**Laboratory of Hydrology and Water Management, Ghent University**

The Laboratory of Hydrology and Water Management of Ghent University is involved in several projects concerning monitoring and modelling hydrological extremes (both floods and droughts). Two approaches are taken. A first makes use of remote sensing observations (cfr. the Hydras+ and SAT-EX projects), the second concerns the stochastic modelling of current and future scenario forcing data (rainfall and evapotranspiration) as input to rainfall-runoff models in order to derive extreme value statistics of e.g. discharge. In this short description, only the first approach is highlighted.

***HYDRAS+***

HYDRAS+ is a BELSPO-financed project primarily focused on advancing techniques of assimilating satellite observations into hydrologic models to improve their soil moisture behaviour. Assimilation experiments range from regional scale to continental scale with 1 km to 0.25 degrees spatial resolution respectively and a novel copula-based approach for downscaling the mostly course-scale satellite observations to the model resolution at the regional scale is implemented. Further, since assimilating raw satellite data into hydrologic models requires detailed information on vegetation, the potential of dual-state parameter estimation is explored in order to update both soil moisture and vegetation (e.g. LAI) simultaneously giving both improved soil moisture and vegetation information as an output. Two distinct hydrologic models, namely the Community Land Model and the conceptual SUPERFLEX model, are compared in order to assess whether a simpler conceptual model can yield comparable results as the fully-physical, but computationally very demanding, CLM model. All the methods developed within the project are specifically examined for their usefulness within the context of drought monitoring and their potential to improve existing drought-monitoring systems. Within this scope a number of drought indices will be computed from the in-situ validated model outputs and compared to other state-of-the-art datasets for specific drought events. To meet end-user demands as closely as possible experiments can be changed or set-up specifically to any requests.

***SAT-EX***

Recent advances in satellite Earth Observation (EO) – with the development of consistent global historical records of crucial environmental and climatic variables – provide new means to start unravelling the processes driving long-term changes in climate extremes, and understanding the impact of these changes on terrestrial ecosystems. In addition, these datasets offer an observational benchmark to evaluate the skill of climate models at representing climatic extremes and vegetation dynamics. With the goal of revealing how droughts, heatwaves and extreme rain events have changed in frequency and intensity over the past three decades, SAT-EX aims at detecting the causes behind these changes and assessing the consequences for terrestrial vegetation. The ability of our current IPCC climate models to estimate these processes will be evaluated by comparison to novel satellite-based data records. The methods used within the framework of SAT-EX and applied to the EO records include spatiotemporal modelling, fingerprint analyses, and machine learning techniques. The datasets produced will be made freely available for all potential users.