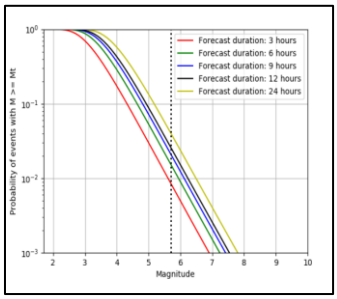
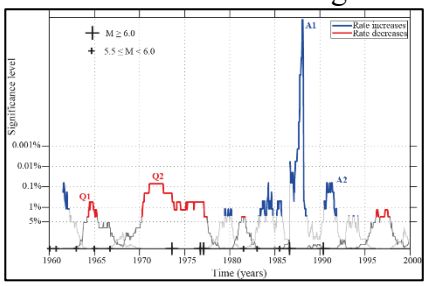
AFROS - Analysis and Forecasting of ROmanian Seismicity - PN-III-P4-ID-PCE-2020-1361

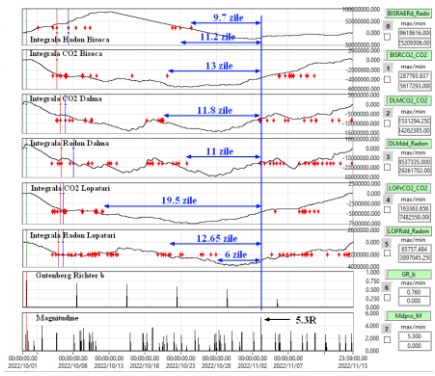
The territory of Romania is characterized by moderate to high seismicity. In particular, the Vrancea area is known for the occurrence of relatively large earthquakes of intermediate-depth, which pose a high risk for the country's capital, Bucharest, as well as for other cities. Other seismic regions, such as Galați, Gorj and Banat, have also recently experienced significant seismic activity that affected cities such as Galați, Targu Jiu and Arad and their neighboring areas.

The AFROS project, carried out within the National Institute for Earth Physics, proposed the creation of an integrated framework for monitoring, analyzing and forecasting the seismicity of the Romanian territory. In addition to traditional techniques used for seismicity analysis and forecasting (temporal changes in earthquake occurrence rate, frequency-magnitude distribution, space-time clustering, and static stress changes), the project explored new mathematical algorithms that can better reveal the "hidden" characteristics of the complexity of earthquake occurrence. **Advanced statistical and machine learning tools** were used to quantify the spatial and temporal characteristics of Romanian seismicity that can be used for seismic forecasts. **Statistical testing** was used to evaluate the performance of forecasts and to discriminate erroneous changes in seismicity from those that can be substantiated from a geophysical point of view and potentially have a precursory character. *(The figures represent "Probabilistic forecasts of aftershocks as a function of magnitude" - on the left and "Statistical significance of relative decreases and increases of seismicity" - on the right)*





An important objective of the AFROS project was the expansion of the multidisciplinary network with geochemical sensors both in the Vrancea region and outside it and the incorporation of geophysical and geochemical data (carbon dioxide, radon emissions, air ionization and electromagnetic data) into the forecasting system. The possible correlations of these observables with seismicity were analyzed, with the ultimate goal of increasing the accuracy of seismic forecasts. *(The figure represents "the M5.3 Vrancea earthquake and integrated signals: radon, CO_2, STA/LTA trigger").*



The AFROS project proposed the creation for the first time for the territory of Romania, of some seismic forecasting algorithms that will be able - as a finality - to be applied in real time (or quasi-real time). This effort is part of a broader international framework of understanding different seismicity regimes, as well as the spatiotemporal interaction between earthquakes, seismicity monitoring and forecasting.

Within the web page of the AFROS project (http://afros.infp.ro/), a dedicated platform is included (http://afros.infp.ro/AFROS.php?link=seismicitate), where seismic, geophysical and geochemical data are incorporated with the aim of generating semi-automatic seismic forecasts: http://afros.infp.ro/AFROS.php?link=hartizvalue, http://afros.infp.ro/AFROS.php?link=dategeofizice. *(The figure represents two captures of the AFROS platform)*