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Assessing the impacts of climate change in Mediterranean catchments under conditions of data scarcity - The Gaza case study

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According to current climate projections, Mediterranean countries are at high risk for an even pronounced susceptibility to changes in the hydrological budget and extremes. While there is scientific consensus that climate induced changes on the hydrology of Mediterranean regions are presently occurring and are projected to amplify in the future, very little knowledge is available about the quantification of these changes, which is hampered by a lack of suitable and cost effective hydrological monitoring and modeling systems.

The European FP7-project CLIMB is aiming to analyze climate induced changes on the hydrology of the Mediterranean Basins by investigating seven test sites located in the countries Italy, France, Turkey, Tunisia, Gaza and Egypt. CLIMB employs a combination of novel geophysical field monitoring concepts, remote sensing techniques and integrated hydrologic modeling to improve process descriptions and understanding and to quantify existing uncertainties in climate change impact analysis.

One of those seven sites is the Gaza Strip, located in the Eastern Mediterranean and part of the Palestinian Autonomous Area, covers an area of 365km^2 with a length of 35km and 6 to 12km in width. Elevation ranges from sea level up to 104m in the East of the test site. Mean annual precipitation varies from 235mm in the South to 420mm in the North of the area. The inter annual variability of rainfall and the rapid population growth in an highly agricultural used area represent the major challenges in this area.

The physically based Water Simulation Model WaSiM Vers. 2 (Schulla & Jasper (1999)) is setup to model current and projected future hydrological conditions. The availability of measured meteorological and hydrological data is poor as common to many Mediterranean catchments. The lack of available measured input data hampers the calibration of the model setup and the validation of model outputs. WaSiM was driven with meteorological forcing taken from 4 different ENSEMBLES climate projections for a reference (1971-2000) and a future (2041-2070) times series.

State of the art remote sensing techniques and field measuring techniques were applied to improve the quality of hydrological input parameters. For the parameterization of the vegetation the Leaf Area Index (LAI) is a crucial component. However, the LAI is difficult to access at field scale, hence a simple remote sensing approach, using the Normalized Difference Vegetation Index (NDVI) and MODIS LAI information, was applied for the parameterization in WaSiM.

As no permanent streams, hence no discharge measurements, exist in the Gaza Strip, the actual evapotranspiration (ETact) outputs of the model were used for model validation. Landsat TM images were applied to calculate the actual monthly mean ETact rates using the triangle method (Jiang and Islam, 1999). Simulated spatial ETact patterns and those derived from remote sensing show a good fit especially for the growing season.