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Preface

"2nd International Conference on Ecohydrology and Climate Change"

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1 Introduction

The International Conference Ecohydrology and Climate Change (EcoHCC) was held at the Polytechnic Institute of Tomar, Portugal, between 15 and 17 September 2011, and was a joint organization between the Polytechnic Institute of Tomar (IPT) and the Institute of Mediterranean Agricultural and Environmental Sciences (ICAAM) of the Évora University. The series of EcoHCC conferences began in 2009, and this edition aimed to be the continuation of a cycle of conferences to be promoted every two years.

In its first edition, EcoHCC'09 had the presence of European and South American researchers in areas of climate, ecohydrology, environment, hydrology, soils, and geostatistics with the aim of sharing experiences and promoting the integration of these themes as a multidisciplinary framework. The present edition, EcoHCC'11, focused on the following themes:

- Water resources and management;
- Water quality and hydrobiology;
- Environmental policies and social impacts;
- Operational and dynamical hydrology, as well as ecohydrology;
- Soil degradation and soil quality, as well as soil function and land use (communications presented at the meeting but not submitted to this journal);
- Earth system science, climate change and extreme events.

The themes chosen are pertinent and of great relevance in the context of a global changing climate and its implications on the socio-economic framework. Projections of future climate on a global scale are broadly disseminated by international projects and institutions such as the IPCC or WMO; however, the same does not apply to the regional-scale impacts of those projections. Regional- to local-scale assessments in scientific and socio-economic relevant sectors, such as power production and energy consumption, water resource management and availability, agriculture, forestry, soil quality and human health, are crucial for a future sustainable development. The nature and extent of these impacts has yet to be determined in many fields of science, as they will enable defining suitable adaptation and mitigation measures and new environmental policies.

The explicit link between the theme of climate change and ecohydrology is in and of itself valid. Nonetheless, potential scientific contributions in areas still under-explored are worth mentioning. Throughout this special issue, a wide variety of methodologies is used ranging from classical monitoring and remote sensing, to statistical and dynamical modelling,

geographic information systems, advanced computing, economics and sociology. Overall, we are hopeful that this conference will be the starting point for integrated research, with great relevance in the formulation of adaptation measures and new sustainable policies. Due to the importance of the themes discussed, we believe that this special issue of EcoHCC'11 is a valuable contribution to the scientific community.

2 Overview of the research presented at the EcoHCC'11 sessions

2.1 Water resources and management

Gómez-Beas et al. (2012) described the development of a management model for Rules reservoir that supplies water to both agricultural and urban demands in the Granada region (southern Spain), and regulated with a set of criteria. The authors show that this can be done in a sustainable manner consistent with existing commitments downstream, with a well-established supply capacity depending on demand, and the probability of failure when the operating requirements are not fulfilled. The results obtained are useful, providing reservoir response at different time scales while acknowledging the associated level of uncertainty.

Salvador et al. (2012) discussed the importance of allogenic recharge in aquifers, the attempt to quantify the response of the Querença–Silves aquifer to allogenic recharge, for further inclusion in a groundwater flow numerical model that already reproduces the aquifer response to autogenic recharge and abstraction in the period 2001–2010.

2.2 Water quality and hydrobiology

Contreras and Polo (2012) assessed the impacts of using different measurement frequencies (monthly, weekly and 15 min) and sampling spatial domains to characterise turbidity and salinity in the main channel of the Guadalquivir estuary (Spain). The authors concluded that a higher frequency of turbidity sampling is required (at least at a weekly scale) and for the whole estuary. For salinity, however, a higher frequency sampling is only required in the lower estuary, mostly owing to the combined influence of both tidal and river components. Their results can constitute a useful guide when implementing monitoring networks in estuaries with strong and transient fluvial dominance in their upper sector and a quasi-permanent tidal dominance in their lower sector, such as the Guadalquivir estuary.

2.3 Environmental policies and social impacts

Gouveia et al. (2013) aimed to study the collective effect of drought and large wildfires in the Iberian Peninsula by using remotely sensed data of vegetation dynamics and leaf moisture content, derived from the VEGETATION data set (1999–2009). The assessment of the impact of the exceptional 2004/2005 drought on vegetation was made for vegetation recovering from the unusual fire season of 2003 and on the conditions that favoured the onset of the fire season of 2005. Recovery times, evaluated by a mono-parametric model based on Normalised Difference Vegetation Index (NDVI) data and values corresponding to drought months, were set to no value, which has shown a delay for several months in all the selected scars from 2003. During spring and early summer months, the study of vegetation dynamics and fire selectivity in 2005 revealed that fires tend to occur in pixels presenting lower vegetative and water stress conditions. Finally, pre-fire vegetation dynamics, mainly vegetation density and water availability during these seasons, have significantly influenced the levels of fire damage. Overall, these findings emphasise the contribution of fuel availability in fire occurrence and its effects over the Iberian Peninsula.

