Responses to comments from Dr. Zhang

Question (Q)

Your paper is very interesting and well written. However, I have several concerns to discuss with you Page 11323, section 2.3 is confusing. It is described that an algorithm for estimating landscape and regional C fluxes including following four steps. Steps one and two are carried out in your paper. I am not clear which parameters are optimized in this study. Which method used to conduct parameter optimization? How the updated satellite-based vegetation photosynthesis model was used for data fusion with other satellite data or directly used for estimating landscape/regional GPP in this study?

Answer (A):

A major revision has been made following the referee's comments. The presentation was significantly improved as well. The optimization of the satellite-based algorithm using a data-model fusion technique with assistance of EC flux tower footprint modeling largely reduced the biases in GPP estimations. The remotely sensed GPP using the optimized algorithm can explain 92 % of the seasonal variations of EC observed GPP. The developed upscaling algorithm was verified in the EC-tower footprint area and applied to a large area of 30 km × 30 km. The upscaling framework was presented clearly in the revised version. *See Section 3*. The model parameter optimization algorithm using the Ensemble Kalman filter (EnKF) data-model assimilation technique was described in Section 3.4.2. Nine parameters were optimised (*see Table 3*) and the parameters were allowed to vary seasonally.

Q:

Pages 11325 and 11326, Pm and Wm are functions of LSWI, which is calculated biweekly from Landsat images. It means that you should a Landsat image every two week. It is practically impossible in your study area. Normally, it is possible to get only several scenes of Landsat images with cloudy coverage smaller than 20% at a year in this area. How many Landsat image you used for this study? Could you give more detailed information about Landsat images used, including path/row numbers, coverage of clouds, and acquired time? How do you deal with pixels affected by clouds and their shadows?

A:

The remote sensing data and data processing were given in Section 2.3 in the revised version. The LANDSAT imagery was georeferenced and atmospherically corrected using the cosine approximation model (COST) of Wu et al. (2005) and radiometrically normalized following the method of Hall et al. (1991) with respect to the 2004 imagery in order to simplify the data comparison. The MODIS data were reprojected to the Universal Transverse Mercator (UTM) projection using the MODIS reprojection tool (Kalvelage and Willems, 2005), clipped to the extent of the available LANDSAT imagery, and resampled to a 30-m spatial resolution using a nearest neighbour approach. A convective series of LANDSAT-like images of the surface reflectance at an 8-day interval were predicted by blending the LANDSAT and

MODIS images using the Spatial and Temporal Adaptive Reflectance Fusion Model (STARFM, Gao et al., IEEE Transactions on Geosciences and Remote Sensing, 2006).

Q:
Do you use ETM+7? Which method did you use to smooth stripped lines on ETM+7 images? Which roles does NDVI play in this study?
A:
Six scenes of ETM+ (see Table 2) were used in this study. All of the scenes with SLC-off were gap-filled following the gap-fill algorithm developed by the USGS Earth Resources Observation Systems (EROS) Data Center (EDC), which is available at http://landsat.usgs.gov/documents/L7SLCGapFilledMethod.pdf.
The NDVI was used to identify the timings of bud burst and leaf full expansion, which is important for Pm calculation (see Equation (9)).

Q:
Page 11328, atmospheric correction is very important for producing a time series of remote sensing images. Which algorithm did you use to implement atmospheric correction? How are some key parameters required for atmospheric correction determined? I am not clear which kinds of other corrections are conducted.
A:
The remote sensing data and data processing were given in Section 2.3 in the revised version.

Q:
Figure 4, there are some water bodies in the 6X6 km area around the tower. NDVI may be negative for these pixels. There are also some paddy rice plots in the 6X6 km area around the tower. NDVI should be also low since rice is at late stage of growth on Oct. 3. I suggest that a land cover map is shown along with the NDVI map. Do you use same maximum light use efficiency values for forests and rice?
A:
The EC flux tower was established in late August of 2002. The forest cover reaches 90% in the 1-km^2 area surrounding the tower and 70% in the 100-km^2 area (Liu et al., 2006). See page 8 lines 7-9. We use one light use efficiency value in this study because of the availability of the land cover data.

Q:
Figure 5. it would be better that the footprints are overlaid on the land cover map. Readers will be easy to understand why the integration of footprints can improve the simulation of GPP.
A:
As given in Liu et al., 2006, the forest cover reaches 90% in the 1-km^2 area surrounding the tower and 70% in the 100-km^2 area. Therefore, the land cover map is not that important in the study area. Moreover, technically speaking, the figure would

be mess if the footprint function and the accumulative contours were overlaid on the detailed land cover maps.

Q:

A figure shows the times of Pm, Wm, LWSI, and EVI for the tower pixel is necessary. It allows readers to see whether Pm and Wm work for this evergreen coniferous forest and analyze the causes of larger seasonal variations of simulated GPP than that of measured GPP.

A:

The VPM model inputs and the parameters are varied seasonally after optimization. The optimized parameters were shown in Table 4 instead of showing a figure.