

CO<sub>2</sub> fluxes were measured continuously for three years (2003–2005) using the eddy covariance technique for the canopy layer with a height of 27 m above the ground in a dominant subtropical evergreen forest in Dinghushan, South China. By applying gapfilling methods, we quantified the different components of the carbon fluxes (net ecosystem exchange (NEE)), gross primary production (GPP) and ecosystem respiration (R<sub>eco</sub>) in order to assess the effects of meteorological variables on these fluxes and the atmosphere-canopy interactions on the forest carbon cycle. Our results showed that monthly average daily maximum net CO<sub>2</sub> exchange of the whole ecosystem varied from  $-3.79$  to  $-14.24$   $\mu\text{mol m}^{-2} \text{s}^{-1}$  and was linearly related to photosynthetic active radiation. The Dinghushan forest acted as a net carbon sink of  $-488$   $\text{g C m}^{-2} \text{y}^{-1}$ , with a GPP of  $1448$   $\text{g C m}^{-2} \text{y}^{-1}$ , and a R<sub>eco</sub> of  $961$   $\text{g C m}^{-2} \text{y}^{-1}$ . Using a carboxylase-based model, we compared the predicted fluxes of CO<sub>2</sub> with measurements. GPP was modelled as  $1443$   $\text{g C m}^{-2} \text{y}^{-1}$ , and the model inversion results helped to explain ca. 90% of temporal variability of the measured ecosystem fluxes. Contribution of CO<sub>2</sub> fluxes in the subtropical forest in the dry season (October-March) was 62.2% of the annual total from the whole forest ecosystem. On average, 43.3% of the net annual carbon sink occurred between October and December, indicating that this time period is an important stage for uptake of CO<sub>2</sub> by the forest ecosystem from the atmosphere. Carbon uptake in the evergreen forest ecosystem is an indicator of the interaction of between the atmosphere and the canopy, especially in terms of driving climate factors such as temperature and rainfall events. We found that the Dinghushan evergreen forest is acting as a carbon sink almost year-round. The study can improve the evaluation of the net carbon uptake of tropical monsoon evergreen forest ecosystem in south China region under climate change conditions.