Hydrol. Earth Syst. Sci. Discuss., 11, C2510–C2521, 2014
www.hydrol-earth-syst-sci-discuss.net/11/C2510/2014/

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Estimating the water needed to end or ameliorate the drought in the Carpathian region" *by* T. Antofie et al.

T. Antofie et al.

tiberiuantofie@yahoo.com

Received and published: 16 July 2014

We would like to thank the Reviewer 1 for the positive comments and suggestions to improve the manuscript. The specific comments are addressed in detail below. Please note that the Reviewers' comments are shown in bold text and authors' replies are in plain or italic text.

General comment :

We have added discussions in the Results sections as the reviewer 1 suggested.

Specific comments:

1. **P 1496, L8-10: What other indicators were computed? How do they compare**

with Sc-PDSI?

The other indicators were added in the text. Comparison of Sc-PDSI with SPI (Standardized Precipitation Index) and SPEI (Standardized Precipitation-Evapotranspiration Index) was mentioned:

When compared with other drought indicators Sc-PDSI shows good correlation with indices of long accumulation periods. The correlation over each grid point and for entire Carpathian region and time period (1961-2010) shows high values with the SPI9 (0.85) and SPEI9 (0.82) detecting the drought events on comparable spatial and temporal resolution and lower values with SPI1 (0.33) and SPEI1 (0.35) (Antofie, et. al., 2013).

2. **P 1496, L11-12: And the other indicators are not able to measure the intensity and severity of droughts?**

Corrections made in the text.

3. **P 1497 L7: There is not description of the region studied in the manuscript. A small description is needed to understand the characteristics of the area in the study. More- over, the location of the region in the continent/globe is not mentioned (for example: located in Central and Eastern Europe). I would be nice to enhance Fig. 1 by locating the region in the continent and then zooming to the region. Furthermore, there is no mention to observed past droughts in the region. Do droughts occur often?**

Description of the region added in the text:

Stretching across Central and Eastern Europe, the Carpathian Mountains spans over seven countries, in the studied region, starting with the Czech Republic Slovakia and Poland in the northwest then continuing East and southwards through Ukraine, Hungary, Romania and Serbia. The region also spans over parts of Croatia, Bosnia Herzegovina, Bulgaria and Republic of Moldova. The Carpathian Mountains represent a prolongation of the Alps to the East and northeast, but their structure is less compact, and

HESSD

11, C2510–C2521, 2014

they are split up into a number of mountain blocks (with heights reaching over 2000 m in altitude) separated by basins (such as Pannonian and Transylvanian) and surrounded by lowlands. As climate feature, the Carpathian region receives polar-continental air masses arriving from the East and northeast in the winter, while during other seasons oceanic air masses from the West and also Mediterranean in the southern part (KEO; UNEP/DEWA 2007).

Drought occurrence in the region is presented in the text (P 1502 L7-L15).

4. **P 1497 L10: What is the temporal scale of the model? Please add.**

The temporal scale was added in the text: *The computation of the Sc-PDSI (Wells et al., 2004) is made on monthly temporal scale.*

5. **P 1497 L14: Where is this precipitation coming from? Is it reanalysis data? or coming from satellite? or measured in the ground?**

Description of the precipitation data provenience was added in the text:

Temperature and precipitation gridded data have been interpolated within the CARPAT-CLIM project from quality-checked, completed, homogenized and harmonized station data. Please see Spinoni et al., 2014 for a more detailed description.

Spinoni, J., Szalai, S., Szentimrey, T., Lakatos, M., Bihari, Z., Nagy, A., Németh, Á., Kovács, T., Mihic, D., Dacic, M., Petrovic, P., Kržič, A., Hiebl, J., Auer, I., Milkovic, J., Štepánek, P., Zahradnícek, P., Kilar, P., Limanowka, D., Pyrc, R., Cheval, S., Birsan, M.-V., Dumitrescu, A., Deak, G., Matei, M., Antolovic, I., Nejedlík, P., ŠtastnÃ¡, P., Kajaba, P., Bochnícek, O., Galo, D., Mikulová, K., Nabyvanets, Y., Skrynyk, O., Krakovska, S., Gnatiuk, N., Tolasz, R., Antofie, T. and Vogt, J.,: Climate of the Carpathian Region in the period 1961–2010: climatologies and trends of 10 variables. Int. J. Climatol.. doi: 10.1002/joc.4059, 2014.

6. **P 1497 L16: Same question for the temperature. Where is this temperature coming from?**

HESSD

11, C2510–C2521, 2014

Description of the precipitation data provenience was added in the text.

