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Multiscale analysis of evapotranspiration and carbon assimilation for a long time series of micrometeorological observation in a typical semi-arid Mediterranean ecosystem

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The evapotranspiration (*ET*) process is a key term of soil water balance. In the Mediterranean climates *ET* represents the main loss term, that could return up to 70% of annual precipitation to the atmosphere. Due to the high seasonal and annual variability of precipitation typical of this this ecosystems, *ET*may be 90% of annual precipitation. Considering that in the Mediterranean areas most of the available water for drinking purpose and for agriculture depends on the water stored in the artificial basins during the rainy period, the quantification of *ET* and its dynamics is of great importance.

ET exhibits a temporal pattern that varies from seconds to decades, and it is mainly dependent as well as by precipitation, also by its guiding factors (e.g. soil water moisture, solar radiation and vapor pressure deficit). Hence, identify the main factors that influence *ET* becomes fundamental to understand its temporal variability, and is needed when modeling *ET* over different timescales.

The case study is the Orroli site in Sardinia (Italy), a typical semi-arid Mediterranean ecosystem, for which are available eddy covariance measurements of sensible heat (*H*), latent heat (*LE*) fluxes, and soil moisture, radiation, air temperature and air humidity measurements, over 15 years. The Mediterranean site is typically characterized by strong interannual variability of meteorological conditions, which can drastically impacts water resources variability during spring and summers, the key seasons for the water resources planning and management of the region.

Based on the half-hour time series, the meteorological measurements were considered into investigation, and their variability has been detected at different time scale, from seconds to year. The conventional Pearson correlation coefficient between *ET* and its guiding factors has been estimated, and showed the main influence of soil moisture and vapor pressure deficit on *ET* process, and suggested that the their control on *ET* vary with timescale.

Furthermore, the orthonormal wavelet transformation (a spectral analysis methodology), was used to investigate the time scale variability of *ET* in the frequency domain, and identify the role of its guiding factors for different time scales. The *ET* spectral density has significant peaks at the daily, seasonal and annual time-scales. In particular, the variability of the *ET* spectral density exhibits two order magnitude more than the daily variability. The wavelet cospectra of *ET* and its

guiding factors showed that the interaction is strongest for the seasonal and the annual time scales.