E-MAIL CONTRIBUTIONS

On the existence and complexity of empirical precursors

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Earthquake prediction is strictly related to empirical precursors. Despite the results presented in recent decades in support of the existence of empirical precursors there is scepticism in the scientific community about whether they exist[1-3]. The widespread argument is that precursor signals reported are unrelated to earthquake activity and that they could have occurred by chance. If this were true, earthquake prediction would not be possible.

Since 1974 our group has been performing research on empirical precursors. Tilts, hydrogeochemicals, electromagnetic emissions and radiowave disturbances have been investigated. We have reported results for the Friuli earthquake[4] (1976), the Umbria earthquake[5] (1979), the Irpinia earthquake[6] (1980), the Spitak earthquake[7,8] (1988) and the largest earthquakes that occurred in southern Kamchatka[9,10] during the past decade. Our field measurement and empirical data led us to suppose that there is an extremely small possibility that the precursors detected occurred randomly and are unrelated to the earthquakes. But it seems that the relationship linking earthquakes and premonitory anomalies is very complex and might be different in relation to seismogenetic zones. Consequently no general rules can be assumed. The following main aspects can be emphasized:

- there are earthquakes that will produce no precursors in the geophysical and geochemical parameters of a network, even if the earthquakes are large enough to be considered as potential sources of precursors;

- there are network sites in which one type of precursor will appear before some earthquakes and not before others, although these earthquakes could be potential sources of precursors;

- there are different premonitory anomaly forms both at different sites of a network for the same earthquake and at the same site for different earthquakes.

These and other features are related to the anisotropy of the natural processes and it might therefore not be possible to eliminate them.

The main problem in using precursors in earthquake prediction is to discover whether in a seismogenetic area these features are totally random or whether there are significant recurrences. In the first case the prediction of earthquakes is a null hypothesis; in the second case the prediction of some earthquakes might be possible.

On the basis of 25 years of field research I believe that a satisfactory solution to this problem is still lacking. More data must be collected and more geophysical and geochemical parameters must be tested. Unfortunately, progress in this research area is connected with the occurrence of earthquakes. Many earthquakes (considered as sources of precursors) are necessary for defining in a meaningful way the relationship linking earthquakes and precursors in a seismogenetic area, but the occurrence of earthquakes

cannot be planned. As a result a deadline for the definition of the problem cannot be foreseen and might be tens of years in the future.

In this framework, countries in which research on precursors is still encouraged and funded are very few. Generally this research is prevented so that in Europe any reference to earthquake precursors in a scientific proposal will guarantee that it will not be funded. Therefore, reputable and qualified scientists in this field are boycotted a priori. Is this the right way to conduct science?

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