Hydrol. Earth Syst. Sci. Discuss., 2, S1155–S1160, 2005
www.copernicus.org/EGU/hess/hessd/2/S1155/
European Geosciences Union

Hydrology and Earth System Sciences Discussions

Interactive comment on "Stratified analysis of satellite imagery of SW Europe during summer 2003: the differential response of vegetation classes to increased water deficit" *by* A. Lobo and P. Maisongrande

A. Lobo and P. Maisongrande

Received and published: 7 December 2005

article latexsym

Dear Editor,

According to the suggestions of the reviewers and following directions received from publishing@cosis.net, we submit the following list of changes to our manuscript hessd-2005-0064 (Stratified analysis of satellite imagery. . . , *by* A. Lobo and P.Maisongrande):

1. In order to clarify the significance of summer of 2003 and its function in the present article, we modify the Introduction (p. 2026, lines 22-26 and p. 2027, lines 1-10:

The productivity of a significant 40% of the continental Biosphere is limited by water availability, while a 30% is limited by temperature (Nemani et al., 2003). The importance of the relationships between water availability and vegetation has been traditionally recognised in Mediterranean and other arid regions and has become a subject of increased general attention giving raise to a new term, ecohydrology (Eagleson, 2002; Rodríguez-Iturbe and Porporato, 2004). The joint analysis of time series of fields of vegetation indices derived from satellite imagery, and fields of climate variables offers the possibility of studying such relationships at continental scales and has a large potential in the context of ecohydrology.

Given the complexity of the combined geographic and temporal variability that is involved in the study of time series of geographic fields of surface variables, extraordinary events such as the warm and dry summer of 2003 in SW Europe can be used as pulses producing a clear response that can be tracked in space and time. The analysis of the surface responses to these pulses, compared to average conditions, offers interesting opportunities for advancing in the understanding of the relationships between vegetation and climate at continental scales. In this context, the analysis of the surface response must consider the geographic variability of the surface, and, in particular, the distribution of different vegetation types. Yet, the differential response of vegetation types has not been considered in most studies involving time series of products derived from satellite imagery (i.e., Zhou et al., 2001; Lucht et al., 2002; Nemani et al., 2003), which at most have stratified their analysis by latitudinal belts and/or broad geographic regions.

Summer of 2003 was probably the hottest in Europe since, at least, AD 1500 (Black et al., 2004), and the hottest in Bourgogne (France) since 1370, with an anomaly of temperature that was 43% higher than the one of the second hottest year (1523; Chuine et al., 2004). Beniston (2003) discussed the possible relationships of the extreme summer of 2003 to global change, and Stott et al. (2004) discussed the possible human influences on increasing the probability of these events. In this article we focus on sum-

HESSD

2, S1155–S1160, 2005

mer 2003 to analyze the differential responses of vegetation classes to increased water stress in SW Europe, an area that is climatically characterised by a strong gradient in moisture and with a prominent boundary between phyto-geographic regions.

2. In order to address the problem of the shortness of the 1999-2002 period, we include the following paragraph in the Methods section (p. 2030, inserted between lines 2 and 3).

1999-2002 was the longest available period to calculate the reference annual course of NDVI from SPOT-VEGETATION imagery. Other instruments provide longer series (i.e., the AVHRR GIMMS series, http://glcf.umiacs.umd.edu/data/gimms), but VEGETATION imagery has a higher quality, essentially because its superior geometric accuracy let us take advantage of its full resolution of 1 km^2, and because of its atmospheric corrections. As landscapes in W Europe are very complex and the stratified analysis according to a fine-resolution land cover map (CORINE 2000) was an essential component of our approach, a time series of images with the finest resolution was required, hence the choice of VEGETATION. The intercalibration of NDVI time series derived from different sensors is still questionable (i.e, Morisette et al. 2004, Berges et al. 2005) and no specific transfer functions are available yet, although work described by Brown et al. (2004) indicates that we could be approaching this goal nowadays. Also, current efforts made by large programs from space agencies to generate multi-sensor products (i.e., the Cyclopes program) will include producing an inter-calibrated NDVI "climatology" that we will be able to use in the future to put the response of vegetation to summer of 2003 in a broader context with a reasonable effort. Meanwhile, we take the 1999-2002 period as an appropriate baseline reference of the NDVI, in particular considering the large abnormality of summer of 2003. In any case, the shortness of the reference period implies that our results and conclusions must be taken with caution.

