Geophysical Research Abstracts
Vol. 18, EGU2016-10225-1, 2016
EGU General Assembly 2016

Adverse weather impacts on arable cropping systems

Anne Gobin
Flemish Institute for Technological Research (VITO), Mol, Belgium

Damages due to extreme or adverse weather strongly depend on crop type, crop stage, soil conditions and management. The impact is largest during the sensitive periods of the farming calendar, and requires a modelling approach to capture the interactions between the crop, its environment and the occurrence of the meteorological event. The hypothesis is that extreme and adverse weather events can be quantified and subsequently incorporated in current crop models.

Since crop development is driven by thermal time and photoperiod, a regional crop model was used to examine the likely frequency, magnitude and impacts of frost, drought, heat stress and waterlogging in relation to the cropping season and crop sensitive stages. Risk profiles and associated return levels were obtained by fitting generalized extreme value distributions to block maxima for air humidity, water balance and temperature variables. The risk profiles were subsequently confronted with yields and yield losses for the major arable crops in Belgium, notably winter wheat, winter barley, winter oilseed rape, sugar beet, potato and maize at the field (farm records) to regional scale (statistics).

The average daily vapour pressure deficit (VPD) and reference evapotranspiration (ET0) during the growing season is significantly lower ($p < 0.001$) and has a higher variability before 1988 than after 1988. Distribution patterns of VPD and ET0 have relevant impacts on crop yields. The response to rising temperatures depends on the crop's capability to condition its microenvironment. Crops short of water close their stomata, lose their evaporative cooling potential and ultimately become susceptible to heat stress. Effects of heat stress therefore have to be combined with moisture availability such as the precipitation deficit or the soil water balance. Risks of combined heat and moisture deficit stress appear during the summer. These risks are subsequently related to crop damage.

The methodology of defining meteorological risks and subsequently relating the risk to the cropping calendar will be demonstrated for major arable crops in Belgium. Physically based crop models assist in understanding the links between adverse weather events, sensitive crop stages and crop damage.

Financial support was obtained from Belspo under research contract SD/RI/03A.