7. **P 1497 L24: What is HYPRES? This should be defined at a first mention.**

The definition was added in the text: . *.Hydraulic Properties of European Soils (HYPRES)..*

8. **P 1498 L3-6: Are runoff and recharge hydrological parameters or fluxes? Please rephrase/expand this paragraph. It is not clear what is computed and what is the input information to the model. Maybe a formula on the water balance with the terms considered in the model would help. Moreover, which are the Palmer constants and what is the meaning of the CAFEC precipitation? Which of the parameters described come from external datasets and from where? This should be clear in this section. The methods described may fit better in section2.2.1.**

Correction made in the text. The paragraph moved in section 2.2.1:

The potential evapotranspiration (PET) is estimated following Thornthwaite (1948), while the other potential parameters are defined as follows: the potential recharge (PR) is the amount of moisture required to bring the soil moisture up to filed capacity (AWC less the total amount of moisture stored in both soil layers), the potential loss (PL) is the moisture that could be lost from the soil if precipitation is zero for the month and the potential runoff (PRO) is defined as total AWC less potential recharge (PR). By summing the monthly mean potential values which are previously scaled by their ratio with the monthly mean actual values, Climatically Appropriate for Existing Conditions (CAFEC) - precipitation, (or the precipitation needed to maintain a normal soil moisture level) is obtained.

9. **P 1498 L7-12: What is the climate characteristic coefficient? Maybe this entire paragraph would fit better in section2.2.2? Or are any of the things described here external datasets?**

HESSD

11, C2510–C2521, 2014

Correction made in the text. The paragraph moved in section 2.2.2.

10. **P 1498 15-17: This sentence is not clear, please rephrase. Originally it was computed on a monthly basis, and what is the temporal basis now?**

The sentence was rephrased:

Sc-PDSI is based on the Palmer Drought Severity Index (PDSI), first introduced by Palmer (1965) and modified by Wells et al. (2004) in order to allow a more accurate comparison of the index at different locations. Sc-PDSI measures the cumulative departure of moisture supply and demand computed on monthly time scale.

11. **P 1498/1499, Section 2.2.1: A brief description of the model in the methodology mentioning key parameters and fluxes would help to understand the methods used. The title of the section is "Sc-PDSI computation" and the computation methods are not described at all.**

A brief description has been presented in Section 2.2.1. We have also presented the main steps of the methodology and the modifications made to obtain Sc-PDSI in Annex I following the already common approach presented in numerous articles (Alley, 1984; Guttman et al., 1992; Weber and Nkemdirim 1998; Wells et al., 2004; van der Schrier et al., 2006). The reason behind our choice was that the methodology that was required in the main body of the paper is the one of the precipitation needed to end or ameliorate the drought recover from the drought, which is the main subject of the paper.

12. **P 1499 L4: What is the sub index i in this section? Is it month?**

The definition of i index was added in the text. The index i in this section denotes the monthly time scale.

13. **P 1501, L9: Why was the gamma distribution used?**

Reasoning has been presented in text:

Gamma distribution has been frequently used in literature to represent precipitation

HESSD

11, C2510–C2521, 2014

(Thom, 1966; Wilks, 1990; 1995, Oeztuerk, 1981) due to the advantage that it excludes negative values, being bounded on the left at zero (Thom, 1966; Wilks, 1995). Analysis of rainfall data strongly depends on its distribution pattern (Sharma, et al., 2010). This is especially important as Gamma distribution is positively skewed and represents an advantage as it mimics the actual rainfall distributions for many geographical areas (Ananthakrishnan, et al., 1989). Also it provides a flexible representation of a variety of rainfall regimes while utilizing only two parameters, the shape and the scale (Wilks, 1990).

Ananthakrishnan, R., Soman, M. K., Statistical distribution of daily rainfall and its association with the coefficient of variation of rainfall series. International Journal of Climatology 9: 485–500, 1989.

Oeztuerk, A.: On the Study of a Probability Distribution for Precipitation Totals, Journal of Applied Meteorology. 20:1499-1505, 1981.

Thom, H. C. S.,: Some Methods of Climatological Analysis. WMO Technical note 81, Secretariat of the WMO, Geneva, Switzerland, 53 pp., 1966.

Wilks, D., S.,: On the Combination of Forecast Probabilities for Consecutive Precipitation Periods. Wea. Forecasting, 5, 640–650, 1990.

Wilks, D. S.,: Forecast verification. Statistical Methods in the Atmospheric Sciences, Academic Press, 467 p, 1995.

Sharma, M. A., Singh, J. B.,: Use of Probability Distribution in Rainfall Analysis New York Science Journal, 23(9), 2010.

