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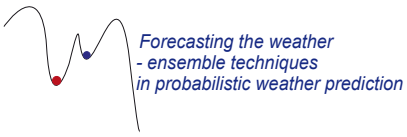

Night-time variability of CO_2 concentration measured in the forest canopy near a mountain ridge top: influence of intermittent vertical mixing

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Night-time exchange of trace gases between the forests and the atmosphere is affected by terrain and site-related non-stationary effects like intermittent mixing, flow decoupling and presence of the canopy or internal gravity waves. The study reports on the variability of CO_2 concentration measured during the growing season 2010 at the Experimental Ecological Study Site Bílý Kříž (800-900 m a.s.l.) in the Czech Republic. The site is situated on a steep (13°) SSW-faced slope near the top of a mountain ridge forested by a young Norway spruce plantation. Flow directions across the ridge strongly prevail at the site. The flow above the canopy on the downwind (leeward) side of the ridge is retarded or it can be even reversed in a layer reaching above the canopy. The intermittent reversal layer is characterized by very high data variability.

High-frequency signals of the wind velocity components, sonic temperature and CO_2 concentration were sampled at the height of z = 10 m in the forest canopy of the mean height hc = 13.5 m. The variance of CO_2 concentration with respect to thermal stratification and mean wind speed measured above the canopy is investigated separately for the “upwind” vs. “downwind” cases. Detailed analysis of typical night time situations with moderate wind speeds under stable stratification reveals that the cases of high CO_2 concentration variability are linked with the periods of intermittent turbulence detected in the records of vertical wind velocity.