



ISAPP (Integrated Systems Approach to Petroleum Production) is a joint project of TNO, Delft University of Technology, ENI, Statoil and Petrobras.

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Documents and Eclipse input decks (and the related include files) have been prepared for the ISAPP field development optimization challenge as requested out of the ISAPP research program. The files pertain to a reservoir-model based on synthetic data assembled for the fictitious field referred to as "Olympus" and to the definition of the ISAPP optimization benchmark challenge for the field. All the files are provided on a strict "as is" basis (via [www.isapp2.com](http://www.isapp2.com)). TNO does not assume any responsibility or liability for any damage that might result from its use by you. You may redistribute the files for your own purposes, however all references to TNO in the file headers should be maintained as is and the files must remain unchanged. Reasonable changes to the files as proposed by you will be considered by TNO.





Compatible input decks (and the related include files) for the Eclipse model generated by TNO for the fictitious field "Olympus" have been prepared for the ISAPP field development optimization challenge. These files concern decks for IMEX obtained with support from CMG, generated for AD-GPRS by Stanford University and for OPM FLOW obtained with support from SINTEF on behalf of the OPM initiative. All the files are provided on a strict "as is" basis (via [www.isapp2.com](http://www.isapp2.com)). TNO and the parties CMG, Stanford University and SINTEF do not assume any responsibility or liability for any damage that might result from its use by you. You may redistribute the files for your own purposes, however all references to TNO and these parties in the file headers should be maintained as is and the files must remain unchanged. Reasonable changes to the files as proposed by you will be considered by TNO and these parties.

## Introduction

This document is meant to provide an overview of the different files and folders necessary to run the model realization for the TNO Field development optimization benchmark study. The models were generated in PETREL and thus have been simulated using ECLIPSE 2014.1. All the realizations are in ECLIPSE format. In addition to the ECLIPSE input decks, input files for IMEX, AD-GPRS and OPM have also been provided in the folder. For these simulators the input deck of a single model realization has been provided as a template to be used by the participants to generate the input files for the different model realizations. Below we describe the files and folder structure for the different simulators.



## OLYMPUS Simulation Models

This folder contains all the necessary input files to run simulations for the different simulators. The folder *OLYMPUS Simulation Models* contains 4 subfolders as






 ADGPRS	2-1-2017 21:21	File folder
 ECLIPSE	2-1-2017 16:32	File folder
 IMEX	3-1-2017 8:49	File folder
 MRST_OPM	3-1-2017 15:57	File folder

## ECLIPSE










The folder *ECLIPSE* contains two ZIP files namely

 OLYMPUS- Input Files Only.zip	9-2-2017 18:08	WinRAR ZIP archive	148.594 KB
 OLYMPUS- Simulated Files.zip	9-2-2017 18:11	WinRAR ZIP archive	148.593 KB

The folder *OLYMPUS-Input Files Only* contains all the input decks for every realization which are numbered from 1 to 50 with the common files included in a folder called *OLYMPUS*.

 OLYMPUS	9-2-2017 16:01	File folder
 OLYMPUS_1	9-2-2017 16:01	File folder
 OLYMPUS_2	9-2-2017 16:01	File folder
 OLYMPUS_3	9-2-2017 16:02	File folder
 OLYMPUS_4	9-2-2017 16:01	File folder
 OLYMPUS_5	9-2-2017 16:01	File folder
 OLYMPUS_6	9-2-2017 16:01	File folder
 OLYMPUS_7	9-2-2017 16:01	File folder
 OLYMPUS_8	9-2-2017 16:01	File folder
 OLYMPUS_9	9-2-2017 16:01	File folder
 OLYMPUS_10	9-2-2017 16:01	File folder

For e.g. in the folder *OLYMPUS\_1* the following files are included

 FaultMLT.INC	23-12-2016 16:59	INC File	1 KB
 OLYMPUS_1.DATA	9-2-2017 11:46	DATA File	3 KB
 OLYMPUS_1_PROP_NTG.GRDECL	23-12-2016 13:37	GRDECL File	1.237 KB
 OLYMPUS_1_PROP_PERMX.GRDECL	23-12-2016 13:37	GRDECL File	1.669 KB
 OLYMPUS_1_PROP_PERMY.GRDECL	23-12-2016 13:37	GRDECL File	1.671 KB
 OLYMPUS_1_PROP_PERMZ.GRDECL	23-12-2016 13:37	GRDECL File	1.641 KB
 OLYMPUS_1_PROP_PORO.GRDECL	23-12-2016 13:37	GRDECL File	1.392 KB
 OLYMPUS_1_PROP_SATNUM.GRDECL	23-12-2016 13:37	GRDECL File	110 KB
 OLYMPUS_1_SCH.INC	23-12-2016 13:37	INC File	25 KB

