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# Optimizing the use of InSAR observations in data assimilation problems to estimate reservoir compaction

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Hydrocarbon production may cause subsidence as a result of the pressure reduction in the gas-producing layer and reservoir compaction. To analyze the process of subsidence and estimate reservoir parameters, we use a particle method to assimilate Interferometric synthetic-aperture radar (InSAR) observations of surface deformation with a conceptual model of reservoir. As example, we use an analytical model of the Groningen gas reservoir based on a geometry representing the compartmentalized structure of the subsurface at the reservoir depth.

The efficacy of the particle method becomes less when the degree of freedom is large compared to the ensemble size. This degree of freedom, in turn, varies because of spatial correlation in the observed field. The resolution of the InSAR data and the number of observations affect the performance of the particle method.

In this study, we quantify the information in a Sentinel-1 SAR dataset using the concept of Shannon entropy from information theory. We investigate how to best capture the level of detail in model resolved by the InSAR data while maximizing their information content for a data assimilation use. We show that incorrect representation of the existing correlations leads to weight collapse when the number of observation increases, unless the ensemble size growths. However, simulations of mutual information show that we could optimize data reduction by choosing an adequate mesh given the spatial correlation in the observed subsidence. Our approach provides a means to achieve a better information use from available InSAR data reducing weight collapse without additional computational cost.