Regional and global variations in soil moisture are commonly assessed by hydrological models and/or remote sensing. Less attention has been paid to the associated large scale mass changes detectable with satellite gravimetry. This study determines variations in soil moisture by means of remote sensing and hydrological modelling. Results are analysed with respect to mass changes in continental water storage from satellite gravimetry. Therefore, test-sites are selected where mass change in soil moisture is expected to be dominant and separable from other hydrological or non-hydrological contributions. Variations in soil moisture are derived from products of the satellite sensors AMSR-E as well as from METOP or SMOS (as far as available) and from the hydrological models WGHM, LaD, and GLDAS. Changes in total water storage (TWS) are computed from GRACE data either via given spherical harmonic gravity models or, in particular, by regional approaches using localizing base functions such as spherical wavelets or B-splines. In order to compare the data with respect to their spatio-temporal patterns, different appropriate mathematical approaches (e.g. multi-dimensional B-spline expansions, PCA) are applied to all data sets. Based on the outcome of these analyses conclusions are drawn in terms of the detectability of soil moisture signatures in TWS variations from GRACE. The results contribute to the discussion of the two questions: (1) to what extent variations in soil moisture influence the change of TWS from satellite gravimetry, and (2) in what way satellite gravimetry can contribute to a better understanding of regional and global variations in soil moisture.