Reply to comments by E. A. B. Eltahir and R. L. Bras on ‘The parametrization of rainfall interception in GCM’s by A. J. Dolman and D. Gregory
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Eltahir and Bras (1994) raise the interesting point of the effect of spatial variation of canopy storage on canopy evaporation and drainage, claiming that it is important to take this variation into account when modelling interception for large areas. A few general comments must be made concerning this idea.

First, they do not make the comparison with the case deemed most favourable in our paper (unified model scheme with \( \mu = 0.1 \) for convective rainfall and \( \mu = 0.5 \) for large-scale rainfall). We must therefore conclude that the large difference in interception loss when using the value \( \mu = 0.3 \) (for both convective and large-scale rainfall) is equally true for a smaller wetted area, such as used by us. The unified model scheme, using these values, shows an interception loss 7% lower than for the scheme against which Eltahir and Bras make their comparison—more in line with the values quoted for their own scheme.

Secondly, and perhaps more important, their work is primarily based on off-line tests which neglect feedback processes. Pitman and Henderson Sellers (1990) in a similar off-line study commented that feedback effects may have a strong modifying effect on the sensitivity of the interception schemes. In their work (as commented on in our paper), a 50% reduction was found when \( \mu \) was reduced from 0.5 to 0.1. Our own work, showing a much reduced sensitivity when these schemes are implemented in a fully interactive model, clearly demonstrates the importance of feedback processes. In another paper Eltahir and Bras (1993) mention some results of their scheme in the GCM context, but it is hard to judge from their remarks whether a similar reduction in sensitivity was obtained as in our study.

In most local-scale Rutter-type models it is supposed that there is no drainage from an unsaturated forest canopy. The evaporation is relatively insensitive to the specification of drainage because the actual evaporation rate will be at a potential rate as soon as the canopy is saturated. Modelling experiments for the Amazon (Lloyd et al. 1988) using a simplified version of the original Rutter model (Gash 1979) have shown that about half the interception loss is the result of evaporation from a saturated canopy, and about half is the result of evaporation from the canopy after the rain has ceased. The latter process is mainly a function of canopy capacity. The effect of the drainage function of interception models is therefore limited. The schemes tested by Dolman and Gregory (1992) corroborate this view, as the main difference between the two schemes lies in the specification of canopy drainage and only a few percent difference is obtained when these schemes are applied to predict interception losses from Amazonian rainforests.

The results presented by Eltahir and Bras refer, however, not to the local, but to the regional, GCM grid-box scale. In both the schemes used in our original paper the local-scale processes are integrated up to the regional scale through the use of a distribution function of rainfall. Locally the use of this function implies that the water balance reflects the different rainfall rates. This will then result in a distribution of canopy storage over the wetted part of the grid box. This makes the use of an additional function for canopy storage unnecessary. Such a function is furthermore very hard to specify or test experimentally. The accurate simulation of interception losses by us when using a portion of 0.1 for the area in which rain falls, suggests that the correct specification of this quantity is of prime importance in large-scale modelling of interception.

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