**Review of “PHREEQCRM: A reaction module for transport simulators based on the geochemical model PHREEQC” by Parkhurst and Wissmeier**

**Review by Diederik Jacques (11/01/2015)**

The paper described in detail a C++ class having methods to ease the implementation of (i)Phreeqc as a geochemical solver in a reactive transport model. It helps software developers with the data exchange between the geochemical solver and their transport model by providing appropriate procedures. In addition, it includes methods for parallel processing.

The paper consists of two main parts. The first part gives a description of the module. However, because of the many details given, it reads somewhat as a user manual rather than a scientific paper. I suggest to reduce this part of the paper to the essentials and referring to an user manual for all details.

The second part illustrates the applicability of the module and demonstrates the scalability of the code. The relevance of this part is mainly the implementation of the MoMaS benchmark and demonstration that PHREEQCRM combined with FEFLOW is able to solve these benchmarks. This greatly increases the reliability of the PHREEQC-based reactive transport codes and this is worth publishing itself (especially, but not exclusive, if this study is the first describing the MoMas benchmark solved with the PHREEQC-codes).

There are a few additional remarks:

Abstract line 23: the term inactive grid cell is no clear within the scope of the abstract.

Introduction: The introduction gives some large domains in which reactive transport modeling is applied for quite complex applications. Soil systems or unsaturated flow systems are lacking somewhat as challenging systems for reactive transport. Recently, a few studies have been published with applications of reactive transport models in soil systems.

Line 104: 'all of the capabilities': does it allow to change transport properties induced by changes in geochemical conditions?

Line 110-111: '... With predefined time steps.' What is meant with this?

Lines 154-158: This is one of the examples in which to much details are given.

Line 166: 'Water can be included or excluded...': Not complete clear here. What are the advantages of one or the other, and one should choose one of these two options.

Line 171: "chemically inactive zones or symmetry': With respect to symmetry, is it not more straightforward to reduce the transport domain itself and implementing a no-flow boundary?

Line 211: "special calculations': unclear? Maybe illustrate with an example.

Line 240 'equivalent to Fortran storage': sentence not clear. Also not clear why this is mentioned here.

Lines 245-248: 'mixing of equilibrium phases'. Not complete clear why this is useful. Can you illustrate this with an example.

Line 293-295. Another example (at least for me) which is not needed in a paper, but is rather for an 'user-manual'.

MoMaS benchmark: Provide thermodynamic datafile and maybe also phreeqc input file as supplementary material.

Line 560: 'specified dispersivity': it was mentioned that only the advective cases are presented. In these cases, there is no dispersivity?

Line 629: Not clear if this is for the MoMaS benchmark implementation or in general?