Atlantic and Pacific oscillations lost in the noise

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The Atlantic Multidecadal Oscillation (AMO) and the Pacific Decadal Oscillation (PDO) do not appear to exist, according to a team of meteorologists who believe this has implications for both the validity of previous studies attributing past trends to these hypothetical natural

oscillations and for the prospects of decade-scale climate predictability.

Using both observational data and climate model simulations, the researchers showed that there was no consistent evidence for decadal or longer-term internal oscillatory signals that could be differentiated from climatic noise—random year to year variation. The only verifiable oscillation is the well-known El Niño/Southern Oscillation (ENSO).

"A distinct—40 to 50 year timescale—spectral peak that appears in global surface temperature observations appears to reflect the response of the climate system to a combination of anthropogenic and natural forcing rather than any intrinsic internal oscillation," the researchers report today (Jan. 3) in *Nature Communications*.

According to the researchers, if the Atlantic Multidecadal or Pacific Decadal oscillations existed, there would be evidence for their existence across the suite of current state-of-the-art climate model simulations.

"Given the current sophistication of climate models as seen in their ability to capture the El Niño/Southern Oscillation, we would expect to see consistent evidence for oscillations across a suite of climate models," said Michael E. Mann, distinguished professor of atmospheric science at Penn State. "We found no such evidence."

Using the MTM-SVD method—a tool co-developed by Mann in the mid-1990s and used so far in more than 50 peer reviewed articles across several fields—the researchers looked at observational and long term "control" simulation generated global surface temperature data. The observational record goes back more than 150 years. The control simulations, which have no external drivers applied to the models, are from the most recent global climate model intercomparison projects (CMIPS).

"We found a tendency in the control models for oscillations in the three to seven year ENSO band," said Mann. "However, we found no other signals, no Pacific or Atlantic climate variability on decadal or longer timescales that could be characterized as a true oscillation. Such variability was essentially indistinguishable from random noise."

Using the "forced" suite of CMIPS simulations where the climate models are driven with external factors such as volcanoes and human increase in pollution, the researchers showed that the apparent 40 to 50 year spectral peak sometimes associated with the AMO is actually an artifact of the slowdown in warming from the 1950s to 1970s. This warming was due to the buildup of sulfur "aerosol" pollutants that cool the Earth's surface. The passage of the Clean Air Acts in the 1970s removed the cooling effect and greenhouse gas warming increasingly dominated. The slowdown and subsequent acceleration of warming masquerades as an apparent "oscillation."

"Our study provides another line of evidence that purported decadal and longer timescale internal oscillation in climate that have been identified through analysis of observational data are in fact mostly a result of external influences like greenhouse gas and aerosol emissions by humans," said study co-author Byron A. Steinman, associate professor of earth and environmental science at the University of Minnesota Duluth.

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