Case simulation study of evaporation ducts over the sea area around Taiwan in the summer of 2022

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Atmospheric variations can induce changes in the propagation direction and distance of electromagnetic waves, affecting communication range and radar detection efficiency. This phenomenon, known as atmospheric duct. Especially evaporation ducts close to the sea surface often appear on the ocean surface where sea-air interaction is obvious, causing problems for civilian and military applications, and are particularly valuable for research.
This study focuses on the use of the WRF model to simulate the lower atmospheric conditions in the peripheral waters around Taiwan from August 15 to 18, 2022. The atmospheric refractivity is calculated based on the simulation results, and the evaporation duct heights are determined using the P-J model. The findings reveal the widespread presence of evaporation ducts in the waters surrounding Taiwan. Under the influence of the southwest monsoon, the terrain significantly affects wind strength, resulting in weaker winds near the coast and leeward sides. In the offshore waters of eastern and southern Taiwan, evaporation duct heights are higher than those in the northern regions. Additionally, the offshore evaporation duct heights in the eastern seas are higher compared to the nearshore heights. Regarding diurnal variations, evaporation duct heights show an increasing trend with the intensification of solar radiation, indicating a correlation with enhanced sea surface evaporation throughout the day.

Keywords: Evaporation Duct, Modified Refractivity, Paulas-Jeske Model, WRF

