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The carbon balance of Russia

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We determine the net land to atmosphere flux of carbon in Russia, including Ukraine, Belarus and Kazakhstan using inventory based, eddy covariance, and inversion methods. Our high boundary estimate is -342 Tg C yr-1 from the eddy covariance method, and this is close to the upper bounds of the inventory based Land Ecosystem Assessment and inverse models estimate. A lower boundary estimate is provided at -1350 Tg C yr-1 from from the inversion models. The average of the three methods is -613.5 Tg C yr-1. The methane emission is estimated separately at 41.4 TgC yr-1.

These three methods agree well within their respective error bounds. There is thus good consistency between bottom up and top down methods. The forests of Russia primarily cause the net atmosphere to land flux (-692 Tg C yr-1 from the LEA) with remarkable little interannual variability. It remains however remarkable that the three methods provide such close estimates (-615, -662, -554 TgCyr-1) for NBP, given the inherent uncertainties in all of the approaches. The lack of recent forest inventories, the few eddy covariance sites and associated uncertainty with upscaling and under sampling of concentrations for the inversions are among the prime causes of the uncertainty. The DGVMs suggest a much lower uptake at -91Tg C yr-1 and we argue that this is caused by a high estimate of heterotrophic respiration compared to other methods.