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Development of Process-oriented Diagnostics through NOAA's Model Development Task Force

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Coupled climate models and their components are subject to systematic biases. Continued model development may improve these biases, but it is important to determine whether or not the underlying physical processes are correct and consistent with the model simulations. In other cases, model improvements introduce additional degrees of freedom that need to be evaluated and constrained by observations. Several coordinated analysis efforts exist within the community that are targeted toward model evaluation and performance benchmarks. The MDTF Diagnostics Package differs from existing packages as its primary focus is the development and standardization of process-oriented diagnostics (PODs). Through a proposal-driven approach, the Modeling, Analysis, Predictions, and Projections (MAPP) Division of NOAA's Climate Program Office (CPO) currently supports the development of PODs aimed at improving model simulations of a diverse set of quantities. We anticipate development over the next three years of PODs related to: ENSO, tropical and extratropical cyclones, Arctic sea ice, lake-effect snowfall, forced shifts in rainfall patterns, warm-cloud microphysical processes, weather typing, the North American monsoon, and ocean-related diagnostics including sea level and the Atlantic Meridional Overturning Circulation. The proposed diagnostics will span timescales from the fast timescales of parameterized convection and cloud processes through seasonal prediction and decadal/centennial climate projections. A prototype analysis framework exists for running the process-oriented diagnostics on GFDL and NCAR model output, but we seek to broaden this framework and incorporate results from a broader collection of CMIP models and experiments. We also seek engagement with other community diagnostic efforts to improve interoperability, sharing of diagnostics, and to identify synergistic opportunities towards a more complete model analysis enterprise that spans the "development-to-production" continuum.