

**A climate model from 80 AD to 1350 AD for the Hautes Fagnes plateau (Belgium), based on pollen grains, testate amoebae and humification analyses. Application of the model to Subatlantic palaeolandslides in the Pays de Herve (eastern Belgium).**

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The Misten bog is located on the Hautes Fagnes plateau (eastern Belgium). It includes thick peat deposit with more than 7 m of peat accumulation in ombrotrophic situation. Several palaeoclimatic and/or palaeohydrological proxies such as pollen grains, *Sphagnum* remains and testate amoebae have been fossilized under anoxic conditions. Several peat cores were retrieved from the bog during a study conducted by the University of Liège and the field laboratory of the Hautes Fagnes (DE VLEESCHOUWER *et al.*, 2010). The peat was cored using a Wardenaar corer (for the top first meter) and a Belarus corer for the layers below. The Belarus sections of cores reached about 7.5 m in depth. The distance between cores 01 and 07, which are considered in this paper, is 1.5 m. The Belarus sections of cores 01 and 07 were correlated thanks to palynology and the analysis of the degree of humification.

An age-depth model was elaborated for the 01 core using <sup>14</sup>C AMS dating and was calibrated with the IntCal09 radiocarbon age calibration curve (REIMER *et al.*, 2009). Our pollen analysis was combined with the results of the preliminary study (DE VLEESCHOUWER *et al.*, 2010) in order to obtain a continuous high-resolution ( $\approx 1$  cm for the Wardenaar monolith and 1.5 cm for the Belarus section) sequence. This pollen diagram includes 103 samples over a depth of 134 cm, more or less representing the last two thousand years. The degree of peat humification was measured with a spectrophotometer. The degree of peat humification of core 01 and the degree of peat humification of a part of core 07 (40 to 123 cm) were compared with the pollen diagram. We also analyzed the relative abundance of species of testate amoebae of the Wardenaar section of core 01 and of the Belarus section of core 07. Results obtained on the testate amoebae were also correlated with the plant macrofossils diagram (*Sphagnum imbricatum* and *Sphagnum cuspidatum*) of the Wardenaar section of core 01.

Taxa indicative of wet conditions or high water table levels are *Fagus* in the palynological assemblage and, according to (CHARMAN *et al.*, 2000), *Amphitrema wrightianum* in the testate amoebae populations. Low humification was also considered, in first approximation, as being linked to high water table level. On the basis of (i) the diagrams of the relative abundance of the two taxa, and (ii) the results of humification, we constructed a palaeo-hydro-climatological model from 80 AD to 1350 AD. In that model, the average of each variable was reset to 0. The minima and the maxima of each variable were, respectively, reset to -1 and +1. That model gives us a climate coefficient ranging between -1 and +1. We divided the model in wetter and drier climatic phases.

The model was applied to a hillslope processes' problem located in the Pays de Herve (Battice area, eastern Belgium). We had to confirm or disprove the hypothesis of a climatic origin of the deep-seated rotational palaeolandslides initiation falls ( $150 \pm 80$  A.D.\*) or the reactivation episodes (~400, 700-750 and 1250-1300 A.D.,  $^{14}\text{C}$  dating\*) of the palaeolandslides (DEMOULIN *et al.*, 2003). On the basis of our climate model, we defined 7 levels of peat deposition. They were named from PHL1 to PHL7 ("Potentially Hydric" Levels). All of the "Potentially Hydric" Levels are characterized by maxima of moisture. According to the model, these maxima may have been contemporaneous with wet climatic conditions during the Subatlantic stage. Consequently, those wet episodes were potentially favorable, to a regional scale, to landslides initiation or to landslides reactivation.

We correlated the ages of the landslides with the "Potentially Hydric" Levels. It supports one of the hypotheses of DEMOULIN *et al.* (2003) about a climatic origin of the palaeolandslides in the Pays de Herve. The ages obtained for the probably initiation of landslides, that could have occurred simultaneously, and for the first two reactivations coincide with wet climatic episodes, particularly favorable for landslides. The climatic hypothesis for the initiation of the third reactivation is however highly debatable; our results are actually not contradictory with the hypothesis of a tectono-climatic trigger of landslides (seismic events during a globally wet climatic episode).

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