Interactive comment on "Extrapolating regional probability of drying of headwater streams using discrete observations and gauging networks" by Aurélien Beaufort et al.

Catherine Sefton (Referee), 11 February 2018

General comments

This paper makes a valuable contribution to the study of the hydrology of intermittent rivers and ephemeral streams. In particular, it is the first time observations of river flow and groundwater level have been used in combination with observations of hydrological state in a regionalisation approach, marking a step forward in the modelling and mapping of intermittency at national scale.

The ONDE dataset is unique in the literature, notably the large number of sites, the coverage of headwater streams and the national extent, but has limitations in the summer-only timing and small number of observations. The merging of the "no visible flow" status with the "dried out" status means that a key benefit of the dataset is not utilised, as the two-status classification of flowing and drying that remains is no advantage over that available from gauged river flow data. Discussion of the network would benefit from broader contextual comment on the contribution and application of these data.

The paper is well written and referenced and is recommended for final publication with minor revisions.

Specific comments

Given the small number of observations at each site, the claim that the ONDE dataset offers more accurate assessment of inter-annual variability than the gauging station network (L376-377) needs further justification. Conversely, the claim that the dataset makes it possible to capture drying events at the regional scale (L381-382) would benefit from stressing the monitoring of both upstream and downstream drying – uniquely each with national extent – in your approach.

The presentation of summer-only status data as "% drying" needs qualification, as it suggests assumptions about the status in the rest of the year. In particular, clarification would be helpful in line 242, when the context implies it means the number of sites with at least one drying each year (as in line 241), rather than the % of all observations at all sites (as in Fig 4).

The technique of constructing mean non-exceedance frequency from river flows and groundwater level is attractive and robust. However, its limitation in this regional approach of failing to capture the effect of local rainfall should be commented upon, especially given the dominance of rainfall-driven intermittency stated in section 3.3.2.

The frequency of drying from gauging station data needs to be defined (line 272). Context suggests it is flow permanence (dry days or dry months per time period), but frequency in intermittent rivers and ephemeral streams can also mean dry spells per time period, and it also needs to be clear and justified whether it's calculated from daily means or monthly means.

In section 3.2.1., the difference in performance between the two explanatory hydrological datasets is attributed to the difference in the number of gauging stations and piezometers. The pattern in Figure 8

is not as clear as the text suggests, and it would be good to comment also on the assumption of stationarity and how it might vary between HER2-HR combinations. Similarly, historical reconstructions make assumptions about stationarity that need to be acknowledged.

The conclusion is a good summary of the results but would benefit from contextual comment, both with respect to the stated objective of this paper and more broadly on the contribution being made to the field.

Text corrections

General	inconsistent hyphenation and capitalisation of "hydroecoregions"
L8	"have frequently flows intermittence" -> "and frequently have flow intermittence"
L22	"The two regressions models" -> "The two regression models"
L43	"are referred as" -> "are referred to as"
L48	"they represents" -> "they represent"
L51	"severely underestimate" -> "severe underestimation of"
L73	"citizen science has proved" -> "citizen science is proven to"
L79	"in few catchments" -> "in a few catchments"
L88-89	"and to characterise their information contribution in comparison with" -> "in order to characterise the information that they contribute in comparison with"
L141	"more likely reason" -> "most likely reason, therefore"
L165	"composed by" -> "composed of"
L186	"groundwater level were" -> "groundwater level was"
L230	"have been calibrating" -> "have been calibrated"
L235	"be noted that models predictions" -> "be noted that model predictions"
L245	"in more details -> "in more detail"
L247-8	"but follow the same pattern with an increased…and reached…" -> "but follows the same pattern with an increase…and reaching…"
L250	"August 4% and reach 7%...critical period occur" -> "August (4%), reaching 7%...critical period occurs"
L252	"until reaching…situation is gradually deteriorated" -> "until it reaches…situation gradually deteriorates"
L264	"HYDRO dataset" -> "The HYDRO dataset"
L317	"when both models use with the" -> "when both models use"

L346	"temporal and spatial extension" -> "spatial and temporal extent"
L373	"headwater" -> "headwaters"
L374/482	"dryings detection" -> "detection of drying"
L375/482	"capture" -> "capturing of the"
L375/483	"upstream" -> "upstream extent of"
L434	"in sedimentary" -> "in the sedimentary"
L444	"results" -> "result"
L448	"France territory" -> "of France"
L454	"than LR model" -> "than the LR model"
L455	"To illustrate these differences…with a fictive extreme F" -> "In a sensitivity test to illustrate these differences …with an extreme F of"
L456	"France territory" -> "study area"
L457	"of the territory" -> "of the area"
L463	"ONDE network…it is not currently possible to differentiate between the two models similar performances" -> "Since the ONDE network monitoring period does not include a period with flows as low as were seen in 1990, it is not currently possible to differentiate between the two models' performances"
L479	"reconstitute" -> "reconstruct"
L486	"would allow to quantify the" -> "would allow quantification of the"
L487	") report and" -> ") and"
L494	"and" -> "but"

Figures

Figure 3, textbox 3	The text is truncated
Figure 5	The legend is in French
Figure 3, step 1	It is unclear why HR1, 4 and 6 are shown as types of monitoring site, when section 2.1 has defined them as types of hydrological regime.
Figure 9	Referenced as Figure 10 in line 307
Figure 10	This would benefit from additional plots for a year that has good NSE, as the text is comparing years as well as model performance.
Figure 12	The caption does not say which explanatory dataset was used.