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Scalewise investigation of two-phase flow turbulence in upward turbulent bubbly pipe flows[1] JUN HO LEE, HYUNSEOK KIM, HYUNGMIN PARK, Seoul National University — In the present study, the two-phase flow turbulence in upward turbulent bubbly pipe flows (at the Reynolds number of 5300) is invesgitated, especially focusing on the changes in flow structures with bubbles depending on the length scales. For the scalewise investigation, we perform the wavelet multi-resolution analysis on the velocity fields at three streamwise locations, measured with high-speed two-phase particle image velocimetry technology. While we intentaionlly introduce asymmetrically distributed bubbles at the pipe inlet, the mean volume void fraction is varied from from 0.3% to 1.86% and the considered mean bubble diameter is roughly maintained at 3.8 mm. With the present condition, turbulence enhancement is achieived for most cases but the turbulent suppression is also captured near the wall for the smallest void fraction case. Comparing the scalewise energy contribution, it is understood that the flow structures with length scales between bubble radius and bubble wake size are enhanced due to bubbles, resulting in the turbulence enhancement. On the other hand, flow structure with smaller length scales (mostly existing near the wall) may decrease depending on the bubble condition, which may be one of the explanations in turbulence suppression with bubbles.

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