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Effects of water salinity on the correlation scale of Root density and Evapotranspiration fluxes

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Spatial pattern and the correlation of different soil and plant parameters were examined in a green bean field experiment carried out at the Mediterranean Agronomic Institute of Bari, Italy. The experiment aimed to evaluate the role of local processes of salt accumulation and transport which mainly influences the evapotranspiration (and thus the root uptake) processes under different water salinity levels. The experiment consisted of three transects of 30m length and 4.2 m width, irrigated with three different salinity levels (1dSm-1, 3dSm-1, 6dSm-1). Soil measurements (electrical conductivity and soil water content) were monitored along transects in 24 sites, 1 m apart by using TDR probes and Diviner 2000. Water storage measured by TDR and Diviner sensor were coupled for calculating directly the evapotranspiration fluxes along the whole soil profile under the different salinity levels imposed during the experiment. In the same sites, crop monitoring involved measurements of Leaf Area Index (LAI), Osmotic Potential (OP), Leaf Water Potential (LWP), and Root length Density (RlD). Soil and plant properties were analyzed by classical statistics, geostatistics methods and spectral analysis. Results indicated moderate to large spatial variability across the field for soil and plant parameters under all salinity treatments. Furthermore, cross-semivariograms exhibited a strong positive spatial interdependence between electrical conductivity of soil solution ECw with ET and RlD in transect treated with 3dSm-1 as well as with LAI in transect treated with 6dSm-1 at all 24 monitoring sites. Spectral analysis enabled to identify the observation window to sample the soil salinity information responsible for a given plant response (ET, OP, RlD). It is also allowed a clear identification of the spatial scale at which the soil water salinity level and distribution and the crop response in terms of actual evapotranspiration ET, RlD and OP, are actually correlated. Additionally, significant peaks in the power and coherency spectra around 6-8 m suggested organization into hierarchical levels of soil variability.