Geophysical Research Abstracts
Vol. 21, EGU2019-7082, 2019
EGU General Assembly 2019

A new gridded reconstruction of continental and oceanic surface temperatures over the last millennium to infer the impact of the multi-decadal Atlantic variability

Simon Michel (1), Didier Swingedouw (1), Juliette Mignot (2), Myriam Khodri (2), and Pablo Ortega (3)

(1) Environnemments et Paléoenvironnements Océaniques et Continentaux, Université de Bordeaux, Pessac, France, (2) Laboratoire d'Océanographie et du Climat, Sorbonne Université, Paris, France, (3) Barcelona Supercomputing Center, Universitat Polytecnica de Catalunya, Barcelona, Spain

Observations suggest that over the instrumental era both sea surface temperatures (SSTs) and continental surface temperatures (CSTs) are experiencing an unequivocal rise following the anthropogenic greenhouse gases emissions in the atmosphere. On top of this anthropogenically forced trend in temperatures, internal processes are still driving a large amount of climate variations at the multi-decadal time-scale. Nevertheless, with only around 150 years of observed temperatures available, it is difficult to understand the exact processes that control these variations.
Here, we present a gridded reconstruction, at the global scale, of temperatures for both the continental and ocean surface temperatures that goes back to 850 AD. For doing so, we use state-of-the-art machine learning techniques, combining ensemble Partial Least Squares regression and cross validation algorithms, performed on each grid point of HadISST and GISTEMP datasets and using relevant proxy records from the latest Pages 2K database to go back in time. We thus obtain a 1° resolution reconstruction for SSTs and a 2° resolution reconstruction for CSTs. This temperature reconstruction has significant validation scores for more than 99% of the grid points, with significantly higher scores for SSTs than CSTs.
We extract large-scale variability modes from this reconstruction to investigate their relationship over the last millennium. We find that a positive Atlantic Multidecadal Variability (AMV) is leading a negative phase of the Interdecadal Pacific Variability (IPV) by ten years for the most part of the millennium, although this relationship is not stationary in time. This result thus supports a recent model-based hypothesis concerning this AMV-IPV link, which have played a key role in the recent 1998-2012 hiatus in global temperature. We also find that Subpolar gyre SSTs are driving inter-hemispheric temperature gradient, confirming from observations another hypothesis derived from models, and providing key insights concerning the main drivers of the AMV and its role in driving other large-scale modes of climate variability.