



Dawn-dusk asymmetry of earthward and tailward flows near lunar orbit

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A statistical investigation of earthward and tailward flows at around 60 RE downtail is presented based on five years (2011-2015) of ARTEMIS data. A significant fraction of fast flows is directed earthward, comprising 43% ($v_x > 400\text{km/s}$) to 56% ($v_x > 100\text{km/s}$) of all observed flows. This suggests that near-Earth and mid-tail reconnection are equally probable of occurring on either side of the ARTEMIS downtail distance. For fast convective flows ($v_{\text{perp}_x} > 400\text{km/s}$), this fraction of earthward flows is reduced to about 29%, which is in line with reconnection as source of these flows and a downtail decreasing Alfvén velocity. More than 60% of tailward convective flows occur in the dusk sector (as opposed to the dawn sector), while earthward convective flows are nearly symmetrically distributed between the two sectors for low AL ($> -400\text{nT}$) and asymmetrically distributed towards the dusk sector for high AL ($< -400\text{nT}$). This indicates that the dawn-dusk asymmetry is more pronounced closer to Earth and moves further downtail during high geomagnetic activity. We infer that near-Earth reconnection is preferentially located at dusk, whereas midtail reconnection ($X > -60\text{ RE}$) is likely symmetric across the tail during weak substorms and asymmetric towards the dusk sector for strong substorms, as the dawn-dusk asymmetric nature of reconnection onset in the near-Earth region progresses downtail.