Comments made by Anonymous Referee 1 are provided in black text.
Author responses are provided in blue text.

Reviewer #2 Comments

A bit puzzled on the whole process here. Not seeing any open scientific discussion having occurred at all, just the comments made weeks ago by Anonymous Referee #1.In the absence of the former, fail to see how the process of peer review and publication in Natural Hazards and Earth System Sciences (NHESS) differs from traditional scientific journals. Also unclear on what the expectations are for a “Brief Communication” submission and am unable to find information in that regard. It is with those caveats that this review is provided, and I leave it to the editor and authors as to how they wish to consider my comments. Recommendation: Accept for publication after suitable moderate to major revision.

In this discussion context, both reviewer or public comments and author responses are available to the public during review and after publication. At the beginning of the manuscript open discussion process in late June 2018, the link to the discussion was posted on the National Weather Service Los Angeles/Oxnard Facebook and Twitter pages, which have 35K and 20K followers, respectively. The same week, we sent the link to over 100 attendees of the International Atmospheric Rivers Conference as well as to a group of approximately 30 scientists and emergency managers who had attended a workshop on the Montecito debris flows in February 2018 at the University of California, Santa Barbara. Despite our efforts to make the discussion paper known and invite commentary, we did not receive any beyond the anonymous reviewer evaluations. NHESS statistics do show over 700 views and 146 downloads of the discussion paper.

Major Comment #1: Would like to see this focused down to what the key triggering meteorological event was, the accompanying hydrometeorological circumstances that resulted in the extreme outcome, and the basic synoptic and mesoscale evolution. Much of that is already there, but believe it could be better organized to present a clearer picture.

- In section 2.1, just give the basic synoptic evolution – say 500 mb, SLP and IWV every 12 hours for the 36 or so hours leading up to the event. Can omit the rest of it.

In the initial submission we were limited to three figures, ~2500 words, and 20 references. We propose the following additional figure to address the synoptic evolution of the event. We have updated the text in section 2.1 to describe this sequence.