14. **P 1502, L17-26: Was this compared with recorded droughts events in the region in the past years?**

Recorded droughts in the region mentioned in the text:

The recorded drought occurrence in the region presented through country reports

at UNCCD's 1st Regional Workshop on Capacity Development to Support National Drought Management Policies for Eastern European Countries (July 9-11, 2013, Bucharest) confirms the drought-prone characteristic of the region. The years with the highest drought incidence mentioned in the region are 2000, 2003, 2007 and 2012, (Holjevac, et al.,2013,), beginning of the 1990's (Gregorič, et al., 2013), the sequences from 1961 -1965, 1973-1974 and also 1980's since when it is noticed an increasing in the number of droughts (Mateescu, et al., 2013, Gregorič, et al., 2013).

Mateescu, E., Smarandache, M., Jeler, N., Apostol, V.,: Drought conditions and management strategies in Romania, Country Report, 1st Regional Workshop on Capacity Development to Support National Drought Management Policies for Eastern European Countries, Initiative on "Capacity Development to support National Drought Management Policy"(WMO, UNCCD, FAO and UNW-DPC, July 9-11, Bucharest Romania, 2013.

Holjevac, M.C., Pavlovic, D., Pandzic, K.,: Drought conditions and management strategies in Croatia, Country Report, 1st Regional Workshop on Capacity Development to Support National Drought Management Policies for Eastern European Countries, Initiative on "Capacity Development to support National Drought Management Policy"(WMO, UNCCD, FAO and UNW-DPC, July 9-11,Bucharest Romania, 2013.

Gregorič, G., Sušnik, A.,: Drought conditions and management strategies in Romania, Country Report, 1st Regional Workshop on Capacity Development to Support National Drought Management Policies for Eastern European Countries, Initiative on "Capacity Development to support National Drought Management Policy"(WMO, UNCCD, FAO and UNW-DPC, July 9-11, Bucharest Romania, 2013.

15. **P 1503, L29 - P1504 L2: If the months mentioned here correspond to the points tagged in Fig.5 there are some that do not match. E.g: August 1990 for moderate droughts, and January 1990 for severe droughts.**

Corrections made in the text. After correction for moderate droughts is July 1990 and

for severe droughts is January 1991.

16. **P 1504, L28 - P1505 L3: Please rephrase this sentence to clarify. Should it say "...beginning of summer (May/June/July) and end of summer (July/August) respectively, ..."?**

Sentence rephrased as indicated.

17. **P1505 L4-5: Is this on average for the whole period? Indicate in the text.**

Corrections added in the text.

18. **P1505 L9: Add "in the next month" after "to end a drought".**

Corrections added in the text.

19. **P1506 L13: Is it "May and June" or "April and May"?**

Corrections made in the text.

20. **P1506 L15: And also Oct/Nov/Dec for the north-eastern area.**

Corrections added in the text.

21. **P1506 L16: Corresponding with which months of the annual precipitation cycle?**

Correction added in the text: ... corresponding with the driest months of the annual precipitation cycle.

22. **P1506 L27: January and February?**

Correction made in the text.

23. **P1508 L2-5: Were the results verified in some way with observed/recorded data?**

The 'drought –prone' characteristic of the region has been mentioned. Results ob-

HESSD

11, C2510–C2521, 2014

tained with Sc-PDSI have been validated by comparison with other drought indicators.

24. **P 1509, L7: What do you mean by "... until the layer is full"?**

Correction made in the text: *". . ..until the layer is saturated.."*

25. **P 1509, L9: Are actual values of evaporation, recharge and runoff hydrological parameters or fluxes? How are the potential values estimated? A formula on the model water balance would help.**

Definitions added in the text:

The potential evapotranspiration was computed using the Thorntwaite formula while the other potential parameters are computed as follow (Weber and Nkemdirim 1998): the potential recharge (PR) is the amount of moisture required to bring the soil moisture up to filed capacity (AWC less the total amount of moisture stored in both soil layers), the potential loss (PL) is the moisture that could be lost from the soil if precipitation is zero for the month and the potential runoff (PRO) is defined as total AWC less potential recharge (PR).

26. **P 1525: Fig 8. Please make sure that the figure is clear and the text is readable in the final format. The font size seems very small (unreadable) but it might be to the format provided in HESSD.**

All the figures have been provided to the publisher with the requested resolution (300dpi)

Technical corrections:

27. **P 1495, L20: Why 2010b? Is there a 2010a?**

Correction made in the text.

28. **P 1495, L26: Why 2000a? There is not another reference to Wilhite et al. in the 2000.**

HESSD

11, C2510–C2521, 2014

Correction made in the text.

