# Description for the general public

The research proposal aims at contributing to development of new techniques for the investigation of some random elements describing occupation-, exit- and entrance-type problems for randomly changing problems that are modeled by, so called, Gaussian processes and fields.

Strong stimulus to focus on this problems comes both from theory-oriented open questions in extreme value theory and their applications in modern applied probability models, as in risk theory, insurance and financial mathematics, teleinformation networks. The richness and timeliness of these problems make the analysis of the above topics an important field both for the theory of stochastic modelling and probability theory.

We plan to study high exceedances and time spent in some distant set by randomly evolving processes. Additionally, we plan to investigate properties of some constants that appear in formulas for the above random quantities.

Within the research project, we expect to derive a new theory for the probability that a randomly evolving process will ultimately take a high value or spend some specified quantity of time in a distant set. The derived theoretical results will be illustrated by applications to problems that stem from modelling of simultaneous ruin probability of mutually dependent insurance companies and buffer overflow models in telecommunication networks.

We plan to publish the results of the project in such journals as *The Annals of Applied Probability, Bernoulli, Extremes, Journal of Applied Probability, Stochastic Processes and their Applications,* and also more applied ones like *Queueing Systems, Stochastic Models.*