Project Outcomes

Outcomes are results of the activity that produce an effect on the overall communities or issues you serve. Outcomes include the advancement of science and cultural, economic, policy and societal effects. For example, an outcome may be a change in governance policy based on recommendations from field research.

They are gathered in categories : advancement of knowledge sciences, advancement of other knowledge, cultural or economic effet, models, societal or policy effect and then need to tell if it is with other pojects, stakeholders . For what we do in PACMEDY I propose the different classes below (include the needed entries + for each of them a very short paragraph telling (what academic disciplines were affected; how has it been used or implemented by the stakeholder; how has it been used or implemented by those outside the project team; how has it advanced knowledge; what economic, social, or policy effect has it produced)

Advancement of knowledge

indicate here mostly outreach or large audience synthesis, contributions to international WCRP or Future Earth working groups, or others pacmedy contributions to new national call for example or product that will use outside the community targetted by this JPI-Bemont call (database and publications are in outputs)

- Contribution to WCRP grand challenge on Climate sensitivity, circulation and clouds
- Contribution to WCRP grand challenge on Weather and Climate Extremes
- Participation in WCRP lighthouse activities workshop

PACMEDY observational and modeling activities have contributed to WCRP grand challenge discussions on the climate sensitivity, vegetation climate feedbacks (carbon feedbacks) and climate extremes in the South American Monsoon System (SAMS). • IPCC models have been able to reproduce some important characteristics of the SAMS variability in the last Holocene, such as major seesaw patterns the east/west and north/south features (NE Brazil x Amazon and NE Brazil x South/Southeastern Brazil). • The centennial variability reported in the proxy data is present in some PMIP models. The fact that these models produce centennial variability without solar forcing is indicative of long term cycles related to internal variability of the ocean/atmosphere/biosphere nonlinear coupling. • Theoretical studies conducted by the PACMEDY group provides support to the idea that nonlinear interactions in the climate system can promote energy transfer from interannual, annual and even shorter time scales, such as the intraseasonal, up to much longer periods, such as decadal, multidecadal and longer timescales. These theoretical results have important implication in future model development and raise further applicability of the high time resolution proxy data.

- Contribution to PAGES working group :

PAGES-SISAL. PACMEDY has supported the creation of the PAGES SISAL working group database. This is a global compilations of δ18O and δ13C records from speleothems that can be used to document climate changes over the Holocene and on glacial-interglacial timescales. PACMEDY has also supported workshops of the PAGES SISAL working group to discuss and promote analyses of these data. The first version of the SISAL database was published in Earth System Science Data (see project publications) and the second version of the database is currently in ESSD Discussions.

PAGES-Iso2k. Datasets produced by PACMEDY and PACMEDY members contributed to building the Iso2k Database: A global compilation of paleo-δ18O and δ²H records to aid understanding of Common Era climate. This is the first global-scale collection of water isotope proxy records from multiple types of geological and biological archives. It is suitable for evaluating hydroclimate processes through time and space using large-scale synthesis, model-data intercomparison and (paleo)data assimilation. The database has been submitted to Earth System Science Data.

PACMEDY has been active in the PAGES LandCover6k Working Group, specifically to promote the compilation of land use and land cover data that can be used as inputs to climate model simulations to evaluate the impact of anthropogenic activities during the Holocene.

PACMEDY played a key role in the PMIP4 working group on “Past2Future: insights from a constant varyingly past”. This included substantial participation in a London Workshop in May 2019. PACMEDY ended up leading two of the key papers emerging from the workshop.

- large audience publications

PAGES newsletters

Harrison, S.P., 2017. The big data revolution and paleoecology. Past Global Changes Magazine 25: 96-97.

Comas-Bru, L., Deininger, M. Harrison, S.P., Bar-Matthews, M., Baker, A., Duan, W. and Stríkis, N., 2017. Speleothem synthesis and analysis working group. Past Global Changes Magazine 25: 129, DOI:10.22498/pages.25.2.129.

Harrison, S.P., Stocker, B.D., Klein Goldewijk, K., Kaplan, J.O., Braconnot, P., 2018. Do we need to include anthropogenic land-use and land-cover changes in paleoclimate simulations? Past Global Changes Magazine 26, https://doi.org/10.22498/pages.26.1.4.

Harrison, S.P., Gaillard, M.-J., Stocker, B.D., 2019. Co-designed paleo experiments on land-cover and land-use change impacts. Past Global Changes Magazine 27, doi.org/10.22498/pages.27.1.38

Stakeholder

The wake of the negationist trend on climate change raised the stakeholders interest of the renewable energy and agribusiness sectors in Brazil on evidence of significant climate variability in the past. The fact that 21th Century future climate projections indicate scenarios that have not been reported in the recent instrumental era raises the question: how was the past climate, well before the instrumental records? Did we observe long term droughts or floods in areas where these events are sporadic? Was the “normal” climate in long periods in the past similar to what is now considered as an extreme situation?

