The BBVA Foundation recognizes Cazenave, Church and Gregory for their achievements in detecting, understanding and projecting sea-level rise due to climate change

- The three laureates "pioneered the integration of satellite observations with in situ measurements and innovations in numerical modeling to develop an accurate and consistent depiction of sea-level change globally," in the words of the award committee
- As well as identifying the effect of human action on sea-level rise, their work has revealed that that the rate of increase is accelerating over time
- Forecasts incorporating their findings warn that failure to curb greenhouse gas emissions could result in a sea-level rise exceeding one full meter by the end of this century, threatening the homes of around 100 million people living in coastal areas
- The three coincide in emphasizing the gravity of the problem and the urgency of the international community taking effective steps to address the threat and contain its potential impact

Madrid, 9 January, 2019.- The BBVA Foundation Frontiers of Knowledge Award in the Climate Change category has gone in this eleventh edition to Anny Cazenave (France), John Church (Australia) and Jonathan Gregory (UK), for their outstanding contributions, the committee states, "to detecting, understanding and projecting the response of global and regional sea level to anthropogenic climate change."

"Rising sea level imperils low-lying ages with manifold societal and ecological impacts," the citation continues. "Because it is influenced by many factors, interpreting and projecting sea-level change is a tremendous scientific challenge."

Despite being one of the severest impacts of climate change – an increase of just one meter would affect hundreds of millions of people – the extent of sea-level rise is particularly hard for scientists to pin down, due to the large natural variability this magnitude has shown throughout Earth's history. Some 20,000 years

ago – a mere blink on the geological time scale – sea level was 120 meters lower than today's, and in the last 5,000 years it has climbed by two meters.

Identifying humanity's footprint within such a wide range has occupied scientists for decades, and it was only two years ago that awardee John Church was able to confirm, writing in *Nature*, that from 1970 onwards human activity has been the chief factor driving sea-level rise. This conclusion could not have been reached without gathering and integrating data from multiple sources, and it is here that the three laureates' efforts have been pivotal, on an individual, collaborative and, above all, complementary basis.

Cazenave, Church and Gregory, the committee remarks, "pioneered the integration of satellite observations with in situ measurements and innovations in numerical modeling to develop an accurate and consistent depiction of sea-level rise globally (…) Their findings have been instrumental in testing our understanding of how the Earth system works, enabling better grounded projections."

Cazenave is Director for Earth Sciences at the International Space Science Institute in Bern, Switzerland, and an emeritus scientist at the Laboratoire d'Etudes en Géophysique et Océanographie Spatiales (LEGOS), belonging to French space agency CNES. Church is a professor in the University of New South Wales in Sydney (Australia), while Gregory is a professor in the Department of Meteorology at the University of Reading (United Kingdom) and a senior scientist in the National Centre for Atmospheric Science.

A growing rate of increase

Besides identifying the anthropogenic footprint in sea-level rise, laureates' work has established that the increase is getting faster. "Collectively, their research demonstrated the recent acceleration of regional and global sea-level change and quantified the relative contributions of the different causes of sea-level rise, most importantly ocean thermal expansion and the melting of ice sheets and glaciers driven by anthropogenic global warming," in the words of the citation.

There is a consensus to the effect that since the early 1990s, sea level has been climbing at a rate of 3 millimeters a year, giving a mean increase of 8 centimeters over the last 25 years. And that is a lot. The latest report from the Intergovernmental Panel on Climate Change (IPCC), published in 2014, states that "the rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia." And to make matters worse, observations show that the pace picked up over the 20th century, and will very likely continue to do so.

Observations from space

Satellite observations have played a crucial role in facilitating these conclusions. Initiated in the 1990s, their global, planetary perspective was able to impose order on the tide records gathered haphazardly for decades at ports and other

points along the coasts. Cazenave, a geophysics specialist, was a pioneer in interpreting these new measurements, whose first source was the Franco-American satellite TOPEX/Poseidon. Her work corrected the errors of previous estimates to deliver the first accurate and reliable set of data on sea level globally.

As she explains, "observations from space have had a key role. Before the satellite altimetry era that began at the start of the 1990s, the only information we had about sea-level rise was from an instrument installed in ports, which gave no data on the open ocean. So very little was known about the phenomenon."

Church, an oceanographer, and Cazenave were able to reconcile the new satellite data with existing local registers, and by this means build a solid record of sea-level change in the recent period. The next steps were to extend their records into the past and draw up projections for the future, and it was here that Gregory's numerical models came into their own.

This British researcher is an expert in calibrating climate sensitivity to diverse factors, be it the rise in atmospheric CO_2 or the speed of ice melt. Thanks to his work, such variables can now be integrated and existing data adjusted in a way that permits reliable predictions of the system's future evolution, with a known margin of uncertainty.