Carbone et al. (2012) discussed the importance of raising the awareness of human communities to scientific knowledge, so that cultural heritage can be disseminated and maintained through generations. Under this theme the PAIDEIA approach and its applications are discussed.

2.4 Operational and dynamical hydrology, ecohydrology

Egüen et al. (2012) studied the influence of different cell sizes (30, 100, and 500 m) in physically based distributed hydrological modelling and the corresponding basin responses under Mediterranean environments. More specifically, a watershed in Andalusia (Spain) was selected for this purpose. The WiMMed model was thus applied to a 3 yr period. This model was calibrated on a monthly basis using the available daily flows at the respective reservoir, and different input (calibration) parameters were used for each spatial resolution. The authors highlighted the importance of choosing a suitable spatial scale, which should provide a reasonably high data quality at relatively low computational costs. In their case study, cell sizes of 30 and 100 m were shown to be largely preferable over 500 m, as the latter resulted in a significant overestimation of run-off. The authors stress that this inappropriate spatial resolution may lead to erroneous decisions in water resource management and planning.

2.5 Earth science, climate change and extreme events

Andrade et al. (2012) used canonical correlation analysis to assess robust links between sea level pressure patterns and two temperature extreme indices (TN10p – cold nights and TX90p –warm days) over Europe. Obtained results show that North Atlantic Oscillation-like patterns and strong anomalies in the atmospheric flow westwards of the British Isles are leading couplings between large-scale atmospheric circulation and winter, spring and autumn occurrences of both cold nights and warm days in Europe. Less precise results are

observed for summer, although some relevant atmospheric circulation anomalies are key driving mechanisms. Finally, statistically significant downward (upward) trends are detected in the cold night (warm day) occurrences over the period 1961–2010 throughout Europe, particularly in summer, which is in clear agreement with the overall warming detected.

Paulo et al. (2012) used a network of 27 weather stations in Portugal in the period 1941–2006, to compute the following four drought indices: standardised precipitation index (SPI), Palmer Drought Severity Index (PDSI), modified PDSI for Mediterranean conditions (MedPDSI) and the standardised precipitation–evapotranspiration index (SPEI). In the first part of their study, a trend analysis of temperature and precipitation in Portugal was undertaken prior to index analysis. A comparison between these indices was then carried out, giving evidence for their similar behaviour (SPI vs. SPEI and PDSI vs. MedPDSI). Nevertheless, the authors also concluded that PDSI and MedPDSI are more effective than SPI and SPEI not only in identifying severe droughts, but also in detecting their onsets (earlier detection), as actual soil water balances (of an olive crop in the case of MedPDSI) are taken into account in the first two indices.

Santos et al. (2012) studied the cloud-to-ground discharges (CGDs) over Portugal using data collected by a network of sensors maintained by the Portuguese Meteorological Institute for 2003–2009 (7 yr). Towards this aim, only cloud-to-ground flashes were considered, and negative polarity CGDs were largely dominant. Results revealed that the total number of discharges has a considerable interannual variability and a large irregularity in their distribution throughout the year. Also a large number of discharges that occur in the May–September period (about 71 %) have a bimodal distribution that peaks in May and September, with most of the lightning activity recorded in the afternoon (from 16:00 to 18:00 UTC). During spring and autumn, the lightning activity tends to be scattered throughout the country, while in summer it tends to be more concentrated over northeastern Portugal. Winters generally present low lightning activity. Results show that a regional forcing, mainly in summer, and a remote forcing are the two significant couplings between the monthly number of days with discharges and the large-scale atmospheric circulation. The authors have also identified the three most relevant atmospheric conditions for triggering daily lightning activity: regional cut-off lows, cold troughs induced by remote low pressure systems and summertime regional low pressures at low-tropospheric levels combined with a mid-tropospheric cold trough.

Martins et al. (2012) analysed the spatial variability of precipitation and drought for Portugal, covering the common period of 1941–2006, using monthly precipitation from 74 stations and minimum and maximum temperature from 27 stations. Towards this aim, seasonal precipitation and the corresponding percentages in the year, and also the precipitation concentration index (PCI), were attained for all 74 stations and subsequently used as an input matrix for an R-mode principal component analysis to detect the precipitation patterns. Authors computed the standardised precipitation index at 3- and 12-month time scales for all stations, whilst the Palmer Drought Severity Index (PDSI) and the modified PDSI for Mediterranean conditions (MedPDSI) were calculated for the stations with temperature data. Additionally, by applying the S-mode principal component analysis coupled with varimax rotation to the drought index matrices, spatial patterns of drought over Portugal were identified. Results show two distinct sub-regions in the country relative to both precipitation regimes and drought variability. Furthermore, no linear trend indicating drought aggravation or decrease was found for all indices. Finally, this study showed that results for SPI-3, SPI-12, PDSI and MedPDSI are coherent among them.

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