Hydrol. Earth Syst. Sci. Discuss., 4, S839–S842, 2007
www.hydrol-earth-syst-sci-discuss.net/4/S839/2007/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Local δ^{18}O and δ^{2}H variability in UK rainfall" *by* M. D. Jones et al.

Anonymous Referee #1

Received and published: 29 August 2007

This paper presents new data for oxygen and hydrogen isotope ratios in precipitation, sampled twice-weekly and weekly at three nearby sites in the Nottingham area, United Kingdom. Through comparisons with meteorological data at each site, and by comparing the δ^{18}O variability between sites, the authors discuss potential climate controls over the isotope signal and issues concerning interpretation of water isotope records aspalaeoclimate archives. In particular, their data support previously published observations that the climate-isotope relationship varies according to temporal sampling resolution, and the authors highlight potentially important differences in the weighted mean annual δ^{18}O between sites, despite their close proximity to each other (within 20 km). The paper is written clearly and concisely, the figures are of good quality and arerelevant to the discussion. Despite interest in rain water isotope ratios for over 50 years, and the broad use of water isotope proxy records to reconstruct past climate change, the number of studies which have attempted to address the climate-isotope

relationship based on monitoring data is surprisingly limited. The climate controls over δ^{18}O and δ^{2}H in precipitation vary markedly geographically, and therefore studies such as this offer considerable interest and merit. Therefore, I would advise that this paper falls within the scope of HESS and should be accepted for publication. However, the following major and minor amendments should be addressed:

Major considerations

A) Although I can not discount the interpretation (page 2410, paragraph 1) that the difference in weighted mean δ^{18}O between Watnall and Sutton Bonnington occurs due to a progressive rainout effect, the argument is not convincing. If this process leads to such marked differences between these closely located sites, then how is the relatively modest isotope gradient between Valentia (Ireland) and Keyworth explained? The findings presented here are potentially very important with regards extrapolation of rainfall δ^{18}O data, and therefore warrant a more detailed discussion. In particular, it would be useful to present all supporting data for each site - is it possible that the differences can be explained by microclimatic effects, perhaps driven by differing land use/topographic factors? If the authors are correct and a rainout effect does exist, are there also significant differences in precipitation amount or humidity between sites? Unless there is a reduction in air temperature, rainout will lead to a reduction in precipitable moisture downwind.

B) Notable amongst the data presented is the marked seasonal variability in δ^{18}O, deuterium excess (d-excess), meteoric water line slope and correlation between δ^{18}O and climate (temperature/precipitation amount). It would be beneficial to include a more detailed, mechanistic interpretation of these phenomena, in addition to the traditional δ^{18}O vs. temperature and precipitation comparison. For instance, where correlations are not found with temperature or precipitation, how is this explained? Of particular note is the omission of evaporation during rainfall as a potential forcing agent. This might seem an unlikely factor to affect precipitation in the UK, however the occurrence of positive δ^{18}O values for summer precipitation, coinciding with marked reductions

HESSD
4, S839–S842, 2007

in the $\delta^{18}O/\delta^{2}H$ slope and d-excess strongly suggest that evaporation is taking place. Again, it is impossible to prove/disprove this hypothesis, however a more detailed analysis and discussion of such potential effects should be given.

Minor corrections

page 2405, line 5: "87Which data were used to calculate these

p. 2406, l. 11: "δ2H": Place "2" in superscript

p. 2406, l. 25+: "... is lower than at the other two sites... probably due to effect of lower sampling resolution..": This is testable by calculating the weighted average of the higher resolution data to equivalent time periods of the Keyworth data. Then this statement could be made with more conviction.

p. 2407, l. 4: "(not including August and September 2005...": How does the omission of data from these months affect the weighted mean? This could be potentially important with respect to subsequent discussion.

p. 2408, l. 24: "sample": Add "s" (samples)

p. 2408, l. 28: Different mean values for NE and SW wind directions: Note that air temperature and precipitation amount are also likely to vary according to these weather types, making it difficult to make an independent estimate of wind direction effects.

p. 2409, l. 2: "... temperatures explain 39Without consulting Figure 5, it is unclear which data you are citing - monthly averages for the whole dataset, or a running monthly mean?

p. 2409, l. 4: "Not only...": Add: "Between daily and monthly data, ..."

p. 2409, l. 8: "variability at the three stations is due to short term changes in the amount of precipitation..": Figure 5 suggests that very little of the short term variability is driven by precipitation amount.

HESSD
4, S839–S842, 2007

p. 2409, l. 14: Refer to Figure 3 here.

p. 2409, l. 19: "thee": Change to "these"

p. 2409, l. 23: "Significant differences": Is it possible to do a statistical test here - e.g. a t test or similar? It would also be interesting, in Table 1, to know difference in temperature and precipitation amount between these sites.

p. 2411, l. 5: "heavier": I suggest consistency in isotope terminology: higher/lower or more/less positive would be clearer.

p. 2411, l. 7: "drier": Change to "less precipitation" or similar.

p. 2411, l. 8: "that expected": Change to "those expected" (pleural)

p. 2411, l. 10: "precipitation amount relationships....": If you are referring to the relationships in Fig. 5, which are not strong, then this doesn't make a convincing argument. Furthermore, the data suggest that precipitation amount is even less influential over longer timescales.

Table 1: Label A as "slope" and B as "intercept"

Table 2: It would be useful here to have an indication of the direction of the relationships (e.g. quote +/-ve r values rather than r^2), and also the significance (p value). "Temp." appears misplaced within the table on the Sutton Bonnington row - is this intended?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 4, 2403, 2007.