AGU 2001
American Geophysical Uniun, Fall Meeting
San Francisco 10-14 December 2001

Satellite-based albedo, sea surface temperature and effective land roughness maps used in the HIRLAM model for weather and climate scenarios.

Charlotte Bay Hasager, Niels Woetmann Nielsen, Jens Hesselbjerg Christensen, Henrik Soegaard, Eva Boegh, Michael Schultz Rasmussen, Niels Otto Jensen

Abstract:
A study is conducted on the effect of introducing maps of geophysical parameters retrieved from satellite Earth Observation data into the atmospheric model HIRLAM (HIgh Resolution Limited Area Model). . The HIRLAM system was developed by the HIRLAM project group, a cooperative project of the national weather services in Denmark, Finland, Iceland, Ireland, the Netherlands, Norway and Sweden. It is currently used by weather services in several European countries. The exchanges of sensible heat, water vapour and momentum between the land- and ocean surface and the atmosphere are very important dynamical processes in this type of model.

The results from the HIRLAM model when using the improved surface boundary conditions is validated from wind and temperature data at synoptic weather stations and surface flux data from land- and ocean meteorological masts in Denmark. The results from a set of scenarios covering the hurricane in Denmark in December 1999 and several springtime cases in 2000 show improved weather forecasts.

The methodology on retrieving improved boundary conditions is based on satellite image data. Maps on the geophysical parameters albedo and sea surface temperature are retrieved at a 1 km spatial resolution from NOAA AVHRR. Furthermore, land cover maps based on Landsat TM satellite data are used to assess the regional roughness. The high-resolution land roughness map (Areal Systems Information in a 25 m pixel resolution) is area-averaged into effective roughness values (15 km grid) by using a non-linear aggregation technique (QJRMS 1999, vol 125, 2075-2102). The area-averaging is highly non-linear due to the turbulent physical processes involved. Thus the effective surface conditions cannot be obtained by simple averaging but only by a flow model taking horizontal advection into consideration. The effect of hedges in the landscape is included as a correction index based on a vector-based map.

The land surface fluxes of heat and water vapour is also estimated from a new concept using vegetation state and surface temperatures from either NOAA AVHRR satellite data or HIRLAM model results. Furthermore, a one-year climate simulation will be carried out with the seasonal land surface effects included in the input conditions. This work is basic to improvements in global climate change predictions. Funding from Danish Research Agency to the SAT-MAP-CLIMATE project (5006-00-0063) is acknowledged.