appropriation of land for the production of bioenergy, a relatively new goal of agriculture, threatens food security and the environment by creating substantial global imbalances. The major challenge is to ensure the food security of the poorest populations, which is the focus of development-oriented research and the design of techniques and technologies to intensify crop production in an eco-friendly manner.

ALTERNATIVE ENERGY

Alternative energies that emit lower levels of greenhouse gases are the focus of many French research projects. Energy alternatives including bioenergy, geothermal energy, thermodynamic heating, solar (thermal, photovoltaic, concentrated), wind, wave, hydraulic, and various hydrogen-related forms – are analyzed from the point of view of their output (yield) and their emissions. Reflecting those analytical efforts, the nation's energy research strategy emphasizes energy efficiency, solar energy, energy storage, biofuels, and forms of energy derived from the sea. For all such research, meteorology and climatology are essential disciplines, enabling researchers and energy companies to better assess available resources and to optimize combinations of different energy sources on a routine basis.

CARBON FOOTPRINT

Designates the amount of carbon, in metric tons, emitted by an activity or organization. The concept makes it possible to represent the demands that the burning of fossil fuels make on the planet. Emissions of carbon dioxide, expressed as the forest area required to sequester it, accounts for half of the whole human ecological footprint.

In the 1990's, France began several air-quality and wastetreatment initiatives. Environmental protection became a national priority with the creation of the **Agence de l'environnement et de la maîtrise de l'énergie** (ADEME, environment and energy management agency) and the adoption of a national environmental plan. Under the Kyoto Protocol, France made a commitment to stabilize, over the period 2008–12, greenhouse gas emissions at 1990 levels. In 2000, the **Programme de Lutte contre le Changement Climatique** (PNLCC, program to combat climate change) made it possible for France to meet its commitment. By 2004, France had made a plan, which was followed in 2007 by a national environmental task force. Programs that included renewable forms of energy were incorporated into a master carbon assessment, which gave rise to regional climate plans.

By 2015, France's emissions had declined by 16% since 1990 thanks to the combination of attenuation measures, including improved industrial processes, better building insulation, and the use of renewable energy, among others.

Alliance nationale de recherche pour l'environnement (AllEnvi national environmental research alliance)

- **Food, climate, water, land use** AllEnvi brings together public research efforts to program and coordinate France's environmental science strategy, which emphasizes adaptation to and attenuation of the effects of climate change. Improving observational data for better climate modeling is a key part of the Ocean component of the European Global Monitoring for Environment and Security program. Along with climate, several other thematic areas take climatology into account in a cross-cutting way: agroecology and soil, food processing, biodiversity, water, environmental evaluation, oceans and seas, and risks. www.allenvi.fr

Agence de l'environnement et de la maîtrise de l'énergie (ADEME, environment and energy security agency)

ADEME supports research and development into vehicles, buildings, new energy technologies, and ways to use alternative and renewable energy to reduce greenhouse gas emissions. The agency participated in the national climate plan in 2004 and helped businesses complete their own carbon assessments. www.ademe.fr >Nos expertises>Changement climatique

CIRAD, agronomic research for development

With a global network of partners in 90 countries, CIRAD supports project-based research related to the engagement against climate change: climate change and emerging animal diseases; climate change and plant health; livestock and climate change; climate change and food security; payments for environmental services and climate change; climate change and strengthening national and local capacity; international negotiations and national climate policies. www.cirad.fr >Innovation & expertise>Compétences et expertises>Changement climatique et agriculture

Climat-Environnement-Société (scientific interest group on climate, environment, and society)

Through its 13 laboratories and the Île-de-France research federation, the GIS supports and coordinates interdisciplinary



