

The 2010 Pakistan floods: high-resolution simulations with the WRF model

F. Viterbo¹; A. Parodi², L. Molini², A. Provenzale¹, J. von Hardenberg¹, E. Palazzi¹

¹ *CNR-ISAC, Torino, Italy*

² *CIMA Research Foundation, Savona, Italy*
francesca.viterbo@cimafoundation.org

Estimating current and future water resources in high mountain regions with complex orography is a difficult but crucial task. In particular, the French-Italian project PAPRIKA is focused on two specific regions in the Hindu-Kush -- Himalaya -- Karakorum (HKKH) region: the Shigar basin in Pakistan, at the feet of K2, and the Khumbu valley in Nepal, at the feet of Mount Everest. In this framework, we use the WRF model to simulate precipitation and meteorological conditions with high resolution in areas with extreme orographic slopes, comparing the model output with station and satellite data. Once validated the model, we shall run a set of three future time-slices at very high spatial resolution, in the periods 2046-2050, 2071-2075 and 2096-2100, nested in different climate change scenarios (EXtreme PREcipitation and Hydrological climate Scenario Simulations - EXPRESS-Hydro project). As a prelude to this study, here we discuss the simulation of specific, high-intensity rainfall events in this area. In this paper we focus on the 2010 Pakistan floods which began in late July 2010, producing heavy monsoon rains in the Khyber Pakhtunkhwa, Sindh, Punjab and Balochistan regions of Pakistan and affecting the Indus River basin. Approximately one-fifth of Pakistan's total land area was underwater, with a death toll of about 2000 people. This event has been simulated with the WRF model (version 3.3.) in cloud-permitting mode (d01 14 km and d02 3.5 km): different convective closures and microphysics parameterization have been used. A deeper understanding of the processes responsible for this event has been gained through comparison with rainfall depth observations, radiosounding data and geostationary/polar satellite images.

Key words (for online publication): extreme precipitation, 2010 Pakistan flood, WRF simulations, high resolution modelling, complex topography.