EGU2020-9697
https://doi.org/10.5194/egusphere-egu2020-9697
EGU General Assembly 2020
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# Trend analysis and transient climate sensitivity revealed by CMIP6

**Menghan Yuan**[1] and Thomas Leirvik[2]
[1]Nord University, Graduate School of Business , Norway (menghan.yuan@nord.no)
[2]Nord University, Graduate School of Business , Norway (thomas.leirvik@nord.no)

CMIP6 (Coupled Model Intercomparison Project Version 6) is currently publishing updates on simulations for Global Climate Models (GCMs). In this paper, we focus on analyzing surface temperature and downward solar radiation (SDSR), which are two essential variables in estimating the transient climate sensitivity (TCS). We carry out the analysis for five GCMs that have published data at the moment. More GCMs will be included in the analysis when data is available. The research period dates from 1960 to 2014, providing the latest available projection for climate forcings. Temperature projections accord reasonably well with observations. This is no surprise, as data for CMIP5 was also aligned with observations. On the other hand, a striking improvement has been observed with respect to SDSR. According to Storelvmo et al. (2018), CMIP5 models showed no statistically significant trend over time and revealed egregious mismatch with observations, casting major concerns about their fidelity. The data from CMIP6 models, however, this mismatch between simulations and observations is substantially alleviated. Not only is a negative trend recorded, but the significant fall around the beginning of the 1990s, due to the Mount Pinatubo eruption, is also reproduced, though with a slightly smaller scale compared to the observations in that period.
Based on the econometric framework from Phillips et al. (2019), we estimate the TCS for five GCMs. We find that the TCS estimates range from 2.03K to 2.65K. Each reported TCS for the five GCM's are within it's corresponding 95% confidence interval for the estimated TCS. It is worth noticing that a 25-year rolling window estimation indicates that average TCS for the GCMs varies greatly along time, though it has a significant upward trend from the beginning of the 1990s until 2009, and flattens, or even decreases, afterward.
We also compute the sample average of the TCS estimates. We find that for the period 1964-2005, which is used in Phillips et al. (2019), the average TCS is 1.82 for the CMIP5 models, and 2.07 for CMIP6. The difference is not significant. For the 1964-2014 period, however, the average TCS estimate for CMIP6 is 2.38, which is significantly higher than the average CMIP5 estimates. Since we find that the CMIP6 simulations reproduce observed trends in RSDS much better than the CMIP5 simulations, when compared to observations, this indicates both that the econometric framework of Phillips et al.(2019) is working very well and captures key drivers of the climate, and that the true TCS is most likely closer to the estimated TCS for observations.