Observed winter Arctic sea ice volume budget decomposition over the Cryosat-2 period

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We combine satellite-derived observations of sea ice concentration, drift, and thickness to provide the first observational decomposition of the dynamic (advection/divergence) and thermodynamic (melt/growth) drivers of wintertime Arctic sea ice volume change. Nine winter growth seasons are analyzed over the CryoSat-2 period between October 2010 and April 2019. The method is replicated using model simulations from Los Alamos sea-ice model (CICE), which provides a test of the model's ability to calculate the volume budgets and identifies unrealistic growth regimes in the satellite observational datasets. Sensitivity to several observational products is performed to provide an estimated uncertainty of the budget calculations. The total thermodynamic ice volume growth and dynamic ice losses are calculated with marked seasonal, inter-annual and regional variations. Ice growth is fastest during Autumn, in the Marginal Seas and over first year ice. Our budget decomposition methodology can help diagnose the processes confounding climate model predictions of sea ice.