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Characteristic of daytime F-region backscatter plume structures over low latitude of China

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Ionospheric F-region irregularity backscatter plumes are commonly regarded as a nighttime phenomenon at equatorial and low latitudes. At daytime, there are very few reported cases of F-region backscatter echoes. It is still not clear what caused the daytime echoes. In order to understand the occurrence of daytime F-region echoes, we carried out an experiment with Sanya VHF radar (18.4°N, 109.6°E, dip lat. 12.8°N) during November 2016 to August 2020. Some basic characteristics were released: (1) The daytime F-region echoing structures have an unexpected high occurrence in June solstice of solar minimum. (2) The echoing structures could appear at any time during 0700–1800 LT, with a maximum occurrence around 0900 LT. (3) The echoing structures appeared mostly above 350 km altitude, extending up to 650 km or more (F region topside) with apparent westward drifts at times. Radar interferometry and ICON satellite in situ results show that the daytime F-region echoes were from plume structures consisting of field-aligned irregularities. It is suggested that the plume structures could be remnants of equatorial plasma bubble (EPB) irregularities generated on the previous night around 100–125°E. They rise to high altitudes and drift zonally together with background plasma, causing the daytime F-region backscattering structure over Sanya. With simultaneous observations of several VHF radars at different locations, satellite in-situ measurements and/or EPB model, the dynamics of daytime F-region backscatter plume structures could be better understood in the future.