French scientists offer strong contribution to coordinated international effort to better understand the climate system through computer simulations

Climate scientists at the Institut Pierre Simon Laplace (IPSL) and CNRM-CERFACS announce today the release of new datasets that promise to provide fresh insights into past and future climate change. IPSL and CNRM-CERFACS are engaged, with other climate research centres, in an international effort to provide a new generation of climate change experiments. The new climate models feature many improvements in their treatment of Earth's climate system as well as higher resolution. The datasets, hosted at IPSL and Météo-France and replicated at other sites around the world, are provided freely to everyone and will enable a large international community of researchers to analyze and scrutinize the results. Primary goals are to understand the processes underlying climate change, gauge the strengths and limitations of climate models and provide a strong scientific basis for climate change adaptation and mitigation policies.

The publication of these datasets is the outcome of more than three years of work involving about 100 scientists involved in the CLIMERI-France research infrastructure.

Altogether this represents more than 500 millions of computer hours made available by GENCI (~300 millions of computer hours on the Curie and Joliot-Curie supercomputers at TGCC-CEA and the Ada supercomputer at IDRIS-CNRS for the IPSL-CM6 models) **and Météo-France** (~200 millions of computer hours for the CNRM-CERFACS climate models, including the high resolution configuration CNRM-CM6-HR) for the realization of climate simulations, a tailored user support by the computing centres, 80,000 years of simulated climate produced 24/7 for longer than a year, a storage capacity of 20 PB, a 10Gb/s high-speed network between IPSL, IDRIS and TGCC and an advanced grid data distribution system known as the Earth System Grid Federation (ESGF).

The computing center of CEA located in Bruyères-le-Châtel which houses the Joliot-Curie supercomputers, as well as Cobalt of the CCRT.
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Such an achievement would not have been possible without the participation of scientists and engineers at IPSL, Météo-France, CERFACS, TGCC-CEA and IDRIS-CNRS.

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Arnaud Caubel (Laboratoire des Sciences du Climat et de l'Environnement / IPSL, research engineer in computer sciences at CEA) says "The model development required rigorous quality control for the tens of intermediate versions that were developed successively by our team of IT engineers over the last three years."

Josefine Ghattas (IPSL, research engineer in computer sciences at CNRS) adds "High performance computing is absolutely necessary for a project such as CMIP6 and in particular IPSL could not have produced high resolution simulations without a significant effort on code optimization on GENCI new supercomputer Joliot-Curie at the TGCC-CEA".

Stéphane Sénési (research engineer at Météo-France) highlights that "Meeting the CMIP requirements regarding the variety and amount of results to provide was a real challenge; we addressed it in a fully coordinated way by designing a brand new, shared, seamless data production and formating system which allowed for a very early French contribution".

Guillaume Levavasseur (IPSL, research engineer in data sciences at Sorbonne Université) further says "In the context of overseeing the quality of data, the data dissemination has been redesigned to make the new release of climate datasets fully traceable. Once the data are quality-controlled and verified, each dataset is tagged with a unique persistent identifier. This new structure relies on an ecosystem of services which the IPSL greatly contributed to develop."

As more modeling groups complete their simulations, the archive will become an increasingly rich resource for climate researchers. As in past phases, CMIP-based science should prove invaluable to the Intergovernmental Panel on Climate Change (IPCC) as it prepares the Sixth Assessment Report due for release in 2021. Preliminary scientific results from the CMIP6 project will be presented in early June 2019 in Paris.

Box: CMIP6 international organization

Release of these new climate datasets represents a major milestone for the Coupled Model Intercomparison Project (CMIP). CMIP was established more than twenty years ago by the World Climate Research Programme (WCRP), itself part of the World Meteorological Organization, with governance and infrastructure provided by a number of core international centers. Its goal is to foster international cooperation among the climate modeling centers and to define standard experiments that facilitate comparison of results and lead to new insights and a better understanding of the climate system. The project has grown substantially through five phases, from a single experiment in 1995 (CMIP1) to more than two-hundred experiments in the current phase (CMIP6). The volume of data produced has also ballooned--from megabytes to billions of megabytes-- partly due to the expanded set of experiments, but also because model complexity and resolution have increased to address new science questions.

Participants are responsible for securing funds to support their activities, and by this means, CMIP thrives: modeling centers develop improved and more comprehensive climate models and perform the CMIP experiments; independent groups of scientists design targeted suites of experiments to address a diversity of scientific questions; and scientists and computer specialists develop the software "infrastructure" needed to deliver the results to researchers worldwide.

These links provide additional information:
- CLIMERI-France : https://climeri-france.fr
- IPSL Climate Modelling Centre: https://cmc.ipsl.fr
- CNRM: http://www.umr-cnrm.fr/cmip6/

- GENCI: http://www.genci.fr/en
- CONVERGENCE project: https://convergence.ipsl.fr
- CMIP6 overview: https://www.wcrp-climate.org/wgcm-cmip/wgcm-cmip6

Further CMIP6 resources:
- CMIP6 video: https://www.youtube.com/watch?v=WdRiYPJLt4o
- CMIP6 guides: https://pcmdi.llnl.gov/CMIP6/Guide/
- CMIP6 participating climate research groups: http://rawgit.com/WCRP-CMIP/CMIP6_CVs/master/src/CMIP6_institution_id.html
- Map of CMIP6 participating climate research groups: https://pcmdi.llnl.gov/CMIP6/
- Map of ESGF nodes hosting CMIP6 data: https://goo.gl/HoZ7BE
- CMIP6 available data: https://pcmdi.llnl.gov/CMIP6/ArchiveStatistics/esgf_data_holdings/
- CMIP6 data access: https://esgf-node.llnl.gov/projects/cmip6/