



Precursory pattern of seismicity of the Emilia (Italy) major earthquakes in May 2012

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Analyzing the seismicity of a large region in Northern Italy during the last 7 years, we find that the physical process that drove the seismic dynamical system to the recent major earthquakes in Emilia (Northern Italy, May, 2012) acted as a kind of multiscale space-time focalization, i.e. a time and space reversed diffusion, mostly resembling a Mogi's doughnut in space with a clear acceleration in time. This focalization is shown in terms of i) an acceleration with time of the cumulative Benioff strain expressed as a power law, that points to the time of the recent seismic sequence with possible chaotic characteristics; these latter are more visible in the time-behavior of some power-law parameters estimated with progressing forecasts from around 120 days before the main-shock; ii) a foreshocks seismicity that occurs in an almost circular periphery and then converges (i.e. focuses) to the epicentral area with a time reversed diffusion function; iii) the inter-events shortening toward the epoch of the two major earthquakes. The latter two kinds of focalization are evident looking at the behavior in time of the lower distances front and the upper inter-events boundary of the Benioff strain, respectively. This process of focalization is actually magnitude and size dependent, for this reason we call it "multiscale focalization". Whether this phenomenon is peculiar to Emilia sequence only or shared with other seismic sequences or regions, is unknown so far, thus requiring more case studies. Nonetheless we believe that looking at the different ways the seismicity focuses might be a new tool for a deeper insight into the physics of the seismic sequences eventually preceding a main-shock and, possibly, for an improved scheme of intermediate- and short-term forecasting, helping in reducing the typical amount of uncertainty of the sole application of the accelerating seismic release technique.