USEFUL LINKS

- Airparif, air pollution in Île-de-France: www.airparif.asso.fr
- ANCRE, the national coordinating alliance for energy research: www.allianceenergie.fr
- ANR, national research agency: www.agence-nationale-recherche.fr
- Bilan GES, resource center on greenhouse gas assessments: www.bilans-ges.ademe.fr
- CDC climate research: www.cdcclimat.com/CDC-Climat-Recherche.html
- CEPMMT, European center for medium-term forecasting: www.ecmwf.int
- CERFACS, European center for research and advanced training in scientific computation: www.cerfacs.fr
- CESE, economic, social, and environmental council: www.lecese.fr
- Key climate figures for France and the world 2014: www.cdcclimat.com >Publications
- Climate-KIC, a European project at the FCS Campus-Saclay: www.climate-kic.org
- Club CO₂, carbon capture, storage, and trading: www.captage-stockage-valorisation-co2.fr
- CNRM, national center for meteorological research: www.cnrm.meteo.fr
- COP21, 2015 Paris Climate Conference: www.diplomatie.gouv.fr >Politique étrangère de la France>Environnement et développement durable
- Energy and climate research challenges: www.cea.fr/energie/energies-climatles-defis-de-la-recherche
- Energy and climate, observations and statistics, Ministry of Ecology, Sustainable Development, and Energy: www.statistiques.developpement-durable.gouv.fr >Énergies et climat
- Energy and climate package implemented by France (syntheses): www.ccomptes.fr/Publications/PublicationsLa-mise-en-œuvre-par-la-France-du-Paquet-energie-climat
- ENM Météo/INP Toulouse : www.enm.meteo.fr
- European Institute of Innovation and Technology, KIC-Climat: <http://eit.europa.eu/eit-community/climate-kic>
- Evolution of the climate and the oceans, articles by Édouard Bard of the Collège de France: www.college-de-france.fr/site/edouard-bard/travaux_1.htm
- France's water authorities: www.lesagencesdeleau.fr
- GeoIDD interactive map (France and coastlines), observation service, and statistics from the Ministry of Ecology, Sustainable Development, and Energy: www.statistiques.developpement-durable.gouv.fr/cartographie/750.html
- INSU, national institute of earth and universe sciences: www.insu.cnrs.fr
- IPCC, Intergovernmental Panel on Climate Change: www.ipcc.ch
- La Recherche, climatology archives: www.larecherche.fr/savoirs/climatologie
- MEAE, Ministry of Europe and Foreign Affairs: www.diplomatie.gouv.fr >Politique étrangère de la France>Environnement et développement durable
- MTES - Ministry of the Ecological and Solidarity Transition: www.developpement-durable.gouv.fr >Énergie, air et climat
- Mercator Océan, ocean analysis and forecasting: www.mercator-ocean.fr
- OMP, Observatoires Midi-Pyrénées: www.obs-mip.fr
- ONERC, national observatory on the effects of global warming: www.developpement-durable.gouv.fr/-Impacts-et-adaptation-ONERC-.html
- RAC-FR, climate action network in France: <https://reseauactionclimat.org/>
- Research newsletter of the scientific interest group on climate, the environment, and society: www.gisclimat.fr >Nos activités>Diffusion scientifique
- Sagascience, a collection of multimedia files from CNRS on climate issues and topics: www.cnrs.fr/cw/dossiers/saga.htm
- Scientific interest group on climate, environment, and society: www.gisclimat.fr
- UNFCCC, United Nations Framework Convention on Climate Change: <https://unfccc.int>
- Volatils, earth, atmosphere, and interactions from the Voltaire laboratory of excellence: www.univ-orleans.fr/investissements-avenir/voltaire
- WMO, World Meteorological Organization—Weather, Climate, Water: www.wmo.int
- WCRP, World Climate Research Programme: www.wcrp-climate.org

research on climate change and its environmental and social effects. Work is conducted in the areas of climatology, hydrology, ecology, economics, health, the social sciences, and the humanities. Researchers rely on Système Terre (earth system) digital modeling tools and the Earth observation platforms. The GIS Climat-Environnement-Société funds visits from high-level foreign scholars and researchers. It provides seed funding and support for interdisciplinary projects that will be integrated with European and international scientific programs. It also supports communication and training initiatives in the sciences. www.gisclimat.fr

Institut national des sciences de l'Univers (INSU, national institute of earth and universe sciences) - CNRS

INSU, a part of CNRS organizes and structures environmental research while also providing support for laboratories. Meteorology and climate, as well as the composition and quality of air, water, and soils, are subjected to observations at various levels of time and space, to laboratory and field experiments, and to modeling to test scenarios and effects for forecasting purposes.

www.insu.cnrs.fr/environnement

Observatoire national sur les effets du réchauffement climatique (ONERC, national observatory on the effects of global warming)

In 2001, France established a national observatory on the effects of global warming. The observatory has three major missions: - To gather and disseminate information, research, and studies on risks linked to global warming and extreme weather events - To formulate recommendations concerning measures to prevent and adapt to climate change - To dialogue with developing countries to facilitate their energy transition. ONERC is France's official point of contact with the IPCC. Since 2011, ONERC's website has made available documentation and research, thus becoming the portal of choice on climate change.

www.developpement-durable.gouv.fr/-Impactset-adaptation-ONERC-.html

FRENCH RESEARCH PORTAL

www.campusfrance.org/en/researcher

A UNIQUE, **ONLINE-ACCESS INFORMATION POINT**
FOR LOCATING RESEARCH PROJECTS



◆ UNDERSTANDING FRENCH RESEARCH

- > Understanding how PhDs operate in France;
- > Knowing how to start and finance a PhD;
- > Applying to international research programs (Hubert Curien Partnerships, *Make Our Planet Great Again*, etc.).



◆ DIRECTORY OF DOCTORAL SCHOOLS

Point of entry for starting a PhD and the 270 doctoral schools organizing and supervising doctoral training.

- > Search by ke-words, regions, and disciplines;
- > Comprehensive information on doctoral schools: Research areas, criteria and points of contacts for admission, welcome mechanisms, proposed topics, current financing, international dimension, and points of contacts for associated research laboratories;
- > Access to fields offered by each doctoral schools.

31 doctoral schools in climatology, list accessible at
<https://doctorat.campusfrance.org>
Type «Climatology» in the search field.



◆ PhD TOPICS, MASTER INTERNSHIPS, AND POST-DOCTORAL POSITIONS:

- > Offers financed through doctoral contracts, Industrial agreements for training through research (CIFRE), and specific offers devoted to programs financed by foreign governments;
- > Offers for Master internships for experience in a research laboratory;
- > Post-doctoral offers for work in French laboratories;
- > A detailed financing mechanism for each research offer (PhD topics, post-docs, and internships).

More than 200 offers made public in climatology each year, accessible at: <https://doctorat.campusfrance.org/phd/offers>
Then click on the «Make Our Planet Great Again» logo