3. In order to clarify the definition of NDVI anomalies, we propose the following text in the Methods section to replace Pg. 2029 lines 27-29, and Pg. 2030, lines 1-2:

HESSD

2, S1155–S1160, 2005

We used a dataset of S10 products from 1999 to 2003 of the region extending from 52^o 40' N, 11^o 0' W to 30^o 21' N, 6^o 51' E, with a resolution of 32". We computed an average annual series of monthly mean NDVI images for the period 1999 to 2002, which we use as the "normal" reference, and an annual series of monthly mean NDVI images for 2003:

$$\bar{V}_m = mean(V_{m,a})$$

where V stands for NDVI, m for month, $\bar{V}_m$for the reference NDVI value of month m, and a for the year, ranging from 1999 to 2002. Also, we calculated the images of the NDVI anomaly of June, July and August 2003, as the difference between the monthly 2003 images and the monthly images of the reference period:

$$\Delta V_m = V_{2003,m} - \bar{V}_m$$

where ΔV_m stands for the anomaly of NDVI of month m in 2003.

4. In order to clarify the definition of P-PET anomaly, we propose the insert the following text at the end of line 14 on Pg. 2028:

The anomaly of summer 2003 P-PET is defined as the difference between P-PET in summer 2003 minus the value of P-PET in the summer of the reference period:

$$\Delta(P-PET)_s = (P-PET)_{s,2003} - (\underline{\qquad P-PET \qquad})_s where$$

s$stands for summer$.

5. In order to avoid distracting reader's attention from the focus of the discussion, we propose to modify lines 18-20 in pg. 2040 to just say:

"Compared to herbaceous plants, LAI phonologies of deciduous trees are more stable. The NDVI anomaly. . . "

6. Captions to Figs. 1 and 2 were wrong. They should be:

HESSD

2, S1155–S1160, 2005

Figure 1. Difference between Precipitation and Potencial Evapotranspiration (P-PET) in summer (June to August) in mm. Left, average summer; right, summer 2003.

Figure 2. Anomaly of P-PET in summer of 2003.

7. Color bars in figs. 8, 9 and 11 were in a 0 - 255 scale, which is not consistent with the text. They are rescaled to the [-1, 1] interval.

*8. We wait for you as the Editor on whether an article published after submission of our manuscript (Ciais et al. Europe-wide reduction in primary productivity caused by the heat and drought in 2003 Nature **437**, 529-533, 22 September 2005) should be mentioned in our final version. Our opinion is against including it, but just as a matter of policy. Thus we think that this is a question to be decided by the editor.*

9. New References:

Berges, J.C., Lacaze, B., and Smiej, M.F. A comparison of NOAA-AVHRR, SPOT-VEGETATION, and MSG-SEVIRI for continental scale vegetation monitoring. 25th EARSeL Symposium on Global Developments in Environmental Earth Observation from Space,Porto, Portugal, 6-11 June 2005 www.isn-oldenburg.de/projects/earsel-abstracts2005/ABS_Berges_lacaze.html.

Morisette, J.T., Pinzon, J.E., Brown, M.E., Tucker, C.J. and Justice, C.O. Iitial validation of ndvi time series from AVHRR, VEGETATION and MODIS, www.vgt.vito.be/vgtapen/pages/fullpapers/Morisette_full.pdf, 2004.

Saleous, N Z and Vermote, E F. A long-term Land data record from AVHRR, MODIS and VIIRS. AGU Fall Meeting, San Francisco 13-17 December 2004, www.agu.org/meetings/fm04/fm04-sessions/fm04_B33D.html

We thank both reviewers for pointing errors and making useful critics and comments, which have contributed to improve the first version of our manuscript.

We also thank you as Editor for considering our manuscript for HESS and for the time

HESSD

2, S1155–S1160, 2005

and work involved in your task.

Sincerely yours,

Agustín Lobo

HESSD

2, S1155–S1160, 2005

Interactive Comment