



Much larger winter-time sea ice volume decrease over the Arctic inferred from a relative bias between ICESat and CryoSat-2 ice thickness

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Two available but temporally discontinuous space-borne sea ice thickness data over the Arctic – ICESat and CryoSat-2 were intercompared using a common platform of 2009-2010 period, in order to understand characteristics of the mutual biases and causes of those biases. In doing so, AMSR-E derived vertically polarized emissivity between 10.65 and 18.7 GHz (i.e. $EVD = E_v(10.65\text{GHz}) - E_v(18.7\text{GHz})$), which conveys an ice type information (and thus ice thickness information), was related to the altimeter-derived ice thickness, to obtain regression equations between AMSR EVD and ICESat thickness for February and March of 2004-2008, and between EVD and CryoSat thickness for February and March of 2011. Then those obtained two regressions were applied to the 2009-2010 period, in which two predicted ice thickness data can be compared with common IceBridge data. From the comparison it is shown that there exists a systematic bias; ICESat-like sea ice thickness is systematically lower than CryoSat ice thickness by about 60 cm (or vice versa). It has been reported that the winter ice volume between 2003-2008 ICESat period and 2010-2011 CryoSat period corresponds to be a decrease of 1479 km³ (Laxon et al., 2013). However, taking the relative bias between ICESat and CryoSat ice thickness into account for estimating the sea ice volume, the decrease appears to be much larger, corresponding to 3539 km³.