5. APPENDIX 1: Discussion on the atmospheric forcing variables

SVAT models need a finite number of atmospheric variables to be forced with, normally: air temperature, specific humidity, wind speed and direction, precipitation and radiative fields as direct short-wave radiation, downward long-wave radiation and scattered short-wave radiation. Discussion here will be mainly focused on the radiative fields, because the other variables can be reconstructed without any special treatment directly from observations and the cluster method.

Long term surface observations for the direct short-wave radiation and the downward long-wave radiation can be collected directly from in-situ observations. In function of the study area other sources can be used as the Baseline Surface Radiation Network (BSRN) (**http://www.gewex.org/bsrn.html**) or satellite observations (as the Meteosat Second Generation (MSG) geostationary satellite). Other possibility is to use an analysis database with global coverage but low resolution (around 50 km) as ERA-Interim (**http://www.ecmwf.int/research/era/do/get/era-interim**) or a national analysis database with higher resolution.

For ACCLIMAT and MUSCADE projects, the 1998-2008 direct short-wave and the downward long-wave radiation compounds are extracted from the French SAFRAN analysis database. SAFRAN (Quintana-Segui, 2008; Vidal, 2010) is a meteorological analysis providing eight parameters (10-m wind speed, 2-m relative humidity, 2-m air temperature, total cloud cover, incoming solar and atmospheric/terrestrial radiation, snowfall and rainfall), by using observations as well as model analysis. This database has hourly frequency covering the French territory with an horizontal resolution of 8 km. Seasonal mean daily cycles are obtained using the days associated to each cluster. The reconstruction of a diurnal cycle for a period not clusterized is the same that explained in section 3 and 4. For direct short-wave radiation a correction of the hour of daybreak/sunset is, in addition, applied in function of the day and the latitude and values are forced to be zero after sunset.

The scattered short-wave radiation compound was derived from the hourly reconstructed direct short-wave radiation using the parameterization developed by Bindi et al. (1992):

$Sd = 1 - 0.09\ Sg$ for $Sg < 0.22$

$Sd = 0.951 - 0.169\ Sg + 4.39\ Sg^2 - 16.64\ Sg^3 + 12.34\ Sg^4$ for $0.22 < Sg < 0.8$

$Sd = 0.165$ for $Sg > 0.8$

Where Sd and Sg are the normalized diffuse and global radiation, respectively; i.e. divided by the theoretical extraterrestrial radiation for this day and latitude.