DIACHRONIC CLIMATIC IMPACTS ON WATER RESOURCES

WITH EMPHASIS ON MEDITERRANEAN REGION

NATO – ADVANCED RESEARCH WORKSHOP

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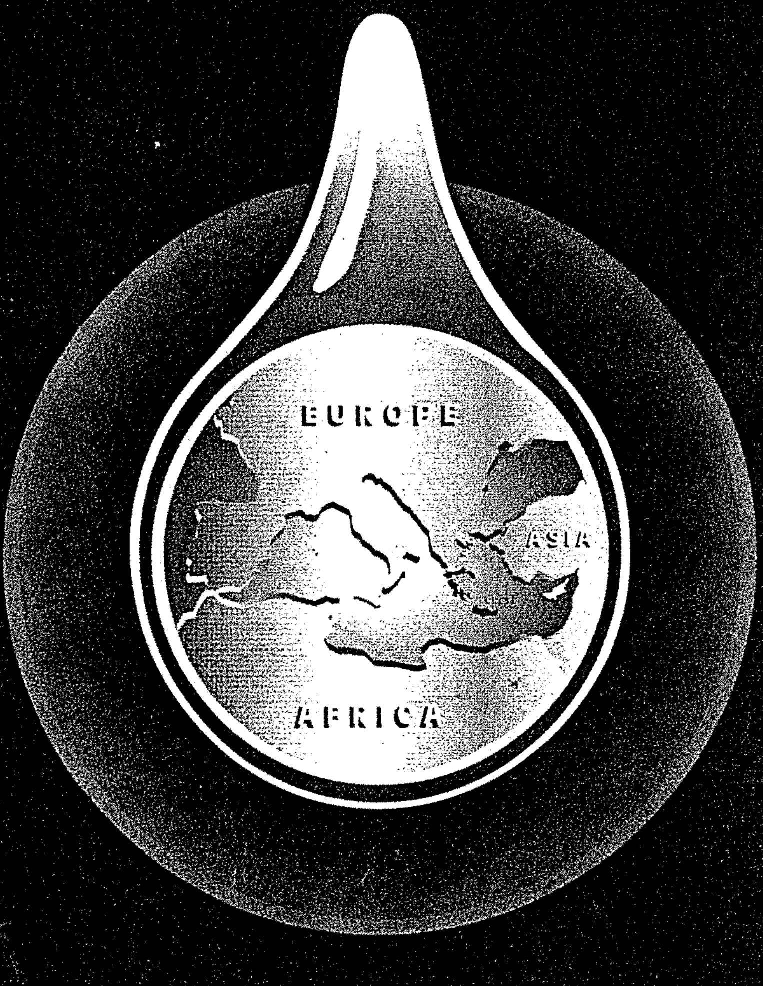
ABSTRACTS



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SENSITIVITY ANALYSIS OF CATCHMENT HYDROLOGIC RESPONSE TO CLIMATE CHANGES

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A method to estimate the hydrologic response sensitivity of a mountainous catchment to global climate change is developed. The approach must be applicable to medium-sized catchments and account for changes in snowmelt hydrology that would result from long-term temperature increases coupled with possible changes in precipitation and evapotranspiration. In solving a such problem, the methodology of conceptual deterministic simulation is adopted, which in this study, combines the functioning of two hydrologic models: the Snow Accumulation and Ablation Model, as well as the Soil Moisture Accounting Model of the U.S. National Service River Forecast System (US NWSRFS). The US NWSRFS models are deemed to operate on daily of shorter time steps, as required by the simulation of catchment hydrologic response to storm's events, considering that the rainfall-runoff process is highly nonlinear, also that such subprocesses as infiltration and evapotranspiration depend strongly on the storage and movement of water within the soil column during storms, as well as on the soil moisture condition on the onset of storms. The aforesaid hydrological models, were calibrated for long-term historic data, hypothetical long-term average changes in precipitation, temperature and potential evapotranspiration, as well as for mean monthly changes of the same variables that result from Goddard Institute for Spare Studies model for CO_2 doubling. The stimulated variables, as calibrated for historic and altered climate regimes, are: snow storage, runoff, actual evapotranspiration and soil moisture of the catchment. The research was applied to the Mesochora catchment that drains into the mountainous part of Acheloos river. Despite the uncertainties surrounding the nature and timing of expected climate changes and the resulting consequences, the sensitivity analysis of the above-mentioned hydrologic variables on a mean (long-term) monthly basis yielded useful conclusions. The most important one is that a general warming of Earth (about 4°C increase) would cause a major reduction in winter snow accumulation and hence increases in winter runoff and reductions in spring and summer runoff. Attendant changes in the

seasonal distribution of soil moisture and actual evapotranspiration could also occur. Finally, the climate changes have the potential to greatly exacerbate water-resources problems, especially when these are combined with growing pressures from population increases as well as from groundwater depletion and/or contamination, plus agricultural and/or industrial development. Unfortunately, while our ability to estimate changes keeps on improving, the extent of our knowledge of climatic impacts is still limited. Until such times as more appropriate methods of hydrologic response prediction to climate changes are the potentially dangerous and misleading assumption that future climate will resemble the climate of the recent past.