29. **P 1495, L27: The reference on WMO, 2006 is missing. Also, the reference on ISDR, 2007 is missing.**

References added:

ISDR, International Strategy for Disaster Reduction: Drought Risk Reduction Framework and Practices: Contributing to the Implementation of the Hyogo Framework for Action. United Nations Secretariat of the International Strategy for Disaster Reduction (UN/ISDR), Geneva, Switzerland, 98+vi pp, 2007.

WMO, World Meteorological Organization: Drought monitoring and early warning: Concepts, progress and future challenges. WMO-No. 1006, 2006.

30. **P 1497, L1: 4 sections?**

Correction made in the text.

31. **P 1498, L20: The reference on Weber and Nkemdirim, 1998 is missing.**

Reference added: *Weber, L., Nkemdirim, L.: Palmer's drought indices revisited Geogr. Ann., 80 A(2):153-172, 1998.*

32. **P 1498, L21: Remove the b after Vicente-Serrano et al., 2010.**

Correction made in the text.

33. **P 1499, L1: Remove the comma after "presented in"**

Correction made in the text.

34. **P 1501, L8: Replace "precipitations" for "precipitation"**

Correction made in the text.

35. **P 1502, L17: Remove "the" previous to "Fig.4"**

HESSD

11, C2510–C2521, 2014

Correction made in the text.

36. **P 1503, L3 and L6: Change "SC-PDSI" to "Sc-PDSI" to uniformize.**

Correction made in the text.

37. **P 1505, L29: The reference Busuioc, 2001 is missing.**

Reference added:

Busuioc, A.,: Large-scale mechanism, influencing the winter Romanian climate variability, Detecting and Modelling Regional Climate Change and Associated Impacts, M. Brunet and D. Lopez eds Springer-Verlag, 333-343. 2001.

38. **P 1508, L24: Reference is not correct, change "Thornthwaite's method, 1948" for "Thornthwaite, 1948"**

Correction made in the text.

39. **P 1511, L13: Shouldn't it say "dry/wet spells" instead of "drought/wet spells"?**

Correction made in the text.

40. **P 1511, L23: Shouldn't it say "dry" instead of "drought"?**

Correction made in the text.

42. **P 1512, L9: Is the reference on Allen et al., 1998 mentioned somewhere in the manuscript?**

Correction made in the text.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 1493, 2014.

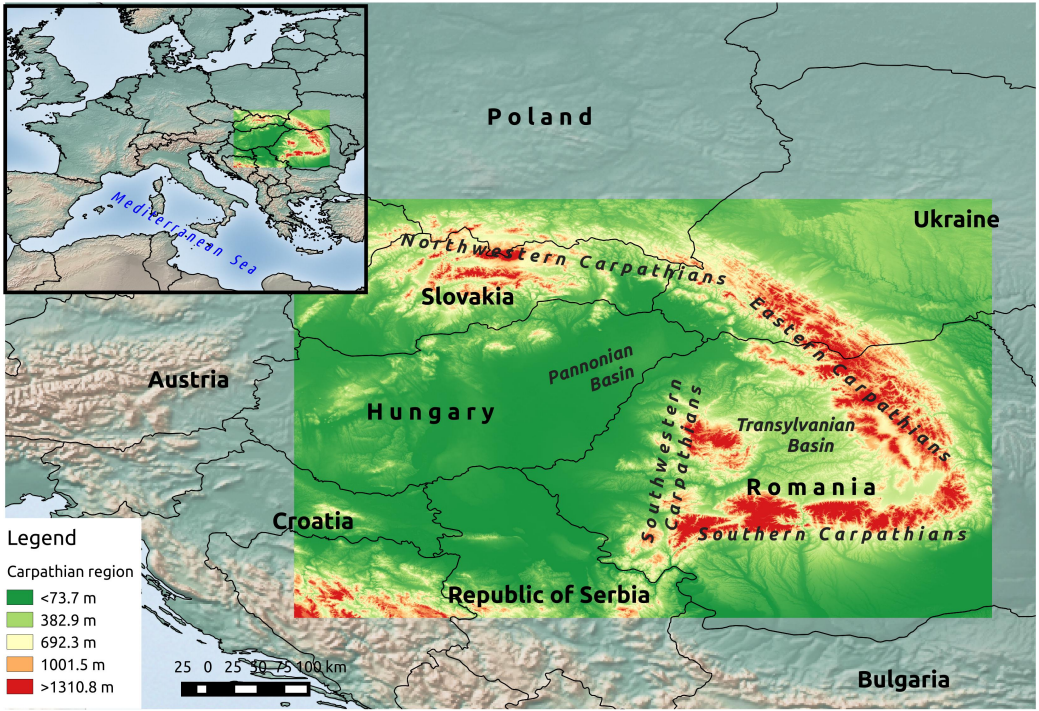

Fig. 1.

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper