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The effect of inlet boundary conditions in image-based CFD modeling of aortic flow SUDHARSAN MADHAVAN, ERICA CHERRY KEMMERLING, Department of Mechanical Engineering, Tufts University — CFD of cardiovascular flow is a growing and useful field, but simulations are subject to a number of sources of uncertainty which must be quantified. Our work focuses on the uncertainty introduced by the selection of inlet boundary conditions in an image-based, patient-specific model of the aorta. Specifically, we examined the differences between plug flow, fully developed parabolic flow, linear shear flows, skewed parabolic flow profiles, and Womersley flow. Only the shape of the inlet velocity profile was varied–all other parameters were held constant between simulations, including the physiologically realistic inlet flow rate waveform and outlet flow resistance. We found that flow solutions with different inlet conditions did not exhibit significant differences beyond 1.75 inlet diameters from the aortic root. Time averaged wall shear stress (TAWSS) was also calculated. The linear shear velocity boundary condition solution exhibited the highest spatially averaged TAWSS, about 2.5% higher than the fully developed parabolic velocity boundary condition, which had the lowest spatially averaged TAWSS.

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