

## ***Interactive comment on* “Scaling and trends of hourly precipitation extremes in two different climate zones – Hong Kong and the Netherlands” by G. Lenderink et al.**

### **Anonymous Referee #2**

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The authors demonstrate that the upper bound of precipitation intensity can be related to the dew point temperature. For sites in both Hong Kong and De Bilt, Netherlands, 99th and 99.9th percentile rainfall intensity increases by 14% with each degree increase in dew point temperature. This relationship is demonstrated by pooling all data from the 100+ year records and looking directly at the change in rainfall intensity for a given change in dew point as well as by comparing fluctuations in the time series of using a 15-year moving window analysis. The authors had previously demonstrated a relationship between temperature and precipitation intensity in De Bilt at a higher ratio than would be expected given the moisture holding content of air predicted by the

Clausius-Claperyon equation; the inclusion of Hong Kong is intended to show that the finding is relatively universal across different climatic regions.

The paper builds on an ongoing line of investigation into the utility of the Clausius-Claperyon relationship as a predictor of changes in rainfall extremes in a warming climate. This work is an important and useful addition to existing analyses on this topic. However, there are several aspects of the paper that the authors may wish to further consider:

1. Hong Kong data is used to demonstrate that climate regions that are different from De Bilt have similar behavior. In addition to noting that Hong Kong is in a tropical locale subject to convective events (p4703 Line 25), it would be useful for the authors to provide some additional details on its climate and dominant storm patterns. For instance, how do typhoons affect Hong Kong rainfall intensity data and how might they compare to coastal storms that influence De Bilt?

2. Given that dew point temperature appears a more robust predictor of rainfall intensity than dry-bulb temperature, what are the implications for predicting rainfall intensity in a warming climate?

In using dry-bulb temperature as a predictor of intensity, it was presumed that humidity may be varying within all the precipitation events lumped into a given temperature bin, but that the highest rainfall in a given temperature bin (the 99th and 99.9th values being identified in the analysis) would probably be occurring near vapor saturation or some fraction of saturation that would be constant across temperatures (consistent with statement that relative humidity would remain relatively constant in a warming climate ; e.g. Held and Soden. 2000. Annual Rev. of Energy Envir. ).

However, this analysis suggests otherwise. If dew point explains precipitation extremes, dry bulb temperature alone is not a sufficient predictor of precipitation extremes and now information on changes in humidity in a changing climate need to be included to make future predictions of changes in rainfall intensity. Such a conclusion may be

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supported by observation that global average relative humidity should remain near constant but that there may be sizable regional changes in relative humidity (e.g. Wright, Sobel, and Galewsky. 2010. *Journal of Climate*).

Thus, it seems that the simplifying nature of the Clausius-Clapeyron (C-C) relationship has been somewhat lost. It is fine if this is the case, but I think this outcome should be made more explicit. It should also be considered whether the relationship between dew point and precipitation intensity should even be referred to as a type of super C-C relation? A C-C relationship suggests there is a direct connection between dry bulb temperature, water vapor content at saturation, and precipitation. With dew point as a predictor, it is more just a connection between atmospheric water vapor content and precipitation.

There are several areas of the text that could use some minor edits to improve clarity to the reader: 1. P4707, Line 18 – emphasize that the reader should be looking at Figure 2 “For instance, for summer in NL (see Figure 2) the difference. . .” 2. P4711, Line 5 – reiterate that Hong Kong precipitation intensity may only be able to be predicted in dry months since lack of relationship in wet months

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Interactive comment on *Hydrol. Earth Syst. Sci. Discuss.*, 8, 4701, 2011.

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