



## WS01 Interpreting Geodetic Data with Physical Models of Lithospheric Deformation

Tue-30 Jul 2019 | 2:30pm to 6:00pm | MR300

To be led by Dr James D. P. Moore and Dr Eric O. Lindsey from Earth Observatory of Singapore, Nanyang Technological University. Both Instructors have led coding workshops regionally and internationally.



James D. P. Moore



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We are entering a new era of “big data” geodesy, with a plethora of observations now available from dense GPS networks and rapid Synthetic Aperture Radar acquisitions (InSAR). Recent advances in modelling, inversion, and theory (Muto et. al. in review, Moore et. al. 2017, Barbot, Moore & Lambert 2017) allow us to exploit these spatially and temporally dense observations to explore complex physical models at greater speed and resolution than ever before.

In this hands-on workshop, we will cover how to build physical models of the lithosphere, either for forward modelling or inversions, using a set of modular libraries to make our lives easier as Earth Scientists. We can incorporate both on-fault and off-fault deformation mechanisms, consider topography, surface loading, gravitational effects, and pressure sources. We will describe from first principles how to simulate a range of real-world deformation data, in particular GPS and InSAR. We will examine several important cases including postseismic deformation, lake loading, and volcano deformation.

We start by discussing the rheological assumptions and our choice of deformation models (Elastic, Rate and State friction, Maxwell, Burgers, power law, or a combination). We will then demonstrate how to simulate geodetic time series based on the evolution of stress in the system governed by these rheological assumptions. We will also demonstrate how to create numerical simulations of earthquake cycles, allowing for off-fault ductile deformation, and spontaneous earthquake ruptures governed by rate and state friction. Finally, we will look at inversion methods for fault slip and distributed deformation.

This workshop is aimed at geologists, geodesists, and geophysicists interested in simulating lithospheric deformation and who may have limited experience with physics or programming. The simulations will be carried out using modular code libraries, and the workshop only requires a basic knowledge of computer programming.