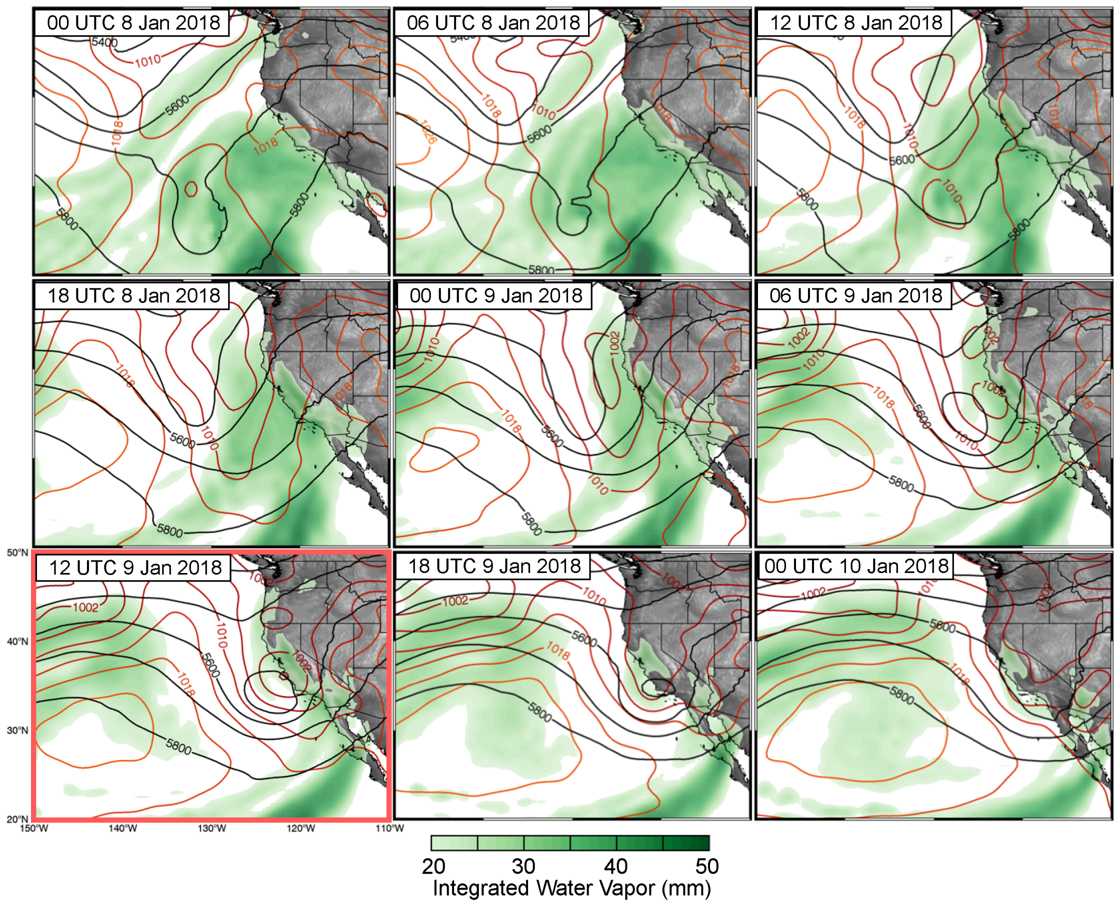

Figure 2: 500 hPa geopotential heights (black contour lines), sea level pressure (pink contour lines) and integrated water vapor (IWV; green filled contours) at 6-hour intervals for 36 h preceding to the event, time nearest event (outlined in pink), and twelve hours following the event.

- Not immediately seeing the connection between this event and atmospheric rivers. Page 2, lines 20-26:
    - (i) need to provide evidence in support of the claim that the moisture plume resulted from re-organization of the remnant moisture from the AR that moved through the previous day.

Removed reference to this reorganization (to describe this process in full detail is beyond the scope of the project) and introduced figure above to help describe the evolution of moisture plumes in this event. In lines 20-26, we now provide a simple narrative of the evolution of the moisture plumes.

- (ii) Are you really making the claim that this event itself was associated with a weak AR? Are the spatial scales consistent with the definition of an AR? And then might want to expand a bit on the consequent implication that weak ARs can potentially result in catastrophic hydro events
- On the other hand, if it isn't an AR, would be worth noting that catastrophic hydro events can occur in coastal California that are not associated with ARs. Either way, it's interesting and important, just needs to be clarified.

We do indeed interpret this as a weak AR. Restructured this section to state that both the IWV and IVT values and the shape and orientation of this moisture plume are consistent with the definition of an atmospheric river, though a weak one. Additionally, to address the important point the reviewer makes, we added to the conclusion that, "A weak atmospheric river was present at the time of the event, demonstrating that catastrophic hydrologic impacts can occur even in the absence of substantial water vapor transport (i.e., a strong atmospheric river) due to synoptic-to-mesoscale forcing."

- In section 2.2, just need clear sequences of satellite images, radar images, and surface analyses leading up to the event.

Given the brevity of this manuscript, it is not feasible to include all variables suggested. We focus on a few key features of interest to make a short communication on some of the main features observed. We do provide satellite imagery in the supplementary material (Fig S7), radar imagery in Fig 4 and S9, and now have SLP in Fig 2 (see above) and timeseries of surface winds available in the profiler data in Fig S8.

- New section 2.3: focus down on the microscale event itself, when and where the 5 to 15 minute extreme precip bursts occurred, how much fell, and in relation the exact locations and time frame of the debris flows.

Our intention is to show the 5-minute high intensity rainfall, its timing, and locations of the debris flows in Fig 1, with additional info in Tables S1-S3. It is well established that post-fire debris flows occur within moments of intense rainfall (e.g. Kean et al. 2011), thus the times provided can be considered associated with debris flow occurrence. We have added additional references to section 3.1 (historical context of precipitation).

