A NOTE ON BIASED DAY-TIME TEMPERATURES

Carl Fortelius, 15. April 2004

Duty forecasters at FMI have complained about underpredicted day-time temperatures during sunny spring days of early April 2004 over Scandinavia in the RCR-suite, based on HL-version 6.2.1. The problem is said to be worse than last year, when the operational suite was based on HIRLAM version 5.1.4. However, no clean comparison of the two systems is available for this period.

In any case,a tendency of RCR to underpredict the spring time dayily maximum temperatures is clearly evident in the verification results. Figure 1 shows the running temperature bias relative to scandinavian observations for the last 30 days. In late march the bias is small, but in April, when the weather became predominantly sunny and warm, it grows large and negative, showing a marked diurnal cycle with little bias at night.

An intercomparison with observations from Sodankylä suggests that an unrealistic partitioning of global radiation into sensible and latent heat fluxes might play a crucial role in distorting the temperature cycle. Figure 2 shows predicted and observed temperature, humidity as well as surface heat fluxes for Sodankylä during a few days. The 13th of April was a relatively clear day in the model and in reality (cfm the global radiation in panel 3) , and the temperature (panel 1) reached 4 degrees in the afternoon, while the relative humidity (panel 2) dropped to about 40% from a night-time value of 100%. HIRLAM underestimates the temperature-cycle and produces hardly any humidity-cycle at all. On the following day, clouds covered the sky and the diurnal range was much smaller in all variables. This situation seems to have been much better handled by the model.

The very strong latent heat flux (panel 5) on the 13th is not supported by the measurements, that show strong sensible heat flux instead (panel 4). This heat flux likely originates from the trees of the forest covering the site. The canopy gets heated by the sun, and since the trees do not transpire the heating is balanced by sensible heat flux.

In the model, the available energy seems to be partioned in the opposite way. One might speculate about the relation between the high relative humidity and this spurious water vapour injection into the surface layer.

The model-output shown here are grid-point values corresponing to the grid square including the Sodankylä site. The terrain is rather flat and the surface type is 100 % forest. There is a thick snow cover in the model as well as in reality.

