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Hydrology and Earth System Sciences Discussions

Interactive comment on "Improving arable land heterogeneity information in available land cover products for land surface modelling using MERIS NDVI data" *by* F. Zabel et al.

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Dear Referee #3,

Thank you for your helpful comments. We agree that this paper does not show the improvement in the model performance adequately. Actually, the intension of the paper was the development of a land use classification that is taking arable land heterogeneity information into account since this is not done in available land use/cover products yet. The original intension of section 3.2 was to demonstrate the impact of the newly developed land use approach on the latent heat flux, not to show the actual improve-

ment in model performance. Nonetheless, the authors agree with the statement that a clear evidence of improvement in the model performance would be a sensible goal. Besides the spatial analyses of the modelled evapotranspiration, we validated the model results with the help of gauge measurements in order to quantify the improvements obtained with the new land use approach. The results and conclusions sections were revised accordingly (Sects. 3 and 4).

Therefore, Fig. 8 and 9 were replaced by a new figure (attached) that shows the simulated monthly mean evapotranspiration (1971-2000) for the months of May and August with three different land use/cover classification schemes implemented in PROMET (CLC winter wheat, CLC maize and the new land use/cover approach) for the Upper Danube catchment.

Comparing the modelled monthly mean evapotranspiration of 'CLC winter wheat' and 'CLC maize' (Fig. 8) for the month of May as well as for August, a distinct behaviour in evapotranspiration due to the different phenological development of spring- and summer crops is obvious. While the 'CLC winter wheat' classification in May already shows high values of monthly evapotranspiration for the winter wheat areas of up to 70 mm, the maize classification does not contribute to the evapotranspiration yet (Fig. 8). In August, however, the winter wheat already is harvested and is not able to transpire any more, while the maize transpires between 80 mm and 100 mm per month and therefore is heavily involved with the catchment evapotranspiration. This clearly demonstrates a huge impact of the land use on the simulated evapotranspiration. Regional differences of up to 80 mm per month depending on whether the land use is maize or winter wheat may occur. Only within the new land use approach, it is possible to trace spring and summer active crops in the modelled evapotranspiration. This gives a more realistic picture of the spatial behaviour of evapotranspiration in May and August. Spatial patterns of simulated evapotranspiration for the new land use approach in Fig. 8 indicate the different phenological state of spring and summer crops in May and August respectively.

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In order to quantify the improvement of the new land use/cover approach, the water balance was calculated using the three land use/cover classifications 'CLC winter wheat', 'CLC maize' and the new land use approach. The resulting runoff was compared to the measured runoff volume at the outlet gauge in Achleiten. Since the Upper Danube catchment is evenly fractioned in spring and summer crops and therefore, the yearly evapotranspiration sums between the three land use classifications do not differ largely, the water balance for the whole year is supposed to be similar. Only during the growing season from May to September, the new land use approach has an impact on the amount of evapotranspiration and therefore on the water balance. Runoff formation in the Upper Danube catchment is predominantly influenced by the snow cover dynamics. In order to clearly identify the improvement caused by the new land cover approach, the month of August was selected for further analysis since the influence of the snow cover was supposed to be comparably small. The observed monthly mean precipitation in August (1971-2000) is 117 mm. PROMET returned mean monthly evapotranspiration of 55 mm (CLC winter wheat), 74 mm (CLC maize), 64 mm (New approach). According to the water balance, this leads to mean monthly runoff values of 62 mm (CLC winter wheat), 43 mm (CLC maize) and 53 mm (New approach) respectively. Compared to the measured runoff value gathered from the outlet gauge in Achleiten, the new approach significantly improves the model results (see Table 6).

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 4145, 2010.

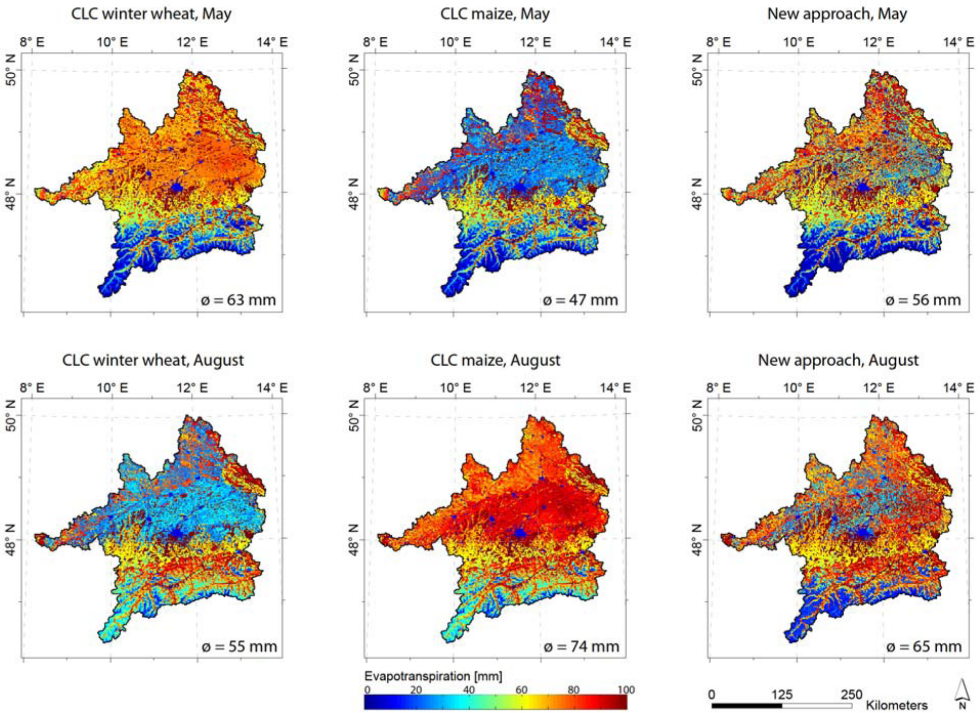

Fig. 8. Modelled mean monthly evapotranspiration (1971-2000) in May and August with three different land use/cover classification schemes implemented in PROMET (CLC winter wheat, CLC maize and the new land use/cover approach) for the Upper Danube catchment.

Fig. 1.

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Table 6: Water balance of three PROMET simulations using the CLC winter wheat, the CLC maize and the new land use/cover approach in comparison to the measured gauge in Achleiten as mean values from 1971 - 2000 for the month of August.

	Precipitation	Evapo-transpiration	Runoff	Gauge Achleiten
CLC winter wheat	117 mm	55 mm	62 mm	55 mm
CLC maize	117 mm	74 mm	43 mm	55 mm
New approach	117 mm	64 mm	53 mm	55 mm

Fig. 2.

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