# INSAR REPEAT INTERVAL: ERROR ANALYSIS AND IMPACTS ON DETERMINING POSTSEISMIC GEOPHYSICAL PROCESSES

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## 1. INTRODUCTION

NASA's planned DESDynI mission addresses several disciplines including solid Earth, cryosphere, and ecosystem sciences. Different observation strategies are required for each discipline in order to optimize the science results. It is therefore necessary to understand the impacts of different strategies on each science discipline. Here we look at the impact of sampling interval on the ability to resolve postseismic geophysical processes. A key advance in understanding the earthquake cycle and the impacts of stress changes on faults will come from determining postseismic processes following earthquakes. Determination of postseismic processes from the observed surface deformation is dependent on the line of site range change error, the duration of the observations, and the sampling interval between observations. Design choices on DESDynI will impact each science discipline. Here we evaluate the various observation strategies to understand the point at which DESDynI would no longer provide any valuable scientific return.

Improved understanding of the earthquake cycle will come from measurements of surface deformation following earthquakes and determining the postseismic process responsible for that deformation. This will provide insight into the stress state of the crust and the potential for future large aftershocks or earthquakes. Here we consider relaxation of the lower crust, which is expressed as an exponential function, fault afterslip, expressed by a logarithmic function, and a combination of these two mechanisms. Bulk deformation of the crust or poroelastic deformation can also occur following earthquakes and should also be evaluated.

As a starting point we generated time dependent postseismic surface deformation with 1 cm error from an ensemble of synthetic earthquakes for the ascending pass only of the satellite. We considered a linear combination of logarithmic afterslip and exponential decay relaxation. Coseismic and postseismic slip and the time constants for postseismic processes were generated from random distributions based on published postseismic parameters. A time series with parameter partials was generated for each synthetic event and transformed into estimation errors. We consider a synthetic event to be successfully resolved if the estimated amplitudes for both afterslip and relaxation have formal relative error less than half the larger of the two amplitudes. For two years of observations following an event, using an 8-day repeat as the nominal design we lose 5 per cent of the resolved events by changing to a 14 day repeat, and 19 per cent by changing to a 45 day repeat. If we consider a half-year observation time and 8 day repeat, we will fail to resolve 58 per cent of the nominal resolved cases, 65 per cent for 14 day repeat, and 88 percent for a 45 day repeat.

The current configuration of the DESDynI mission will allow for ascending, descending, left, and right looks at a region. The additional observations should improve the estimates. We will look at combinations of these observations and the impact on discriminating between processes. We will carry out an error analysis to propagate the line of site errors to north-south, east-west, and vertical deformation errors. We will also conduct an analysis of the ability to resolve processes based on the fault orientation and type.