**Article focus: A brainstorming exercise**

In one or two sentences, answer each of the following questions. Please be sure that your answers are appropriate for a general audience.

1) Why is your field important?

Before performing experiments that can be very costly, simulations can help us to find an optimal choice for some parameters. However, running the simulations can also be expensive, if the systems are very large or ill-conditioned. Therefore, to do it in an effective way is important.

2) What has already been studied in your field?

Iterative methods, in combination with preconditioners (matrices modifying the original system), are the most commonly used methods to solve this kind of problems. In the literature, we can also find reduced order models (ROM), where information of the system is reused to accelerate the convergence of such iterative methods. Finally, deflation methods, containing information of the system in a set of vectors have been studied. Vectors containing previous solutions and vectors constructed based on geometric properties are the most common choices.

3) What has not been studied? Why is this gap significant?

An optimal performance is achieved with a small number of vectors. Therefore, it is necessary to find a small number of vectors containing a large amount of information. With ROM the information can be compressed on a basis containing most of the variability of the system.

The combination of both methods has never been studied.

4) How does your research relate to this gap, and what is the goal of the current article? *Be sure to write a sentence that begins “The goal of this article is to […],” followed by a strong and specific verb (“propose,” “theorize,” “develop,” “investigate,” “discover”).*

The goal of this article, is to combine ROM methods with deflation techniques to accelerate the convergence of iterative methods. We propose the construction of deflation vectors with POD methods, based on information obtained from the system. The POD-basis is later studied as selection of deflation vectors. We investigate the convergence of an iterative method (conjugate gradient) when using this combined method, for different numbers of deflation vectors.

5) What have you done, or what are you doing, to achieve this goal?

We have performed a series of experiments with the above-mentioned method, we have investigated the convergence and number of operations required by this method.

6) What is the working title of your article?

POD-based deflation techniques for the solution of two-phase flow problems in large and highly heterogeneous porous media.