

Remote sensing and hydrological modelling of the Rio Bravo, Mexico

Location	Rio Bravo, Mexico	
Contractor	Comisión Nacional del Agua (financed by the BNWP)	
Partner	FutureWater	
Period	2006	

Scope of the project

Modern analytical tools such as remote sensing, GIS and simulation models can help to swiftly obtain data to support the water management decision process. Mexico has critical and urgent water related problems including the overexploitation of surface water and ground water resources . The current situation is clearly not sustainable in the medium and long term. A diagnosis of the Rio Bravo and Northern Central Aquifers has been made to demonstrate management options as well as how to obtain the minimally required data sets to base sound policy decision making upon.

Study approach

The study is a combination of the SEBAL and SWAT model. SEBALbased evapotranspiration fluxes are used to calibrate the plant and soil parameters in SWAT. This powerful calibration philosophy goes far beyond the classical approach of calibrating a catchment scale model with flows measured at one gauging station.

MODIS images were used to generate a land cover map of the entire basin and SEBAL in combination with MODIS was applied to produce maps of actual evapotranspiration, biomass production and soil moisture. Detailed ET and related parameters have been derived from SEBAL in conjunction with Landsat imagery.

Results

The land cover map and evapotranspiration derived from MODIS showed that the evaporative depletion of the irrigation sector is 11.7% of the basin wide depletion (20.5 km³). Although 80 to 90 % of the stream flow is diverted to the irrigation sector, irrigated crops use no more than 10.4% of the basinwide gross rainfall. The evaporative depletion from fragile desert ecosystems is 83 % of all basin-wide depletions.

The combination of Landsat and MODIS results allowed to evaluate crop water demand, crop water use and crop production on a crop-to-crop basis.

Conclusions



Land cover map based on 250-m MODIS

This study demonstrates that a fleet of satellites is available to describe the water resources conditions in a spatially distributed manner. Landsat appears suitable for crop identification, crop ET, soil moisture, crop production and crop water productivity. MODIS is found useful for acquiring the basin wide picture of water depletion, soil moisture and biomass production of all agro-ecosystems including biomass water productivity. TRMM adds key information on the spatial distribution of rainfall. Although the SWAT model and land cover and crop maps are all preliminary versions, it rolls out a new methodology that assist water policy makers in making firm decisions on water use, water diversion and water abstraction and where land cover changes could be considered.