Thus each folder has a .DATA file which is the main ECLIPSE deck being simulated with INCLUDE files for the uncertain parameters i.e. PERMX, PERMY, PERMZ, PORO, NTG and FaultMLT. The SATNUM file provides a link between the different relative permeability fields and the different facies the distribution of which is different in each realization. Additionally although the well locations are exactly the same in each realization since the grid is the same a different SCHEDULE file is also included because the WELL INDEX (connection transmissibility factors) differ based on the different permeability fields.









The folder *OLYMPUS-Simulated Files* contains exactly the same set of files and structure as *OLYMPUS-Input Files Only* with the difference that the folders for each realization also contain the output from an ECLIPSE simulation of each realization. This output could be used by participants either to benchmark the model to any other simulator and/or be used to make sure the initialization in other simulators is consistent with the initialization in ECLIPSE.

### AD-GPRS

In this folder an example realization has been benchmarked with results from ECLIPSE. This exercise has been performed by Dr. Oleg Volkov. The input files in this folder can be used by participants as a guide to generate the input files compatible with AD-GPRS from the input files in the ECLIPSE folder for all the other realizations.

The folder contains

- the model input files that can be run in both AD-GPRS and eclipse without any changes;
- the logs from running AD-GPRS;
- figures comparing two simulators.




 Input	2-1-2017 11:42	File folder	
 MODEL.DATA	2-1-2017 10:37	DATA File	8 KB
 MODEL.log.txt	2-1-2017 11:25	Text Document	537 KB
 TNO_BENCHMARK.FIPS.txt	2-1-2017 11:25	Text Document	61 KB
 TNO_BENCHMARK.rates.txt	2-1-2017 11:25	Text Document	580 KB
 TNO_BENCHMARK.res_partition.bin	2-1-2017 10:37	Virtual CloneDrive	753 KB
 TNO_BENCHMARK.solver_partition.bin	2-1-2017 10:37	Virtual CloneDrive	753 KB
 Comparison Figures	4-1-2017 16:21	File folder	

There are several points to be noted on which Dr. Oleg Volkov can be contacted for further details

1. Extra tool used to generate two-point flux connection table (tpfa.in), depth of the centers of grid blocks (depth.in), volumes of the grid blocks (volume.in) It can be repeated for all realizations
2. ACTNUM and PORO read from the init file of eclipse, but AD-GPRS can use ECLIPSE originals as well, see actnum.in and poro.in.
3. The keyword EQUIL in AD-GPRS sets only pressure. That's why initialization has been done with the PRESSURE and SWAT from ECLIPSE, see init.in.

## IMEX

A sample input deck has also been provided compatible with IMEX 2015.

 TNO Feb 2017.dat	13-2-2017 10:35	DAT File	11.702 KB
 TNO Grid_coord.GRDECL	13-2-2017 10:35	GRDECL File	1.563 KB
 TNO Grid_zcorn.GRDECL	13-2-2017 10:35	GRDECL File	32.874 KB

For use with older versions of IMEX such as IMEX 2009 one modification must be made to the *IMEX.dat* file. The folder IMEX 2009 has a sample input deck for the same realization which has been benchmarked (albeit with differences) to the ECLIPSE model.

## Open Porous Media (OPM)

The files used for ECLIPSE can be used with OPM since OPM is an ECLIPSE clone. Users of OPM need to make one change to be able to run ECLIPSE files in OPM.

Every '`\`' in an ECLIPSE input file needs to be replaced by a '`/`' to be able run the ECLIPSE decks with OPM.

THE OPM version used to benchmark the model was the current (13-Feb-2017) master branch from the Github page of the OPM project. The following link describes the Github project for OPM

[http://opm-project.org/?page\\_id=231](http://opm-project.org/?page_id=231)

The OPM project team plans on shortly making a new release 2017.04, at which point the packaged binary versions should run the benchmark unmodified as well. This version of OPM can then be used.