During the seasonal time window from late summer to the beginning of the winter period, the typical cyclonic circulation over Europe – with deep atmospheric lows located somewhere over the British Islands or Northern France – prompts intense flows of humid and unstable air masses from the south of the Mediterranean Sea to impact in the northern rugged topography coastline. As a consequence of such atmospheric conditions short torrents and rivers draining the southern slopes of the Pyrenees, the Alps Maritimes and the Apennines randomly produce flash intense floods which hit the historical towns and cities densely developed along their courses. After several catastrophic rainfall events which have been recently observed over the Mediterranean area (Barcelona in 1963, Grenada in 1974, Nimes in 1988, Vaison la Roumaine in 1992, Florence in 1966, Genova in 1970 and 1992), the need for the development of methods for the assessment of hydrometeorological hazard capable of producing reliable predictions of extreme rainfall leading to disastrous runoff occurrences urgently arises. Operational strategies are especially needed in order to develop early warning systems which may save human lives and reduce economical losses in the regions of concern.

Traditional rainfall data alone are not useful in this context since an efficient procedure should deal simultaneously with the different scales of evolution which characterize the physics of meteorological processes. The meteorological conditions of interest in the case of potentially hazardous events develop within large mesoscale or synoptic areas, with extension of ten thousands of km². The synoptic conditions at this scale are reflected – at a smaller scale – into bursts of frontal and/or convective structures yielding extreme effects at basin scale. In this view the analysis of possible occurrences of extreme precipitation should be addressed at various scales on the basis of the observational data collected by different monitoring systems.

Barrett et al. (1988) stated that hydrology is now ready for greatly increased data input from satellite sources since conventional data are inadequate for many hydrological purposes, and the development of retrieval algorithms is well under way. Remotely sensed data are particularly important in observing the distribution of a wide range of hydrological parameters and are nowadays providing new
insights in the investigation of the dynamics of the whole water cycle. On the other hand, though addressed since the late 1940s for meteorological applications, the use of radar in flood hazard monitoring and forecasting received a noticeable operational impulse only in recent years. Multiparametric techniques and Doppler releases actually allow – if joined together with a suitable raingauge monitoring network for calibration – enhanced accuracy in rainfall estimates. Moreover, meteorological radar maps do present the enhanced space and time resolution which is needed in the case of flood hazard forecasting applications as well as the suitability for a real time acquisition and processing of data, the latter being crucial for the issuing of meteorological warnings.

The problem of the assessment and forecasting of hydrometeorological hazard claims for an urgent change in the traditional investigation and monitoring perspective in order to allow for a deeper understanding of both meteorological and hydrological basic processes which evolve over different spatial and temporal scales. Integrated multisensor systems hold the best compromise between the remote perception of the large scale features of the processes and the need for an accurate forecasting of the small scale variability of the involved parameters, as it is needed for predicting the probability of the occurrence of critical conditions in rugged orography regions.

Further research efforts are needed to improve the capability of matching data and hydrometeorological information coming from the various sensors in terms of both their monitoring resolution and hydrological interpretation. The problem of properly transferring information from one scale to another is still far to be satisfactory and the validation of remotely sensed data actually suffers from the lack of knowledge about the spatial distribution of the variables of concern due to the point nature of traditional measurements. Coupling the use of remotely sensed parameters in meteorological forecasting and the fractal analysis of landscape geomorphology and drainage systems is probably one of the most fascinating research objective as it looks promising for the estimation of the probability of disastrous events conditional on the observation of meteorological signatures (Lanza et al. 1994).

The conceptual schematization of the multisensor approach basically relies on the following items:

- the analysis of developing meteorological structures on the basis of the identification of enhancing factors and the interpretation of satellite images;
- the tracking of the identified potentially hazardous systems during their evolution while approaching the target region;
- the analysis of the spatial and temporal variability of the precipitation field associated with the incoming meteorological conditions by means of radar derived and traditional ground based observations;
- the simulation of possible rainfall scenarios which preserve the observed overall and small scale storm characteristics;