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PATHFINDER: PATHways For resolvINg long-stanDing barriERs in global climate predictions

Description

Our changing climate is already affecting millions of people across the world and will continue to do so in the coming decades. Successful adaptation strategies require the best available estimate of plausible future climate trajectories. Traditionally, this information has been mostly based on results from climate model projections that follow different future socio-economic pathways. The recent development of decadal predictions has made these predictions a complementary source of near-term climate information with several advantages overthe traditional climate projections. Climate predictions rely on modern observation systems to better constrain the evolution of climate inthe near term. Despite the advantages of climate predictions over projections, many lingering limitations still hinder a more widespread use beyond the scientific community:

- Decadal predictions are very expensive in terms of computational resources and rarely span beyond a decade.
- Decadal predictions are produced by initializing Earth system models (or general circulation models). These models are inherently biased for several reasons, leading to systematic forecast drifts that limit predictability. In addition, the incompatibility at initialization of the different components of the climate system (e.g. ocean, atmosphere and sea ice) leads to shocks that can take a toll onthe forecast quality, especially in regions with strong coupling between these different components.
- The inherent biases in models may also lead to a misrepresentation of important large-scale climate processes (teleconnections) leading to a degradation of forecast quality in regions with societal relevance, like the continental areas.

PATHFINDER will explore different approaches to address the aforementioned limitations:

- The first strategy aims to tackle limitations 1-2, by sampling large ensembles of uninitialized simulations through the selection of members and point in time whose state is most compatible with the observed state at the moment of initialization, avoiding the effect of forecast drifts and initialization shocks, and allowing for forecast ranges to extend well beyond a decade.
- The second strategy addresses limitation 2 and relies on coupled model assimilation to initialize the models in a more compatible state.

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