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Natural Hazards and Earth System Sciences
Discussions



# *Interactive comment on* "Analysis of an Extreme Weather Event in a Hyper Arid Region Using WRF-Hydro Coupling, Station, and Satellite data" *by* Youssef Wehbe et al.

**Anonymous Referee #2**

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This manuscript presents an assessment of modelled rainfall patterns and amounts for an extreme rainfall event in UAE derived from two modelling systems, namely, the standalone WRF and the coupled WRF/Hydro system. The evaluation of model results is based on a comparison with weather stations' data (i.e. gauge rainfall data, temperature, radiation) and satellite products (i.e. the Global Precipitation Measurement (GPM) rainfall, the MODIS cloud fraction, and ASMR2 soil moisture). In the manuscript, analysed variables are limited to these hydrometeorological variables, i.e. precipitation, cloud cover, global radiation, air temperature, and soil moisture. Statistical output of the evaluation shows that the coupled WRF/Hydro is better than the standalone WRF. However, no further effort is made to diagnose the processes and mechanisms con-



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trolling the water cycle that can be better captured by the coupled WRF/Hydro system than the standalone WRF. Thus I recommend that revision should be made for the following key points:

1. Literature review of the manuscript stated that numerous studies in the past have already shown the advantages of the coupled WRF/Hydro over the standalone WRF. If this study is a same kind but just a case study for another geographical location, what would be its unique contributions to knowledge?

2. As claimed in the manuscript, the main objective of the study is to investigate the added value of coupled land surface-atmospheric modeling (WRF-Hydro) over the hyper-arid environment of the UAE. In fact, the coupled WRF-Hydro system captures the dynamics of the water and energy cycles, linking the upper atmosphere to the unsaturated and saturated zones on the land surface. In order to take the full advantage of the WRF-Hydro system, diagnoses of the feedback processes/mechanisms controlling the regional scale water cycle (e.g. runoff, penetration, evaporative fraction, water vapour flux) should be conducted. Such diagnoses may lead to valuable generic outcome that could benefit the research community. In fact, the discussion in the manuscript has cited many publications for such processes/mechanisms for the purpose of interpreting the modelled output, but none of these has been further diagnosed in this study. It is strongly recommended that these diagnoses should be explored.

3. Several speculative arguments (e.g. lines 31-33 of p.10 about the processes linking rainfall to soil moisture and to 2m air temperature, lines 5-6 of p.11 about the effect of soil moisture on surface emissivity/temperature, lines 11-15 of p. 12 about resolved-scale vs subgrid scale cumulus, lines 13-15 of p.12 about underestimation of cloud by MODIS, and lines 19-20 of p. 12 about spin-up time) may be further analysed in order to show in-depth processes.

4. Figure 3 (c) & (d) and Figure 10's soil moisture plots from WRF all have shown weird

stripe structure of modelled accumulated rainfall and soil moisture, respectively. This adds doubts to model settings or post-processing and must be investigated thoroughly and the reasons should be fully explained. Once the errors are identified, all analyses should be re-done and all results should be updated.

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