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Bubbly wall-layers in a vertical channel[1] SOUVIK BISWAS, JIACAI LU, GRETAR TRYGGVASON, Worcester Polytechnic Institute — Direct numerical simulations of nearly spherical bubbles rising in a laminar flow in vertical channels have shown that for upflow the bubbles are pushed to the walls, until the fluid mixture in the center of the channel is in hydrostatic equilibrium. The excess bubbles hug the channel wall, forming a wall-layer, one bubble diameter thick. The upward velocity of the core flow depends entirely on the velocity increase across the wall layer. Here we examine how the bubbles in the wall layer rise and how their rise velocity, as well as the velocity in the center of the channel, depends on the governing parameters of the flow. The study is done using direct numerical simulations where the flow around the bubbles is fully resolved and the uniform flow outside the wall layer is generated by a properly adjusted body force. The behavior of the flow is studied for a range of parameters using a regular periodic array and the results then compared with results from simulations of freely evolving and interacting bubbles for one case, as well as with results of simulations of the full channel. The average properties of the flow in the wall layer are examined and compared with a simple two-fluid model.

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