**GDRI:** *ECO-Math*

Project 2018

*Subordinate processes in a second Wiener space*

*Equipe :*

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*Activites:*

- une visite scientifique de deux semaines a l'Universite Paris 1
- une visite scientifique d'une semaine a l'IMAR

**Research project.** The jump process associated to the fractional Laplace operator was proposed as a stochastic fractal model for the hydraulic conductivity based on the examination of the empirical data from four different sites, see [2]. The choice of this mathematical model is mainly due to the observation that logarithms of the hydraulic conductivity data exhibit a correlation structure similar to that of fractional Brownian motion with the increments more peaked at the model. Other related mathematical models have been studied in the literature.

We intend to enlarge the modelling tool kit by replacing the fractional Brownian by another stochastic process which has the same correlation structure, but it is non-Gaussian, the so-called Rosenblatt process. The concept of subordination of stochastic processes comes from Bochner [1]; for a complete exposition of the theory of we refer to [4]; see [3] for an Lˆp approach. The Rosenblatt process belongs to the second Wiener chaos, i.e., it can be written as a double iterated integral with respect to the Wiener process. Various probabilistic and statistical aspects of this stochastic process have been studied in the last decades, see the monograph [5] and the references therein. We also study the basic properties of this new fractal-type stochastic process and we make a numerical analysis of it. In particular, we compute numerically its moments and cumulants and we provide a method to simulate its sample paths.

## References

[1] S. Bochner (1962): Subordination of non-gaussian stochastic processes, Proc. Natl. Acad. Sci., USA, 48(1), 19-22.

[2] T. Kozubowski, M. Meerschaert and K. Podgorski (2006): Fractional Laplace motion. *Adv. Appl. Prob*., **38**, 451-464.

[3] O. Lupascu (2014): Subordination in the sense of Bochner of $L^p$ semigroups and associated Markov processes*, Acta Mathematica Sinica*, English Series **30**, 187-196.

[4] K.-I. Sato (1999): Levy Processes and Infinitely Divisible Distributions, Cambrige University Press

[5] C.A. Tudor (2013): Analysis of variations for self-similar processes. A stochastic calculus approach. Probability and its Applications (New York). Springer, Cham.