SLIMM-PROJECT

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1. INTRODUCTION

An important aim of **BAHC** (**B**iological **A**spects of the **H**ydrological **C**ycle) is to find the average atmospheric exchange at the gridscale of **G**eneral **C**irculation **M**odels (**GCM**'s). To achieve this goal, scaling-up rules must be developed to average local observations. At an intermediate scale of landscapes, scaling-up rules depend on advection in the atmospheric surface layer above individual patches. The available scaling-up rules at this scale show considerable scatter and have hardly been validated. Moreover, recent studies indicate that scaling-up rules may strongly underestimate the influence of surface heterogeneities on the average landscape exchange.

The general aim of the **SLIMM** project (**S**urface **L**ayer **I**ntegration **M**easurement and **M**odelling) is to determine the soil-vegetation-atmosphere exchange of momentum, heat (sensible and latent) and carbon dioxide at the landscape scale (*~10 km*). At this scale most landscapes are inhomogeneous. Average fluxes at the landscape scale are at present simply estimated by direct averaging of the fluxes of the elements, or, by estimating average values using the concept of blending height. The method of using blending height is to be extended and tested in a heterogeneous landscape. The resulting method should be the first step in scaling-up local observations to areal averages for GCM's.

To achieve the general aim of the SLIMM project, an intensive cooperation has been started between three Dutch universities (Amsterdam, Wageningen and Groningen. In this cooperation an intensive two years' measurement programme is carried out over an inhomogeneous terrain. Moreover, various computer simulations have been initiated in which the experimental evidence is used to validate these models.

2. SITE CONDITIONS

The region from Norg to Fochteloërveen in the north of The Netherlands has been selected as experimental site for collecting data. This location has been indicated in Figure 1.

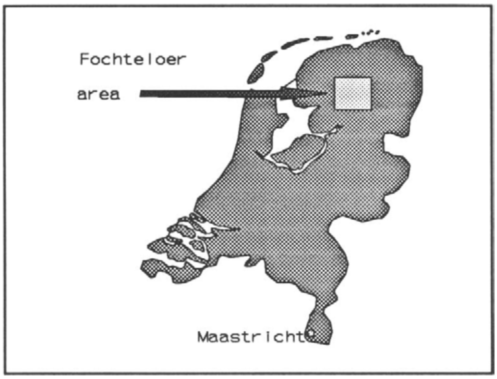

Figure 1. Fochteloërveen location in The Netherlands.

The whole area of interest can be subdivided into three sub-sites; a forest area (Groningen), a bog area (Wageningen) and an area mainly consisting of arable land (Amsterdam). Each subregion has a principle investigation group notated in brackets. The forest site is a combined coniferous/deciduous forest located about 2 km NE from the natural bog site. The agricultural site consists of grass and berry bushes and is situated about 2 km NE from the forest location. This specific region has been selected for the following main reasons:

1) The region has a marked surface heterogeneity within the 10 km scale, our scale of interest.
2) This region is far away from major surface heterogenieties like land-sea interfaces.
3) In the same area a second hydrological experiment is executed in the same period which allows an intensive cooperation with other groups.
4) The region is situated close to one of the universities (Groningen) which guarantees supplementary manpower during the experimental period.
5) The Fochteloërveen area is the largest bog relict in the Netherlands and is extremely useful to study the exchange of greenhouse gases like CO_2 and CH_4.

3. TIME SCHEDULE

The main observations will take place continuously in a two year's period (1994 - 1995) above all the three subregions. The radiation fluxes, the turbulent fluxes of heat, mass (water vapour and carbon dioxide) and momentum and the soil fluxes of heat will be measured continuously. Moreover, during this period, the vegetation and soil characteristics of all three areas will be monitored like, for example, the **L**eaf **A**rea **I**ndex (**LAI**), foliage area distribution, ratio between dead and living material and soil water content.

In addition to the continuous measurement programme, at least three **I**ntensive **F**ield **E**xperiments (**IFE**'s) are planned to investigate areal variations, local advection and regional averages in more detail. One of the IFE's will be focused on the change in surface conditions around the bog-forest interface. Here special attention will be focused on the within-forest and up-wind flow field and the static pressure [1, 2] around the bog-forest interface.

During the IFE's but also incidentally during the continuous measurement period, the following observations of landscape averages will be executed:

1) Boundary layer observations of 3-Dim wind and structure parameters by using a SODAR.
2) Boundary layer observations of the temperature by using a so-called RASS system.

4. MODELLING

The observation results will be used to validate various existing models and, if necessary, to extend these models with the goal to develop advection rules for application in meso-scale models. For example the models of Klaassen [3] and the model of Meesters [4] will be used.

Extending local advection to the 10 km scale implies that the influence of multiple step changes will be analyzed as well. Primarily a smooth-rough-smooth transition will be studied with smaller variations within these elements. For this study the second order model of Kroon [5], and the extended model of Rao [6] will be used.

In day-time, the planetary boundary layer (PBL) has a height of about 1000 m and has horizontal variations of temperature and windspeed that can be neglected at the 10 km scale. At night and possibly after rainy periods, however, a much shallower boundary layer occurs. This means for the boundary layer that can influence the integration rules of the land surface-atmosphere exchange and will be investigated.

Existing, but not yet calibrated, up-scaling rules are based on the concept of a blending height. At this height, the local variations are thought to merge into a regional average. In literature [7, 8,9] a first estimate of this height shows a variation of an order of magnitude. The height of blending might be estimated from elevated measurements at different locations in the landscape and is expected to relate to the scale of heterogeneity and atmospheric stability. Attention will be focused on a technique to arrive at an accurate measure for this height.

5. FUNDING

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6. REFERENCES

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