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Title: A climate model intercomparison at the dynamics level
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Abstract:
Until now, climate model intercomparison has focused primarily on annual and global averages of various quantities or on specific components, not on how well the general dynamics in the models compare to each other. In order to address how well models agree when it comes to dynamics they generate, we have adopted a new approach based on climate networks. We have considered 28 pre-industrial control runs as well as 70 20th-century forced runs from 23 climate models and have constructed networks for the 500 hPa, surface air temperature (SAT), sea level pressure (SLP), and precipitation fields for each run. Then we employed a widely used algorithm to derive the community structure in these networks. Communities separate \223nodes\224 in the network sharing similar dynamics. It has been shown that these communities, or sub-systems, in the climate system are associated with major climate modes and physics of the atmosphere. Once the community structure for all runs is derived, we use a pattern-matching statistic to obtain a measure of how well any two models agree with each other. We find that, with possibly the exception of the 500 hPa field, the consistency for the SAT, SLP, and precipitation fields is questionable. More importantly, none of the models comes close to the community structure of the actual observations (reality). This is a significant finding especially for the temperature and precipitation fields, as these are the fields widely used to produce future projections in time and in space.

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