Geophysical Research Abstracts
Vol. 16, EGU2014-16623, 2014
EGU General Assembly 2014
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Characterisation of areas under irrigated agriculture: mapping and water use

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The evolution of remote sensing and classification methods has enabled effective mapping, monitoring and management of irrigated agriculture. A random forest classification was implemented using learning samples inferred from Landsat TM/ETM data and monthly time-series of remotely-sensed observations from the MODerate resolution Imaging Spectroradiometer (MODIS). The covariates included in the method characterised: (i) the vegetation phenology via the recurrent and persistent fractions of photosynthetically active radiation (*fPAR*$_{rec}$and*fPAR*$_{per}$, respectively); (ii) vegetation water use via estimates of actual evapotranspiration (*AET*), rainfall (P) and the difference between *AET* and P. Maps of irrigated areas under different climates and cropping conditions were produced for the whole Murray-Darling Basin (Australia) for the years 2004 to 2010 with 0.96 observed agreement in terms of the Kappa Index (were a value of 1 indicates perfect agreement). An independent comparison of yearly irrigated area estimates and corresponding water use showed a linear relationship with good agreement (R^2 >0.7) against available yearly metered water withdrawals and estimates of agricultural yields. A sequential covariate optimisation suggested that the most important predictors included the emergence-senescence period (as determined by the fPAR$_{rec}$ and corresponding rates of change) and the *AET* surplus over P during this period. The latter can be important when determining more opportunistic irrigation practices due to unreliable water supply in areas with otherwise high annual rainfall. The procedure can be implemented to map irrigated areas at the global scale: the MODIS time-series used in the classification methodology are available globally since February 2000 and so are the Landsat archives which can be used to infer learning samples and irrigation practices elsewhere.