"What I have done mostly is work on how to put together models that include all components of sea-level change, in order to make projections for the future and to improve understanding of the past," he explains.

We now possess a robust temporal record of sea levels from the end of the 18th to the 21st century. Moreover, in the few years separating one IPCC report from the next, prediction uncertainty has lessened substantially. "Our confidence has improved because we have gained a greater understanding of the past, such that we can now explain how and why sea level has changed over the past 150 years," says Gregory. "A better understanding of the past gives us more confidence in the future."

Adapt as a matter of urgency

The three laureates coincide regarding the gravity and urgency of the problem, and the need for a political response. "Sea level is rising at an increasing rate," says Church. "If it is business as usual, and we fail to curb our emissions, we could see a sea-level rise of up to a meter, perhaps more by the end of the century. But with urgent and significant mitigation, we could reduce that rise to maybe a little over half a meter. The rise in any case will be ongoing for many centuries."

Church also pointed out the vast numbers of people at risk: "About 100 million people live within one meter of current high tide level, so in a century we could have 100 million people having to adapt in some way, either protecting their houses, retreating from the coastline or protecting the coastline."

"This problem is not just important, it's urgent," Church insists. "Many politicians probably recognize the importance but few recognize how urgent a response is required (…) Reducing emissions to achieve a temperature increase no higher than 1.5 degrees is a good target; it is a difficult task but that is what we should be aiming for."

"In Spain, and any other country with a coastline, we need to plan for rising sea levels during the 21st century and beyond. Because sea-level rise will not stop in 2100. And of course we have to mitigate emissions in order to avoid the worst-case scenarios."

"It is not too late"

Sea-level rise may be inevitable, but this should not lead us to inaction, warns Gregory: "Even in the best emission reduction scenario, sea-level rise is not stabilized at the end of the 21st century. It will proceed for many centuries to come, because the time scale for the warming of the deep ocean is centuries or millennia. However, we can have an influence on how much and how fast it will happen. We can't stop the increase, but we are not too late to do something to mitigate it and reduce its impact."

To those who ignore the findings of climate change science, his message is blunt: "These are facts; it is not a matter of opinion. Science deals with objective facts and you can't set aside an objective fact because you don't like it."

Cavenaze too calls for further action: "It is clear that we are not doing enough to combat climate change. Sea-level rise is just one consequence of global warming. There are many others, like extreme weather events, that are becoming more intense. We have to change the model of our society and way of life, consuming less fossil fuels. In Europe the general public is aware of the problem, but at government level we are still waiting for concrete action."

"To skeptics I would say compare the current climate in 2019 to that of 10 or 15 years ago. I would simply say to them to look at the facts and observations," she concludes.

Laureate bio notes

Anny Cazenave

Anny Cazenave (Draveil, France, 1944) obtained her PhD in Geophysics from the University of Toulouse (France) in 1975. She is an emeritus scientist at the Laboratoire d'Etudes en Géophysique et Océanographie Spatiales (LEGOS), belonging to France's Centre National d'Etudes Spatiales (CNES), and in 2013 joined the International Space Science Institute in Bern, Switzerland, where she is currently Director for Earth Sciences.

A member of the Joint Scientific Committee of the World Climate Research Program (WCRP), she was previously lead author on the sea level chapters of the Fourth and Fifth Assessment Reports of the Intergovernmental Panel on Climate Change (IPCC), as well as serving on the Scientific Committee of the IPCC

scholarship program. Since 2017, she has been collaborating in the Sea Level Budget Closure project of the European Space Agency (ESA).

From 1996 to 2007, she was Deputy Director of LEGOS where she headed the Space Geophysics, Oceanography and Hydrology team until 2009.

Among other distinctions, she was elected to the French Academy of Sciences in 2004 and to the U.S. National Academy of Sciences in 2008. In 2012 she was awarded the William Bowie Medal of the American Geophysics Union.

John Church

John Alexander Church (Gympie, Queensland, 1951) is a professor in the Climate Change Research Centre at the University of New South Wales (Australia). BSc in Physics from Queensland University and Doctor of Philosophy, he has been linked for much of his career to the Commonwealth Scientific and Industrial Research Organisation (CSIRO). From 1993 to 2003 he headed the Oceanography Program of the Australian National Antarctic Research Expeditions, and he participated as lead author in the IPCC's Third and Fifth Assessment Reports.

Author of over 150 publications, he is also co-editor of three books and a Fellow of the Australian Academy of Sciences, the Australian Academy of Technological Sciences and Engineering, the Australian Meteorological and Oceanographic Society and the American Meteorological Society. His numerous distinctions include the Roger Revelle Medal of the Intergovernmental Oceanographic Commission and the CSIRO Medal for Research Achievement in 2006, the Eureka Prize for Scientific Research in 2007 and the Morton Medal of the Australian Meteorological and Oceanographic Society (AMOS) in 2017.