Research indicates that models can reproduce important features of the past climates thus rendering confidence in their ability to project the future. As a result, researchers involved in paleoclimate studies, such as PACMEDY (in Brazil, in particular, at the CPTEC/INPE and the IAG/USP groups) have been heavily involved in talks, meeting with the renewable energy and agribusiness sectors using recently acquired knowledge on the climate variability, primarily concerning probability of occurrence of long term (decadal) changes in the climate statistics. As an example, • the wet climate trend in Southern Brazil, Northeast Argentina, Paraguay and the dry trend with long (approximately 7 years)

drought in northeast Brazil, with decreasing intensity towards Southeast Brazil since 2011 (culminating with the major 2013/14 drought episode) and • the extreme droughts and floods in the Amazon in the last 15 years have raised tremendous concern in the renewable energy and agribusiness. Meetings were called in order to answer questions concerning predictability of these events, probability of occurrence in the future and whether these extreme events were observed in the past and if the IPCC climate scenarios for the 21 Century are realistic or not, considering the earth's past history.

Contribution to other project

- Contribution to the international Paleoclimate Modeling Intercomparison Project
- Contribution to the German BMBF PALMOD project
- Contribution to the German BMBF ROMIC project

Organisation of conferences of workshops on PACMEDY subjects

- PaleoENSO workshop : https://paleoenso.sciencesconf.org

Within the context of the PACMEDY meeting 50 scientists from 15 different countries met in Belitung, Indonesia, in August 2019 to discuss past changes in the El Niño-Southern Oscillation (ENSO). This event brought together some of the leading scientists of this field as well as younger post docs and PhD students from a variety of disciplinary fields: paleoclimate, modelling and observations. The research presented during this meeting aimed to provide critical information required to better understand short- and long-term changes in ENSO. Recent findings were reviewed and our present understanding of the factors controlling past ENSO variance were assessed. Areas lacking information were identified, and a common and integrated strategy for future interdisciplinary studies was proposed. This workshop was an opportunity to strengthen a community of interdisciplinary researchers that will continue to benefit significantly from future interactions. The achievements of this workshop were the identification of a list of key questions that urgently need to be addressed. Most recent studies still differ on the factors that control trends in ENSO during the Holocene : stochastic processes, solar insolation, response to the mean climate conditions, or a combination of these factors. Temporal trends in ENSO variance differ and are site specific, highlighting the importance of mapping geographical patterns as well as producing single-site records. Similarly, projected future changes in ENSO are model dependent. Advances in analytical precision and novel

geochemical tools that have recently been developed provide a new impetus to address these research questions.

Elliot, Mary, Cahyarini Sri Yudawati, Abram Nerelie, Felis Thomas, McGregor Helen. Is the El Niño-Southern Oscillation changing? Lessons from the past. Past Global Changes Magazine, vol. 28(1), 28, 2020. https://doi.org/10.22498/pages.28.1.28

- Past2Future workdhop : Past2Future: insights from a constantly varying past

This workshop was organised by the PMIP4 Working Group of the same name. It was held from 13-17th May 2019 at University College London. The local organiser, Chris Brierley, is part of the PACMEDY consortium, and 12 out of the 24 attendees were affiliated with PACMEDY. The workshop was centred around creating PMIP4 outputs in time to feed into the IPCC AR6 report. It has, so far, resulted in 2 published and 2 submitted manuscripts - all bar one involving PACMEDY people.

For further details see past2future.org

Collaborations outside PACMEDY consortium on PACMEDY results or products

- collaboration between LSCE and Fabrizio Falasca (Caltech, USA) on the use of artificial intelligence methodes for the analyses of long transient simulations.
- collabortion between MPI-M and HZG with Andrew Lorrey (National Institute of Water and Atmospheric Research, New Zealand) on proxy-Model comparisons for New Zealand spelothems.

societal or policy effect

- Participtation to the AR6 WG1 IPCC report :

Hegerl: Review Editor, Chapter 1 “Framing, context, methods”

Krishnan: Coordinating Lead Author, Chapter 8 “Water cycle changes”

Braconnot: Review Editor, Chapter 8 “Water cycle changes”

Sabin: Chapter scientist, Chapter 8 “Water cycle changes”

Brierley: Contributing Author, Chapter 3 “Human influence on the climate system” - relating to PACMEDY publication