**Evaluation of binary classifiers for environmental extremes**

**Philippe Naveau1, Juliette Legrand1 and Marco Oesting2**

1Laboratoire des Sciences du Climat et de l’Environnement (LSCE), Rennes University, France

E-mail: [philippe.naveau@lsce.ipsl.fr](mailto:philippe.naveau@lsce.ipsl.fr)

2Siegen University, Siegen, Germany

**Abstract**

Machine learning classification methods usually assume that all possible classes are sufficiently present within the training set. Due to their inherent rarities, extreme events are always under-represented and classifiers tailored for predicting extremes need to be carefully designed to handle this under-representation. In this talk, we address the question of how to assess and compare classifiers with respect to their capacity to capture extreme occurrences. This is also related to the topic of scoring rules used in forecasting literature. In this context, we propose and study different risk functions adapted to extremal classifiers. The inferential properties of our empirical risk estimator are derived under the framework of multivariate regular variation and hidden regular variation. As an example, we study in detail the special class of linear classifiers and show that the optimisation of our risk function leads to a consistent solution. A simulation study compares different classifiers and indicates their performance with respect to our risk functions. To conclude, we apply our framework to the analysis of extreme river discharges in the Danube river basin. The application compares different predictive algorithms and test their capacity at forecasting river discharges from other river stations. As a by-product, we identify the explanatory variables that contribute the most to extremal behaviour. If time allowed, we will also discuss other climate datasets.