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Assessing the Accuracy of Density-Velocity Comparison Methods on Cosmological Parameters

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A promising method for measuring fσ8 involves comparing observed peculiar velocities with those predicted from a galaxy density field using linear perturbation theory. While previous studies have evaluated the effectiveness of this method using N-body simulations these typically focus on idealized mock galaxy surveys which ignore systematic biases that can arise solely due to survey selection effects. Using mock catalogues that replicate the 2M++ density field, we explore the impact of these various effects individually and collectively in order to quantify the accuracy and precision of this method. We find the reconstruction and analysis methods used for our 2M++ mocks produce a value of $f\sigma_8$ that is biased high, and calibrating recent peculiar velocity samples we find a linear $f\sigma_8 = 0.362 \pm 0.023$. Building on these findings, we explore how reconstructing cosmological redshifts using peculiar velocities influence measurements of the Hubble constant (H0). Recent measurements of H0 using type Ia supernovae explicitly correct for their estimated peculiar velocities using the 2M++ reconstruction of the local density field. However, the amount of uncertainty that is generated due to this reconstruction has thus far been unquantified. To rectify this we use our mock 2M++ catalogues and their predicted peculiar velocities, to quantify this component of the error budget.

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