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# Historical tide gauge data provide crucial evidence of natural subsidence rates in the Eastern Po Plain, Italy

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Monitoring and studying vertical movements in northern Italy is of particular importance because the Po plain, a major tectonic feature, extends over this region. The Po plain and the northern Adriatic Sea is a rapidly subsiding sedimentary basin surrounded by the Alps and Apennines chains. Subsidence in this region stems from the combination of natural and anthropogenic components. Natural subsidence can be referred to the dynamics of the lithospheric plates leading to the formation of the Alps and the Apennines, and to loading and compaction of sediments which filled the depression between the two mountain chains. Climatic variations, such as the one that took place since the last glaciation cycle, also contribute to natural subsidence. The anthropogenic contributions to subsidence have contributed remarkably to the present geomorphology of the Po plain. During the second half of the 1900, exploitation of subterranean fluids, primarily water and gas, has significantly increased the natural long-term behavior, in particular, in the southeastern part of the plain and along the northern Adriatic coast. During the last few decades of the 1800 and the first two decades of the 1900, natural subsidence was the only phenomenon responsible for the vertical land motions occurring in the northern Adriatic. The opportunity to investigate such a hypothesis is provided by the historical relative sea level records of four tide gauge stations distributed along the northern Adriatic coast, namely Marina di Ravenna, Venice and Trieste, in Italy, and Pola, in Croatia. We recently rescued the earliest 23 years of historical data of the Marina di Ravenna tide gauge (formerly Porto Corsini), thus producing a homogeneous time series spanning 144 years. For these four tide gauge stations, the years from the early 1870s to 1922, allowed estimating the rate of natural subsidence in the coastal area of the Po plain. The rate of natural subsidence in Ravenna turned out to be in the order of 2 mm/yr, while in Venice it was of 1 mm/yr. This result is in excellent agreement with geological studies showing that natural subsidence in the Po plain decreases from south, where the rates exceed 1 mm/yr, to north.