Project title	Accumulation of Diverging Trajectories
Principal supervisor	Michael Wilkinson
Second supervisor	Marc Pradas
Discipline	Applied mathematics
Research area/keywords	Dynamical systems, stochastic processes, large deviation methods, oceanography
Suitable for	Either full time or part time applicants

Project background and description

The project is concerned with understanding a surprising effect which is seen in trajectories of some chaotic dynamical systems (reference [1] gives an accessible discussion of dynamical chaos). Despite their overall intrinsic instability, investigations of a simple chaotic system show that trajectories may be very strongly convergent in phase space over long periods [2]. Large-deviation and extreme-value statistics were used to explain the effect. The project with be concerned with developing a deeper understanding of this phenomenon, using random dynamical systems described by stochastic differential equations as working models. The topic has applications in environmental science. It is known that debris floating on the ocean tends to accumulate in certain places. The techniques will be used to analyse this effect, using models for random flows [3].

Background reading/references

1 E. Ott, *Chaos in Dynamical Systems, 2nd edition, Cambridge*: University Press, (2002).

2 M. Pradas, A. Pumir, G. Huber and M. Wilkinson, *Convergent Chaos*, *J. Phys. A: Math. Theor.*, **50**, 275101, (2017).

3 J. Larkin, M. M. Bandi, A. Pumir and W. I. Goldburg, *Power-law distributions of particle concentration in free-surface flows*, *Phys. Rev. E*, **80**, 066301,(2009).