

## ***Interactive comment on “Influence of Saharan dust on Atlantic tropical cyclones” by Zhenxi Zhang and Wen Zhou***

### **Anonymous Referee #1**

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The manuscript attempts to investigate the effect of Saharan dust on tropical cyclones. The topic is definitely interesting, but I am deeply concerned with the methodology adopted in this study which is mainly based on the MERRA2 reanalysis. The result analyses seem superficial as well, which fails to reveal the physical linkage between dust and TC. I will further elaborate those two concerns below. In its present form, I cannot recommend publication of this work by ACP.

1) Inappropriate use of reanalysis data. It's well known that reanalysis data like MERRA2 assimilate available observations as much as possible to achieve the best performance. As a result, the different variables in MERRA2, including AOD, SST, LWP, and IWP used in this study, may not be linked physically. The different variables also have different sources of observations with different time/spatial coverages to be

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assimilated, which further impairs the physical relationship among them. Take AOD for example, what are the observational constraints it has before the Terra/Aqua Era (before 1999)? The manuscript's analyses largely rely on the 8-yr strongest and weakest AOD contrast during 1980-2019, but the AOD record during those forty years are of great uncertainty. LWP and IWP in MERRA2 are considered to have even larger uncertainty than AOD, largely owing to the crude convection parameterizations.

2) Too simply analyses. The manuscript assesses the dust impacts via the comparisons of different time periods/conditions with different dust loadings. However, this way cannot rule out the other covarying factors and climate natural variability. Also, the current analyses cannot imply causation for those two-way interactions. For example, AOD can affect SST by interfering atmospheric radiation, but SST can also influence dust outflow by regulating the large-scale circulations. If the authors want to verify and explain the relationships they obtained between AOD and SST/TC/cloud properties, I strongly suggest them perform free-runs of a GCM, ideally the same with MERRA2 uses.

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