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Analyzing temporal changes in climate erosivity using a simplified rainfall erosivity model in Basilicata (southern Italy)

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Summary The objective of this work was to investigate the magnitude, frequency and trends of rainfall erosivity in Basilicata (southern Italy), as an initial step in the study of the consequences of climatic change on soil environments in the central Mediterranean region. First, we derived and calibrated an equation to predict the RUSLE rainfall erosivity (EI_{30}) from daily rainfall, using a continuous 5-year series of 549 daily rainfall events, recorded in 20-min time intervals at five stations located across the region. After validation, this rainfall erosivity model was then applied to the long term daily rainfall series of 53 gauging stations, distributed over the Basilicata territory, yielding time series of annual and seasonal rainfall erosivity for the period 1951–2000. The Mann–Kendall non-parametric test statistic was used to detect time trends in the rainfall erosivity time series. Results indicated that more than half of the stations did not show a statistical trend. Four stations showed an upward trend and 12 a downward trend in seasonal and annual erosivity, the trends becoming stronger during the last 30-year normal (1971–2000), when compared to the overall 50-year period. This analysis of rainfall erosion index values and its regional variability clearly showed the strong local spatial and temporal variation of erosivity in this Mediterranean region. The results further indicated that the decrease in annual rainfall depths observed in a number of locations is compensated by an increase in single

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storm rainfall intensity to produce near stationary long term values of annual rainfall erosivity in the region.

Introduction

Weather and climate extremes, especially in a changing climate, induce an erratic pattern in rainfall and its associated erosivity, which could have a higher impact on the environment than the more-often-cited risk of global warming (Sauerborn et al., 1999; Allen and Ingram, 2002). In this respect, rainfall erosivity constitutes an important factor for understanding the multitude of hydrological and geomorphologic processes taking place in a landscape, such as soil erosion, mudflows, flash floods and leaching. In particular the erosive power of climate depends on how rainfall and runoff are able to produce ''geomorphic work'', such as removing topsoil, reworking land surface materials and modifying the

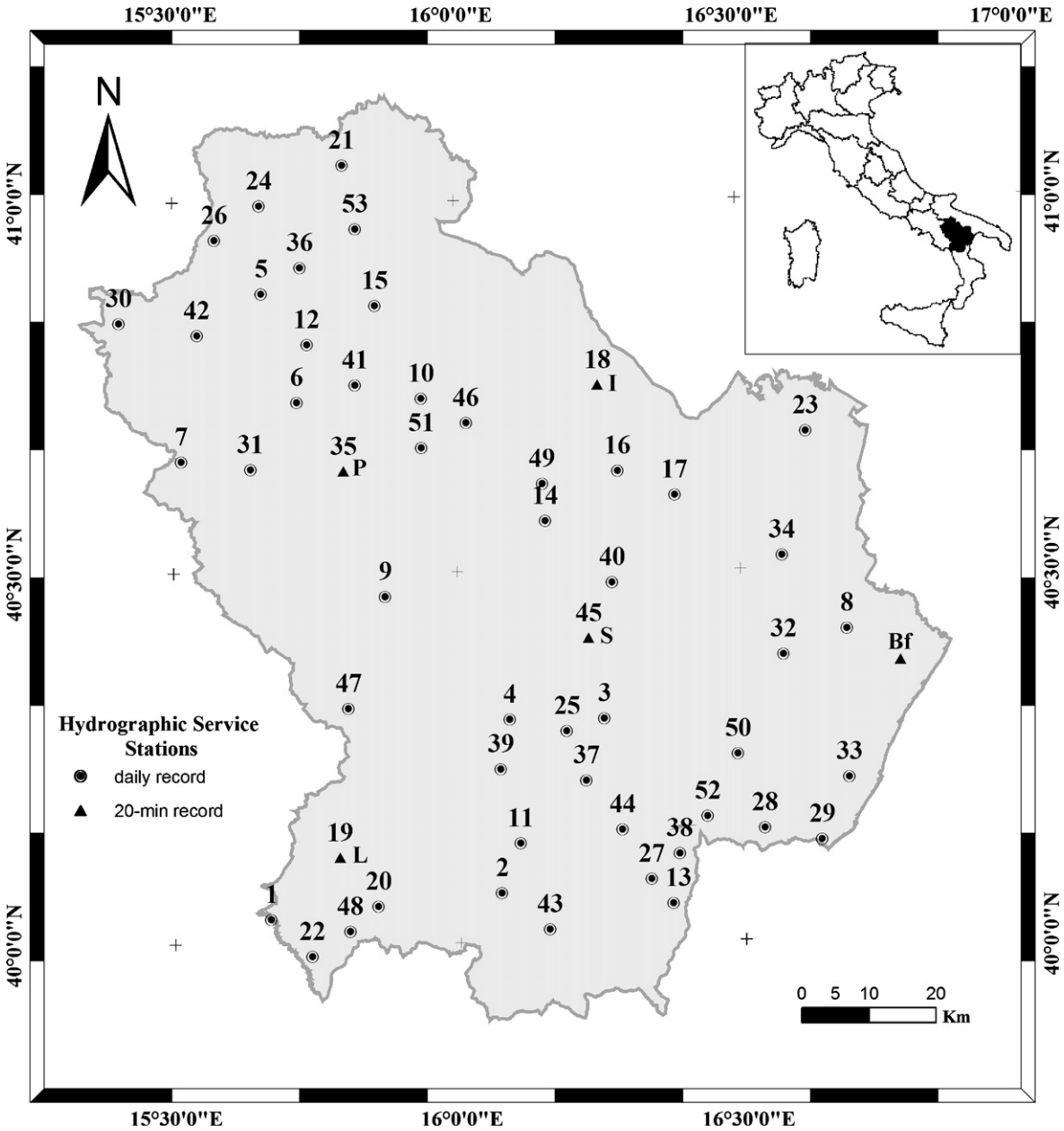

Figure 1 Geographical location of the SAL (Servizio Agrometeorologico Lucano) and SI (Servizio Idrologico Nazionale) meteorological stations in Basilicata region. Numbers refer to station list in Table 1, and letters indicate stations with short duration data used in model calibration and validation (B: Basento Freatimetro, I: Irsina, L: Lagonegro, P: Potenza and S: Stigliano).