Major Comment #2: After reducing down to and organizing key figs, recommend including all in the manuscript itself rather than some as “supplemental material.”

We are limited to three tables/figures in an NHESS Brief Communication, though we are hoping to include a fourth figure (that shown above) with the editor’s approval. Our audience is primarily non-meteorologists, so we have chosen to focus on a few basic variables to communicate a concise message on key characteristics of the event. We want to demonstrate that the event was not caused by orographic enhancement alone, an extreme atmospheric river, or a tropical storm (all descriptions observed in the media). We include several supplementary figures to help support those who would like additional information.

Major Comment #3: Strongly recommend confining the focus to this event, especially given the “Brief Communication” nature of the submission (and thus eliminating Figs S10, S11 and accompanying discussion, etc)

One of our main goals is to put this event in context of historic events, both in terms of rainfall amounts and the meteorological conditions surrounding the event. We would like the reader to understand this was not a rare meteorological event for the area, and that mesoscale features such as NCFRs producing short duration, high intensity rainfall capable of initiating PFDFs are relatively commonplace in this region.

Other Comments:

- Page 1, this event occurred on January 9 but the Thomas Fire not 100% contained until January 12?
    - This is correct, the Thomas Fire was not declared fully contained until Jan 12. Rains on Jan 9 helped firefighters to extinguish the fire. http://www.latimes.com/local/lanow/la-me-thomas-fire-contained-20180112-story.html
- Page 1, might want to note how long it had been since last significant precip
    - This was the first significant rainfall event of the season, and this piece of info is likely of interest to readers. It has been added on page 1, ~line 27

- Page 1, lines 28-29: cite ref re exceeding USGS 15-min design storm
    - Added citation
- Page 3, line 2: Markowski and Richardson, 2010 not found in Reference section.
    - Reference was present, however, in formatting ended up tacked on to the end of the preceding reference. They have now been properly spaced.
- Page 3, line 9: intense convective precip bands? But sounding in Fig S6 shows zero CAPE.
    - This event does not feature substantial CAPE, typical for cool season events in this region. We have added to the Supplement Figure S5, which shows the sounding at the model timestep prior to the event (09 UTC) to complement Fig S6, sounding at the model timestep immediately following the event (12 UTC). In the sounding prior to the event, the most unstable parcel CAPE is 168 J/kg. At the timestep following the event, most unstable parcel CAPE is 42 J/kg. In a study of 19 historic events that produced post-fire debris flows, median CAPE is typically <50 J/kg at the time of the event; most events feature a moist-neutral profile (Oakley et al. 2017). A narrow cold frontal rainband is a line of intense (sometimes forced rather than free) convection associated with the density-current action of the low level leading edge of the cold front (Houze 2014). The documented cases of this type of rainband indicate that is can be produced by the forced ascent of stable or only slightly unstable air (Houze et al. 2014). If you get dynamical forcing in the moist neutral layer, as in this case along the cold front, you can release potential instability by moving the moist-neutral parcel to a higher elevation. We describe this process in Section 2.2, lines 10-12.

- Page 3, line 21: created
    - Made change
- Page 4, lines 30-31: thought this NCFR developed behind the primary AR, not in it.
    - Added "in association with" to clarify
- References: not entirely in alphabetical order.
    - Made change

References:

Houze Jr, R. A. (2014). *Cloud Dynamics* . Academic Press, 573 pp.

Kean, J. W., Staley, D. M., & Cannon, S. H. (2011). In situ measurements of post-fire debris flows in southern California: Comparisons of the timing and magnitude of 24 debris-flow events with rainfall and soil moisture conditions. *Journal of Geophysical Research: Earth Surface*, *116*(F4).

Oakley, N. S., Lancaster, J. T., Kaplan, M. L., & Ralph, F. M. (2017). Synoptic conditions associated with cool season post-fire debris flows in the Transverse Ranges of southern California. *Natural Hazards*, *88*(1), 327-354.