Jonathan Gregory

Jonathan Gregory (Welwyn Garden City, United Kingdom, 1964) completed a BA in Physics at the University of Oxford, before going on to earn a PhD at the University of Birmingham with a thesis on particle physics that drew on his fifteen-month stay at CERN (Geneva, Switzerland). He has worked in Britain throughout this career. After a year at the Climatic Research Unit of the University of East Anglia, in 1990 he joined the Met Office Hadley Centre for Climate Science and Services in Exeter, where he is currently a science fellow. In 2003, he took up an appointment at the University of Reading, where he is now a professor in the Department of Meteorology and a senior scientist in the National Centre for Atmospheric Science.

He contributed as lead author to the Third, Fourth and Fifth Assessment Reports of the Intergovernmental Panel on Climate Change (IPCC), in the chapters dealing with sea-level rise and ocean observation. Among other distinctions, he holds the FitzRoy Prize of the Royal Meteorological Society, and is a Fellow of the Royal Society and the American Geophysical Union.

Climate Change committee and evaluation support panel

The committee in this category was chaired by **Bjorn Stevens**, Director of the Max Planck Institute for Meteorology (Hamburg, Germany), with **Carlos M. Duarte**, holder of the Tarek Ahmed Juffali Research Chair in Red Sea Ecology at King Abdullah University of Science and Technology (Thuwal, Saudi Arabia), acting as secretary. Remaining members were **Sandrine Bony,** Director of Research at the Centre National de la Recherche Scientifique, working at the Laboratoire de Météorologie Dynamique, Sorbonne University (Paris, France); **Miquel Canals,** Director of the Department of Earth and Ocean Dynamics at the University of Barcelona (Spain); **Martin Heimann**, Director Emeritus at the Max Planck Institute for Biogeochemistry (Jena, Germany); **Edward Rubin,** Alumni Chair Professor of Environmental Engineering and Science at Carnegie Mellon University (Pittsburgh, United States); and **Julie Winkler,** Professor of Geography in the Department of Geography, Environment and Spatial Sciences of Michigan State University (United States).

The **evaluation support panel of the Spanish National Research Council (CSIC)** was coordinated by **M. Victoria Moreno,** Deputy Vice President for Scientific and Technical Areas, and formed by: **Francisca Martínez Ruiz,** a Research Scientist at the Andalusian Earth Sciences Institute (IACT); **Eulalia Moreno Mañas**, Research Professor at the Arid Zone Experimental Station (EEZA) and Coordinator of the Council's Natural Resources Area; and **Rafael Simó Martorell,** Research Professor at the Institute of Marine Sciences (ICM).

About the BBVA Foundation Frontiers of Knowledge Awards

The BBVA Foundation centers its activity on the promotion of world-class scientific research and cultural creation, and the encouragement of talent.

The BBVA Foundation Frontiers of Knowledge Awards, established in 2008, recognize and reward contributions of singular impact in science, art and the humanities, privileging achievements that significantly expand the frontiers of the known world, open up new fields, or emerge from the interaction of various disciplinary areas. Their eight categories are congruent with the knowledge map of the 21st century, ranging from basic sciences to key challenges for the natural environment by way of domains at the crossroads of disciplines – Biology and Medicine; Economics, Finance and Management – and the supremely creative realms of music and the opera.

The BBVA Foundation is aided in the evaluation process by the Spanish National Research Council (CSIC), the country's premier public research organization. The Foundation and CSIC jointly appoint the evaluation support panels charged with undertaking an initial assessment of the candidates proposed by institutions across the world and drawing up a reasoned shortlist for the consideration of the award committees. CSIC is also responsible for designating each committee chair.

LAUREATE'S FIRST DECLARATIONS AND IMAGES

A video recording of the new laureate's first interview on receiving news of the award is available from the Atlas FTP with the following coordinates:

Server: **5.40.40.61**

Username: **agenciaatlas2**

Password: **fronteras**

The video is in the folder labelled:

"PREMIO CAMBIO CLIMÁTICO"

In the event of connection difficulties, please contact **Miguel Gil** at production company Atlas:

Mobile: 619 30 87 74

E-mail: mgil@mediaset.es

CALENDAR OF ANNOUNCEMENT EVENTS

Biology and Biomedicine	Tuesday, 29 January, 2019
Ecology and Conservation Biology	Tuesday, 5 February, 2019
Information and Communication Technologies (ICT)	Tuesday, 19 February, 2019
Basic Sciences	Tuesday, 5 March, 2019
Economics, Finance and Management	Tuesday, 26 March, 2019
Music and Opera	Tuesday, 9 April, 2019
Humanities and Social Sciences	Tuesday, 30 April, 2019