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Quantification of Global Warming: A Critical Evaluation of CMIP5 GCMs and Future Projections using and Empirical Model of Global Climate

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We examine decadal time scale predictability of global climate using two approaches: calculations conducted using an Empirical Model of Global Climate (EM-GC) developed by our research group (Salawitch et al., Springer Climate, 2017), and analysis of archived output from the Coupled Model Intercomparison Project Phase 5 (CMIP5) general circulation models (GCMs). Our focus is on developing a probabilistic forecast of the rise in global mean surface temperature (GMST) likely to occur over the next several decades. We begin by evaluating the attributable anthropogenic warming rate (AAWR) on decadal time scales as well as the transient response of climate to cumulative carbon emission (TCRE), using our EM-GC as well as the GCMs. We show AAWR inferred from the climate record over the past three decades using our EM-GC is about less than the GCM-based value: i.e. the CMIP5 GCMs tend to warm too quickly compared to observations. Next, we compare probabilistic projections of the rise in GMST, out to 2100, conducted using our EM-GC approach to those from the CMIP5 GCMs that have been run using the older Representative Concentration Pathway (RCP) scenarios for GHGs and aerosols. We will then show future estimates of GMST found using our EM-GC approach tied to the new Shared Socioeconomic Pathway (SSP) futures for GHGs and aerosols. All of these projections will be used to assess the reduction in the emissions of GHGs that will be needed to achieve the goal (1.5 deg C warming) and upper limit (2 deg C warming) of the Paris Climate Agreement.

Salawitch, R. J., T. P. Canty, A. P. Hope, W. R. Tribett, and B. F. Bennett, Paris Climate Agreement: Beacon of Hope, Springer Climate, doi: 10.1009/978-3-319-469393, 2017.

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