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The Potential of the W-band polarization diversity Doppler radar envisaged for the WIVERN mission for looking into the internal structures of Mediterranean cyclones

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The WIVERN (WInd VElocity Radar Nephoscope, www.wivern.polito.it) mission, one of the four ESA Earth Explorer 11 mission candidates, currently in Phase-0, promises to complement the ADM-Eolus Doppler wind lidar measurements by globally observing, for the first time, vertical profiles of winds in cloudy areas. This work aims to determine the potential of the new cutting edge WIVERN W-band polarization-diversity Doppler radar for sampling Mediterranean hurricanes and monitoring their internal structure. It builds on the recently developed end to end simulator of the WIVERN dual-polarization Doppler conically scanning 94 GHz radar (Battaglia et al., Atmos. Meas. Tech., 15, 3011–3030, 2022, https://doi.org/10.5194/amt-15-3011-2022). The simulator is applied to: 1) the long-term CloudSat observation dataset of intense cyclones in the Mediterranean basin; 2) a Weather Research and Forecasting (WRF) Model very high horizontal resolution (333 m) run for Medicane Apollo occurred in October 2021. The analysis of the CloudSat results provides statistics for understanding which part of the cyclones can actually be seen by the W-band radar and where line of sight winds can be accurately measured. The high resolution WRF simulation provides insight into wind errors introduced by non-uniform beam filling and small-scale convective motions for the WIVERN observing system.