Atmospheric
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Discussions

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Interactive comment on "Climatic controls on water vapor deuterium excess in the marine boundary layer of the North Atlantic based on 500 days of in situ, continuous measurements" *by* H. C. Steen-Larsen et al.

Anonymous Referee #2

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The study by Steen-Larsen et al. deals with continuous measurements of stable isotope ratios of water vapour on the Bermuda Islands including a detailed description of the measurement setup and calibration. The measurements were carried out using a cavity-ringdown-spectrometer. Such data sets are still rare, but very important for a better understanding of the fractionation processes during evaporation from the ocean and therefore interpretation of stable isotope data from ice cores, particularly of the deuterium excess. Therefore the paper is definitely suitable for publication in ACP. However, it needs some revision. Apart from a few small things, my main concern is the

strong conclusion that wind speed has no influence on the deuterium excess and the deuterium excess-humidity relationship. Given the used methods this is a too strong conclusion.

General remarks: The scientific investigation is focussed on the relationship between deuterium excess and relative humidity, based on the model assumptions of Merlivat and Jouzel (1979). It is certainly good to test the MJ model assumptions and results using this new data set. However, the paper would profit from a discussion of the model assumptions. In particular, I think here of the threshold in wind speed for "smooth" and "rough" conditions (corresponding to up to 4Bft below and larger than 5Bft above the threshold, thus not that different) and also of the assumption that the vapour is produced locally. The influence of waves on surface roughness and on potential evaporation area is not discussed either. From Fig. 1 it is obvious that 5-10 m/s is the most frequent wind speed, which means that most of your measurements are in the upper range of "smooth conditions" and the lower range of "rough conditions". I would not expect to find a large difference for those two regimes. It is a too strong conclusion that the wind speed has no influence on the deuterium excess or the d-humidity relationship. It would be better to really compare the low and high end of the wind speed range to get a clearer picture. Also, the question of local or non-local origin of the moisture is only briefly discussed. Low wind-speed could also be associated with high-pressure and thus more local origin of the moisture, whereas higher wind speeds might mean advection of moisture. The differences in the results for different wind directions also hint at some influence here. These points should be addressed more clearly.

Specific remarks: In atmospheric science, humidity is commonly defined as relative, absolute or specific humidity or as mixing ratio. Another measure is humidity ppmv, but this can refer to dry air or to humid air (mostly it refers to dry air, but it is not clearly defined). You can choose the humidity measure you like, of course, but, for the above mentioned reasons, it would be good if you could define the humidity measure you use in your study. "Relative humidity normalized to SST" is an expression that is not only

confusing but incorrect. Relative humidity is always given AT a certain temperature. What you use is the relative humidity at SST, but it is not a normalized value.

Technical remarks:

Check the use of "respectively", in most cases it is used incorrectly

P2367: l22: but the strong correlation. . .

L23: do you mean "not allow identifying the impact of rhSST alone?

P2375, l11: better: at the beginning of autumn

L16: parallel to

L23: do you mean "without any significant local effect"?

P2376/fig. 10: the x-axis should be months not tenth of a year, that is hard to read, and in the text you refer to months, too.

L22: here you refer to <6m/s and∼10m/s, later you compare <6 and >7m/s. ??

P2377: l25: approximately rather than around

P2378, L1: lower winter SST (not colder)

L7: moisture back trajectory calculations is not a good expression. You have quite a few VERY long words that should at least contain a dash (-) at the right position.

L25: prevents frontal systems from passing through

P2379: l6: signal-to-noise ratio

L15: increasing the average time from 2 weeks to 1 month does not significantly further accept this slope.

L16/17: This sentence is not understandable, please reformulate

L19: become closer

L23: reflect

Speculation is not a very scientific method, better use hypothesis

P2380: l11: coming from the American continent (or do you mean off?)

P2381: l2: suggesting a limited. . .

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