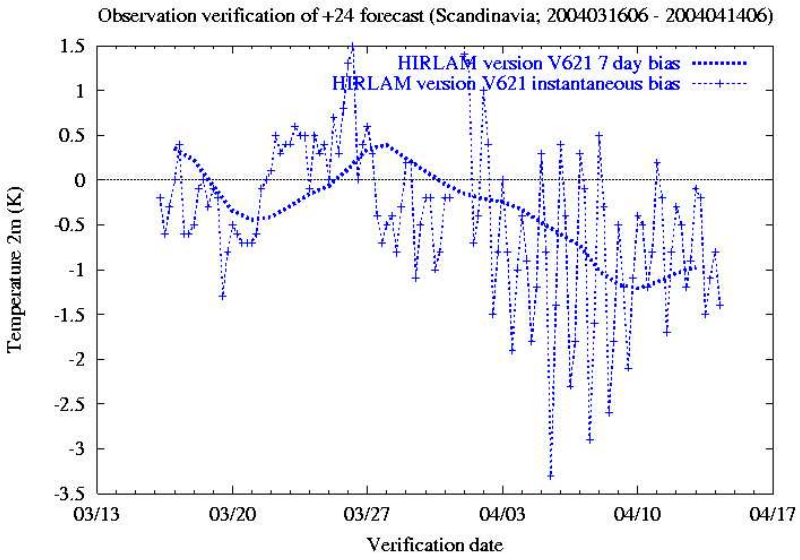

Figure 1: *Cycle by cycle screenlevel temperature bias over Scandinavia.*

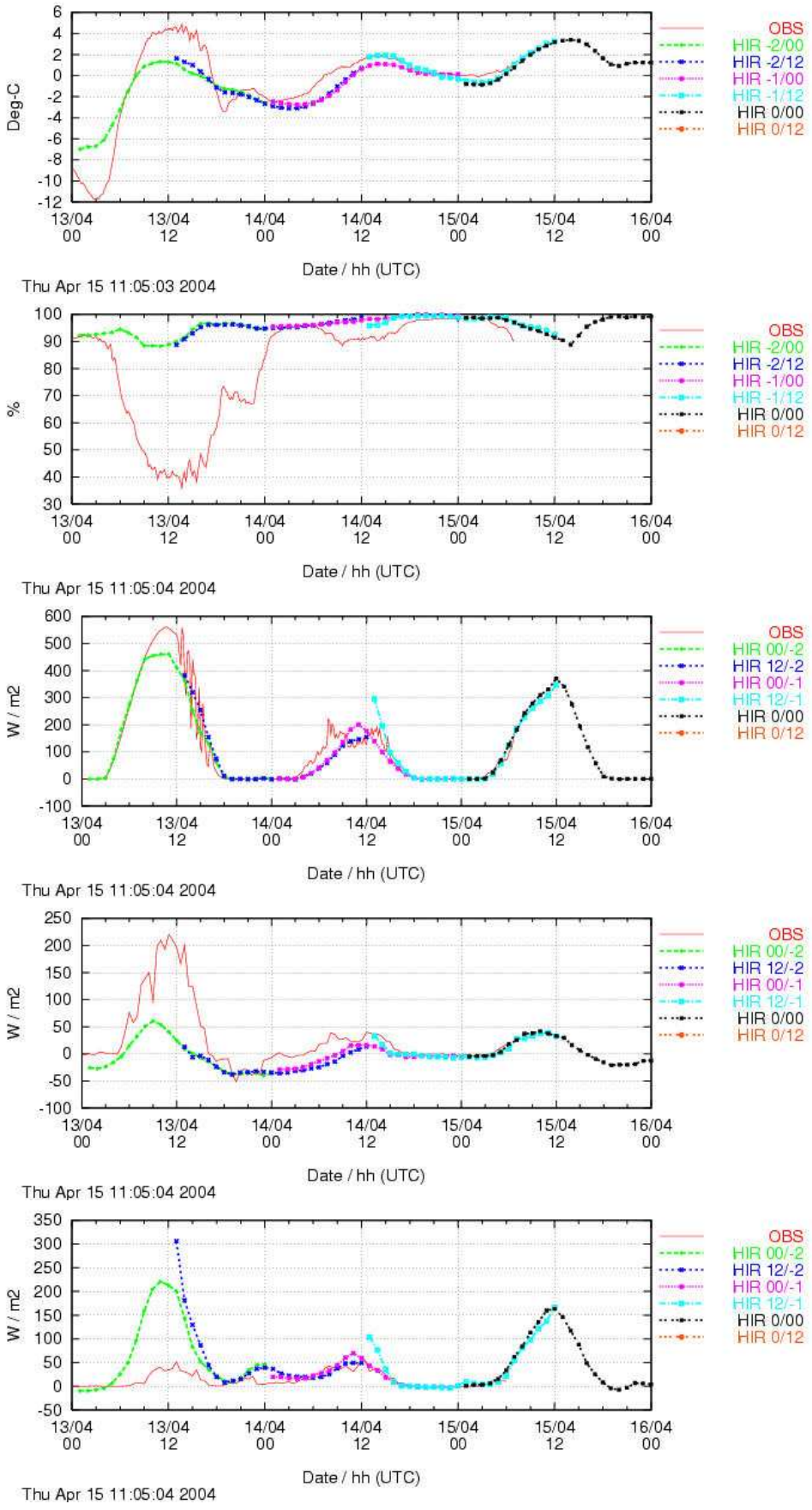

Figure 2: *Predicted and observed Temperature (panel 1), humidity(panel 2), global radiation (panel 3), sensible heat flux (panel 4) and latent heat flux (panle 5) at Sodankyla tower on April 13-15. 2004.*