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Advancing Hydrometeorological use of Multi-Instruments for Experimental Investigation of Precipitation Structure, Dynamics and Microphysics in Eastern Mediterranean: HYDREX

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The inherent spatial and temporal variability of precipitation makes rainfall one of the most difficult geophysical variables to measure anywhere, and yet it is one of the most important in advancing hydrologic and weather forecast applications. In particular, improving local flood and flash flood forecasting requires accurate quantitative rainfall measurements at small temporal (minutes) and spatial (hundred of meters to few kilometers) scales. Arguably, weather radar's capability to monitor precipitation (in particular radars with dual-polarization capability) at high spatial and temporal scales has stimulated great interest and support within the hydro-meteorological community. Furthermore, precipitation over oceans plays a significant role on the hydrological cycle and the ocean circulation. The comprehensive measurement of precipitation is valuable for understanding the water and energy cycle and predicting weather and climate. Climate change has raised the need for accurate spatial and temporal measurement of ocean and land surface precipitation. Furthermore, measuring precipitation enhances overall weather-forecasting capabilities and can determine the location, structure and strength of storms at sea, contributing valuable information for ship routing so that vessels can avoid heavy storms. Satellite instruments present complex trade-offs among their characteristics; for example among spatial resolution, spatial coverage and revisit time, or between sensitivity and spectral resolution. However, the sound produced by rainfall underwater can be used to quantitatively measure rainfall at sea. Further research is needed to understand how to distinguish the acoustic signal of rainfall at sea to identify it and quantify it at the sea surface as well as data from dual-polarization weather radar to predict precipitation dynamics, vertical structure and microphysical properties of storms. HYDREX (Hydrometeorological Experiment) is an experimental set up in the coastal area southeast of Athens targeting measurements of coastal rainfall and urban hydrologic processes from multiple sensors and at various spatio-temporal scales. Experimental data from HYDREX will facilitate studies for (1) developing improved techniques for retrieving rainfall rate and drop size distribution parameters from high-frequency (X-band and C-band) dual-polarization radar observations, (2) the estimation of rainfall and drop size distribution by underwater sound measurements, and (3) investigating the connection of rainfall scaling, microphysical variability and vertical structure as a mean for improving assimilation of remote sensing data in numerical weather prediction and quantitative precipitation estimation. The experimental set up includes the National Observatory of Athens X-band dual-polarization Doppler mobile weather radar (XPOL), the Hellenic National Meteorological Service's C-band dual-polarization and Doppler weather radar, in situ stations consisting of rain gauges and disdrometers (a 2DVD and a Parsivile), a vertically pointing radar (named MRR), and a passive acoustic sensor (PAL) deployed at sea. The experiment was initiated in November 2010 through May 2011. Several storm cases of varying structure, rainfall intensities, and microphysics have been observed and will be presented at the meeting.