

SOME RESULTS FROM "HAPEX-MOBILHY" RELEVANT
TO THE PARAMETERIZATION OF LAND-SURFACE PROCESSES

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Extended summary :

The HAPEX-MOBILHY programme was directed at studying the hydrological budget and evaporation flux at the scale of a GCM grid square, i.e. 10^4 km². Different surface and subsurface networks were operated from mid-1985 to early-1987 to measure and monitor soil moisture, surface-energy budget and surface hydrology, as well as atmospheric properties. A Special Observing Period (SOP) was organized from May 7 to July 15, 1986, and included detailed measurements of atmospheric fluxes and intensive remote-sensing of surface properties using two well-instrumented aircraft.

The first results from the SOP relevant to the parameterization of land-surface processes in GCM's are reported here. It is shown that :

(i) the micro-meteorological measurements of latent and sensible heat fluxes from the surface network were consistent with those from more elaborate, also ground-based, systems ; they neither exhibit bias on a longer, monthly, time scale, as they are shown to balance the soil moisture budget derived from neutron-probing of the upper 1.6 m of soil ;

(ii) a large variability is found in radiometric surface temperature at the 1-100 m spatial scale, as seen from airborne remote-sensing ; this variability may reach more than 10 K over a particular field of young oats experiencing various degrees of moisture availability and soil properties, but most of the time the variability remains, within a given field, less than 3-5 K ;

(iii) spatial variability in surface heat fluxes is associated either with various vegetative covers or with different soil moisture availability from place to place ; most of the variability associated with soil properties can be reduced in two classes, for loamy soils on the one hand and for sandy soils on the other hand ;

(iv) as seen and measured from an aircraft flying at an altitude of about 100 m above the ground, the small-scale surface variability associated with varying vegetative cover and/or soil type and moisture availability is smoothed out by mixing in the lower part of the atmosphere boundary layer ; one is just left with a rather sharp and organized transition between a farmland type of patchwork and a large homogeneous pine forest which is sitting in the western half of the experimental domain ; this transition is to be seen for the sensible heat flux, which is notably larger over the forest, while there is not much difference for the latent heat flux between the forest and the farmland ;

(v) meso- β -scale numerical modelling is presently the most fruitful tool to spatially integrate surface fluxes from the micro meteorological scale at which they are measured up to the 100 km-scale relevant for GCM's and NWP models (see Bougeault et al., 1989) ;

(vi) similarity theory of the atmospheric boundary layer is a very promising tool to retrieve spatially-integrated surface fluxes from vertical profiles of momentum, heat and moisture in a "regional inner

region" just above the "mingling height" (Brutsaert, 1988).

Finally, the complete database, against which parameterization schemes for land-surface water budget can be tested and developed and which is made available to interested scientists, is described.

REFERENCES AND FURTHER READING

André, J.C., et al, 1988 : Evaporation over land-surfaces, first results from HAPEX-MOBILHY Special Observing Period. Annales Geophysicae, 6, 477-492.

André, J.C., Ph. Bougeault, J.F. Mahfouf, P. Mascart, J. Noilhan and J.P. Pinty, 1989 : Impact of forest on mesoscale meteorology. Proc. R. Soc. Land., in press.

Bougeault, Ph., B. Bret, P. Lacarrère and J. Noilhan, 1989 : Design and implementation of a land-surface processes parameterization in a meso-beta-scale model. These Proceedings.

Brutsaert, W., 1988 : Results presented at the Workshop/Fall School on "Measurement and parameterization of land-surface evaporation fluxes", Banyuls (France), October 10-21, 1988.

Goutorbe, J.P., J. Noilhan, R. Cuenca and Ch. Valencogne, 1989 : Soil moisture variations during HAPEX. Annales Geophysicae, in press.

Noilhan, J., and S. Planton, 1988 : A simple parameterization of land-surface processes for meteorological models. Mon. Wea. Rev., in press.