IMPACTS OF CLIMATE CHANGE ON THE FRESH WATER FLUXES TO THE MEDITERRANEAN SEA: CASE STUDY OF COASTAL RIVERS IN LANGUEDOC-ROUSSILLON AREA (SOUTH-EAST OF FRANCE)

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Abstract

Languedoc-Roussillon area experimented a high temperature increase during the spring and summer seasons for the period 1965-2004, but no clear evolution for the precipitation. Increase of the associated water loss by evaporation explains partly the general decrease of discharge in the rivers limited to this area and therefore their contribution less important to the fresh water fluxes to the Mediterranean Sea.

Keywords : Gulf Of Lions, Hydrology, Time Series.

This study was initiated by the recent analyses reported by IPCC (Intergovernmental Panel on Climate Change) about the past, actual and future evolution of bioclimatic conditions on Earth and the observed/excepted consequences on the water cycle. Among recent studies relating to the ongoing climate change context, those pertaining to the Mediterranean area have revealed evidence of a reinforcement of dryness conditions over the recent period [1-3]. This evolution is the result of a coupled effect of a high annual temperature increase in the whole basin and a decrease of precipitation observed mainly during the winter months in some countries (Italy, Greece and Maghreb states). These studies also suggest that western Mediterranean basin is presumably more affected by the ongoing Global Change than the others land-sea areas.

As a consequence of these preliminary results, a comprehensive dataset related to the hydroclimatic conditions and atmospheric dynamic patterns has been collected for the Languedoc-Roussillon area for the period 1965-2004. Climatic data were collected from a network of 44 and 117 stations measuring temperature and precipitation respectively (fig. 1). These climatic parameters were spatially interpolated and averaged for 15 subcatchments whose hydrologic data were equally acquired. Main objective of this work was to study possible recent changes of evolution of climatic conditions presumably related to the ongoing Global Change and its consequences on the hydrology of rivers limited to the studied area. These latter are considered typical to Mediterranean basins, that are characterized by a great interannual variability of discharge and occurrence of severe flash-floods. Statistical analysis performed on time series of hydroclimatic data allowed us to study trends and links between surface hydrologic conditions and climatic variability. An attempt to explain origin of the climatic variability and its recent evolution was investigated from correlation analysis between the observed climatic parameters and related to the atmospheric circulation NCEP data.

This study revealed an annual temperature increase of about 1.5° for the entire studied area during the considered period. Temperature increase was the most important for the spring and summer seasons and negligible during the others seasons indicating that annual thermal amplitude has recently significantly increased in this area. Annual precipitation didn't show clear evolution but some catchments (Orb and Herault) experimented a slight shift in the intra-annual precipitation distribution. Increase of pressure conditions over the Mediterranean area for the period 1965-2004 seems to explain mainly the important temperature increase during most months. Furthermore, high positive phases of NAO index during the wintry months explain partly the observed precipitation decrease during this season for the Orb and Herault catchments.

As a consequence of this recent climatic evolution probably added with human activities influence, most of discharge series showed a general trend to a decreasing of available water resource in Languedoc-Roussillon area, especially during the spring and summer seasons. Correlation analyses showed statistically significant link between temperature and discharge series for the summer season, which underlines role of the increasing water loss due to the temperature increase during this season.

Accounting future climate conditions predicted by most of Global Circulation Models, this study also revealed consistent evolution of the observed past and predicted future conditions for temperature. This is not clearly the case for precipitation, which can be partly explained by the great interannual variability of this parameter in the studied area.

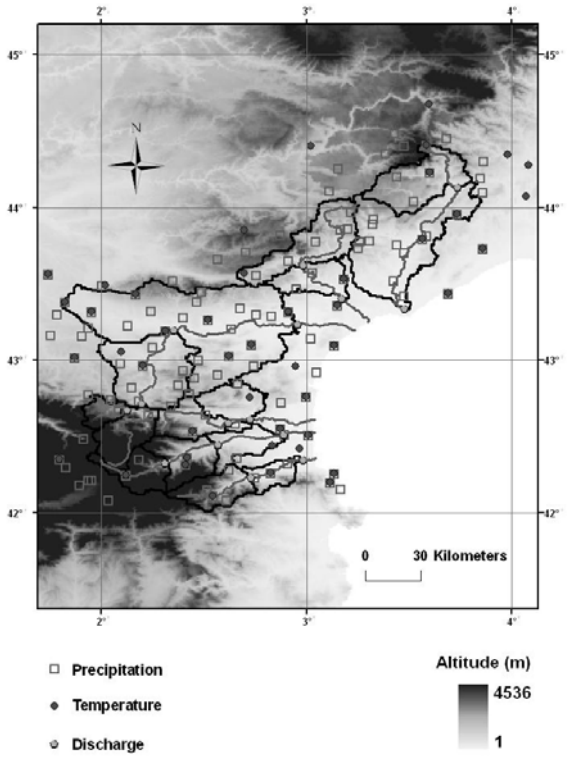

Fig. 1. Location of hydroclimatic stations used in this study.

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