A downscaling-based nowcasting procedure by merging radar data with different space-time resolution

Stefano Farris[1], Marino Marrocu[2], Alessandro Seoni[1], Salvatore Urru[1], Maria Grazia Badas[1], Luca Massidda[2], Simone Manca[2], Gabriella Pusceddu[2], Francesco Viola[1] and Roberto Deidda[1]

(1) Dipartimento di Ingegneria Civile, Ambientale e Architettura, Università degli Studi di Cagliari, Cagliari, Italy
(2) Center for advanced studies, research and development in Sardinia, Pula, Italy

Convective precipitation represents one of the most critical issues in urban areas; numerical weather prediction models frequently fail to forecast such events and early warning systems may be ineffective due to large temporal and spatial variability. In this scenario, radar-based nowcasting models may be a powerful tool for providing reliable short-term forecasts with lead times ranging from minutes to a few hours by extrapolating the most recent observed precipitation fields. In this study we propose a nowcasting chain that takes advantage of relevant information from two radar products with different resolutions and scales: (i) high-resolution (HR) observations retrieved by a X-band weather radar in a small domain (the metropolitan area of Cagliari, located in Sardinia, Italy), and (ii) low-resolution (LR) mosaic data provided by the Italian national radar network (the whole Italian country). To this end, we developed a downscaling-based procedure for merging the corresponding spectral information by generating an artificial power spectrum that captures the power of the large (small) frequencies from the high (low) resolution data spectrum. The proposed downscaling-based nowcasting procedure is thus implemented as follows: (1) acquisition of the latest HR and LR radar frames; (2) application of the downscaling and merging procedure to combine the large-scale precipitation patterns detected in LR data with the statistical properties of the smaller scales emerged in HR retrieval; and (3) employment of nowcasting models to produce forecasts for different lead times. Performances of the proposed approach are then evaluated by proper metrics.