PROJECT facts

NETL

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NETL – DIRECTING THE DEVELOPMENT OF WORLD-CLASS GAS HYDRATE RESERVOIR SIMULATORS

Development of reliable simulators that accurately predict the behavior methane hydrates in nature is a critical component of NETL's program to appraise the gas supply potential of hydrates. NETL is leading the development of a suite of modeling tools that are providing the research and industrial communities with an efficient means to evaluate, refine, and validate their theoretical and commercial concepts prior to expensive field testing.

TOUGH-FX/Hydrate

The first publicly available model designed specifically and exclusively to simulate hydrate reservoir behavior and production potential is TOUGH-FX/Hydrate. TOUGH-FX/Hydrate, developed with NETL's funding and support of Lawrence Berkley National Laboratory, allows users to more accurately predict the behavior of hydrates and hydrate-bearing geologic systems, in the laboratory or field, from the pore to regional scale (see the figure below for a comparison between the model predictions and real world data). It simulates both kinetic and equilibrium hydrate formation and dissociation, and uses state of the art modeling techniques to correctly model both the physical and thermodynamic phenomena operating within currently-contemplated production scenarios.

TOUGH-FX/Hydrate is available for both commercial and non-commercial users. Non-commercial licenses are available at no cost to academic and research institutions, and for use on U.S. Government-sponsored research projects (for more information on obtaining a license for TOUGH-FX/Hydrate please see www.netl.doe.gov/scngo/Software/).
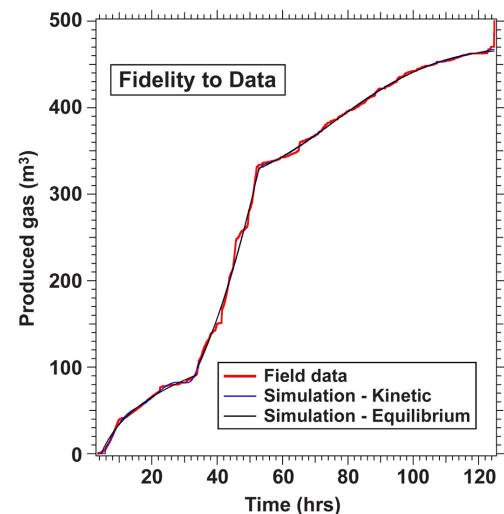
Figure 1. Comparison of measurements and numerical predictions (using calibrated parameters) from the JAPEX/JNOC/GSC et al. Mallik 5L-38 gas hydrate production research well. Reproduced from: Moridis, et al., 2005, Geological Survey of Canada, Bulletin 585.

HydrateResSim

During the summer 2005, NETL will release a freeware reservoir simulator, derived from an earlier version of the TOUGH-FX/Hydrate code, under the name HydrateResSim. This open-source code will be available for use "as-is" from the NETL website (see **www.netl.doe.gov/scngo/Software/**). NETL will provide a limited level of user support for HydrateResSim, potentially including the development of future updates based on modifications made and/or suggested by users. Those interested in obtaining further information about HydrateResSim should contact: Kelly Rose (Kelly.Rose@netl.doe.gov), 304-285-4157 (phone) or 304-285-4216 (fax).

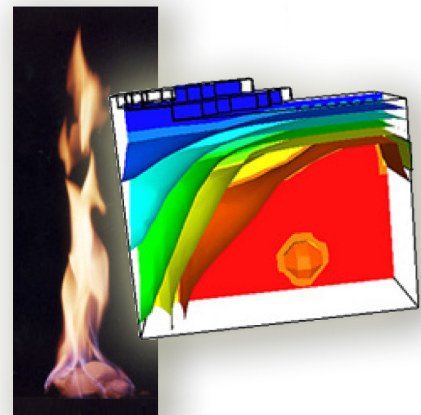**Some of the key features shared by TOUGH-FX/Hydrate and HydrateResSim:**

• Both include an equilibrium and kinetic model of hydrate formation and dissociation,

• Account for heat and up to four mass components (i.e., water, CH4, hydrate, and water-soluble inhibitors such as salts or alcohols),

• Include four possible phases (gas, liquid, ice, and hydrate), and

• Can describe various hydrate dissociation mechanisms (i.e., depressurization, thermal stimulation, salting-out effects, and inhibitor-induced effects).

International Code Comparison

NETL, with support of the U.S. Geological Survey, is leading an international effort to compare a suite of methane hydrate reservoir-scale simulators. Participating codes expected to be included in the comparison are Tough-FX/Hydrate, HydrateResSim, CMG STARS (with use modifications tailored to hydrate), MH-21, and STOMP-HYD. This effort is designed to build confidence in all the leading simulators through an exchange of ideas and cross-validation of simulator results on common datasets of escalating complexity.

PetraSim Version 2.4

To enhance the functionality of TOUGH-FX/Hydrate and HydrateResSim, NETL and Thunderhead Engineering developed an interactive pre- and post-processor tool (PetraSim Version 2.4) that facilitates the creation of input datasets and analysis of results for these simulators. Additional information about PetraSim Version 2.4 is available from our website at **www.netl.doe.gov/scngo/Software/**

Example 3-D temperature contour created using PetraSim

FOR MORE INFORMATION about these software options please see **www.netl.doe.gov/scngo/Software/**

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