One of the basic assumptions in traditional methodologies for seismic hazard assessment consists in the stationarity of seismic activity, which remains generally unproved, mainly due to the short time span (compared to the time scale of the related dynamics) of the available earthquake catalogs. Evidences from pattern recognition analysis of morphostructural and geological features, however, already pointed out that observed seismicity might be not sufficient to identify the sites where the large earthquakes are likely to occur.

We show that a significant short-term (seasonal) and long-term (secular) modulation of seismicity can be detected in regions characterized by present day mountain building and relevant glaciers retreat, namely the Alps and the Himalayas. The secular modulation of seismicity detected over the last ten centuries, appears correlated with surface atmosphere temperature changes in Northern hemisphere, which is considered as a proxy for variations of permanent glaciers dimensions, thus suggesting the possibility for competing effects of tectonic forces and the load due to snow and ice cover.

In view of the evidenced non-stationarity of seismicity, as well as of the limits connected with the available observations, a set of experiments is performed by the neo-deterministic approach, in order to assess the stability of seismic hazard estimates with respect to the time span of the input earthquake catalogue. For the Italian territory, the seismic activity and the corresponding hazard maps are quite different, when considering limited time windows of 500 years; the stability improves when accounting for additional independent indicators (morphostructural information).