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Interactive comment on "A high-resolution reanalysis of global fire weather from 1979 to 2018 – Overwintering the Drought Code" *by* Megan McElhinny et al.

Megan McElhinny et al.

piyush.jain@canada.ca

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We thank the reviewer for their useful comments and include our response to each of their points here.

Specific comments:

Original reviewer comment: 1 - In the paper, authors state that regional adjustments for the carry-over fraction from the previous season's fall moisture and the coefficient for the effectiveness of winter precipitation in recharging moisture reserves in the spring are necessary when calculating the overwintered DC. The authors state that "As noted

by Lawson and Armitage (2008) and Anderson and Otway (2003), the overwintered DC is most accurately represented when regional conditions are analyzed and the coefficients of the wDC function are adjusted accordingly. However, the ERA5 dataset did not contain information that allowed us to vary these coefficients and thus we chose the default values." How sensitive is the dataset to those variables a and b? (lines 223-229)

Response: The a constant is only used to estimate the fall DC value if it was not measured i.e. the fire management agency turned off the weather station prior to ground freeze-up. In this case using the ERA-5 dataset the fall DC value is always known so using a value of 1 is most appropriate for a, and it should not be considered an adjustable parameter here (see Lawson and Armitage, 2008). Variation in the b constant will affect the start-up value of the DC to some extent, the bigger factor being the use of a value above the default (15) for which the total overwinter precipitation is most important to that calculation. It is also important to note that substantial spring or early summer precipitation will reduce the DC back down to 0 regardless of the starting value. Therefore, the analyses is more sensitive to precipitation inputs after the fire season starts. In any case, the b coefficient should be determined regionally based on soil conditions as well as annual variability of weather conditions. Typically, this requires in situ measurements that are not possible at a continental or global scale. We therefore decided to use only the default value for the b coefficient of 0.75 which covers the most general situation.

Original reviewer comment: 2- As been discussed in the paper, Reanalysis products have biases. The bias can transfer to the newly calculated products. To show the robustness of the proposed dataset, I think the validation should be repeated and shown for a few regions prone to wildfires like the western United States or Australia.

Response: We agree that a global validation of the FWI product presented here would advantageous. However, we could not undertake such a validation at this time due to a lack of suitable input data. Although most countries provide meteorological station

data, such data may not be quality controlled (eg. lack of homogenization) or may not include the required local 12 noon observations of all required variables for the FWI calculation. For example, weather data from the Australian Bureau of meteorology (http://www.bom.gov.au/climate/dwo/) includes daily weather at 9am, which does not correspond to the 12pm LST times of the FWI calculation. It should be noted that Tsinko et al. 2018 conclude that using raw over homogenized station data can lead to sizeable errors in the calculation of FWI. The amount of work required to collate and quality control the data necessary is outside the scope of this project. We therefore only validated for the FWI reanalysis for Canada because we had access to the required FWI input variables that had been quality controlled by Environment and Climate Change Canada (ECCC) for the period of the validation. We further note that only Northern latitudes or mountainous areas are expected to be affected by the overwintering procedure. For this reason the validation over Canada is important for our FWI calculation, particularly as overwintering may a moderate influence on the spring start up DC code in some regions in Canada.

Tsinko, Y., Bakhshaii, A., Johnson, E. A., & Martin, Y. E. (2018). Comparisons of fire weather indices using Canadian raw and homogenized weather data. Agricultural and Forest Meteorology, 262, 110-119.

Technical corrections

Original reviewer comment: 1- The quality of Figure 2 should be improved.

Response: A high resolution PDF version of Fig 2 will be provided to the journal for the final version of the manuscript.

Original reviewer comment: 2- Is this a continuing product? If it is, the authors should mention that in the manuscript.

Response: This is not a continuing product and we have added a note to the text accordingly (Line 328 of revised manuscript).

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