Collaborative Geo-Engineering Reservoir Characterization and Modeling on the Web

http://www.kgs.ku.edu/PRS/publication/2004/AAPG/GEMINI

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ABSTRACT

Public domain and proprietary digital warehousing of borehole logs, core analyses, production, and well tests have become increasingly available on the Web. This information sets in motion new strategies to re-explore and re-develop mature areas to find bypassed, underproduced, and previously subtle and uneconomic pay. Web-based reservoir modeling software such as the free, public-domain GEMINI (Geo-Engineering Modeling through Internet Informatics) establishes password-protected projects, workflow, and tutorials to help the online user gather data on-the-fly and perform real-time, interactive collaborative modeling of reservoirs. Java applets used in the applications require a minimal-sized PC and internet access.

Initial screening of reservoir performance and prospective pay prediction can quickly narrow the search space to focus efforts toward enhanced recovery opportunities. Once targets are identified, collaborative users can perform integrated geologic and engineering modeling including iterative approaches and scenario testing. Software tools include **core analysis modeling, log analysis, production and DST analysis, PVT, volumetrics, and material balance**. The refined reservoir characterization and associated economics can be used to identify appropriate recovery technologies. Access to web-based modeling, particularly for small independent oil and gas producers, will encourage use of robust reservoir parameters and models in decision making and in fluid flow simulations. Additional functions in GEMINI provide the means to export results for use in other applications.

GEMINI PROJECT TEAM

Lynn Watney and Tim Carr (petroleum geologists), John Victorine (lead Java programmer), Saibal Bhattacharya (petroleum engineer), John Doveton and Bill Guy (log petrophysicists), Alan Byrnes (core petrophysicist), Geoff Bohling (program designer), Melissa Moore (data manager), Kurt Look and Glen Gagnon (systems programmers), JP Pakalapati (Java programmer) Marty DuBois (petroleum geologist)

Balaji Rajagopalan (programming)
Ken Stalder (web interface, help functions)

A 3-year DOE contract (Fall, 2000 - 2003)

Participating companies

Phillips 66 · Murfin Drilling Co., Inc. · Pioneer · bp · Anadarko Petroleum Corporation · John O. Farmer, Inc.

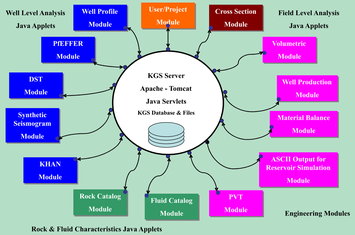
GEMINI
Geo-Engineering Modeling through INternet Informatics

Home | Reports | Personnel | Links | Help

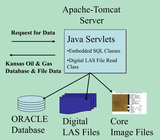
www.kgs.ku.edu/Gemini

Integrated Web-based Petroleum Reservoir Modeling

Home page: http://www.kgs.ku.edu/Gemini/



GEMINI Applet-Servlet Communication



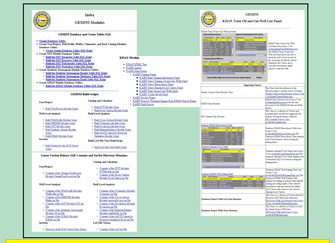
GEMINI Steps in Development

- GEMINI Java Code Standards created before developers write any code.
  - http://www.kgs.ukans.edu/Gemini/R1.0/Documentation/JavaCodeConventions21November2000.doc
- Design of the Modules are worked out with geologist, engineer, and peer review.
- Source Code is accessible to all developers.
  - Java Source Code.
  - SQL Scripts to build GEMINI Database Tables
  - DOS Scripts to build GEMINI Releases.
- Source Code is Documented and displayed on the web for peer review.
  - Developers write html with screen captures and links to the java source code.

- An internet web-site
  - http://www.kgs.ukans.edu/Gemini/index.html
- Rock and Fluid Catalogs
  - Access through the Gemini User/Project Module
  - http://www.kgs.ukans.edu/Gemini/R1.0/GeminiUserProjectModule.htm 1
- Web-based analytical software tools.
  - Well Level Modules (Well Profile, PIEFFER, DST, Synthetic Seismo gram, KHAN)
  - Field Level Modules (Cross Section, Volumetric, Production, Mate rial Balance, ASCII Output for Reservoir Simulation, PVT Calculator)
  - Access through the Gemini User/Project Module
  - http://www.kgs.ukans.edu/Gemini/R1.0/GeminiUserProjectModule.htm 1
- Tutorial module including theory, application of analytical tool s and operation of GEMINI.
  - http://www.kgs.ukans.edu/Gemini/gemini -help.html
- Reports, Seminars, Conferences and Workshops will be provided as records of technology transfer activities.

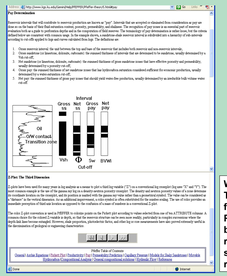
GEMINI deliverables to DOE

Documentation and Help



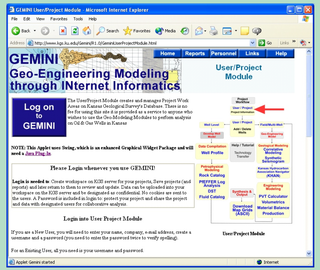
Gemini is modular and documented to facilitate updating and revision.

A portion of the Help dialog in GEMINI showing active buttons used to access concepts and step-by-step tutorial of each module.

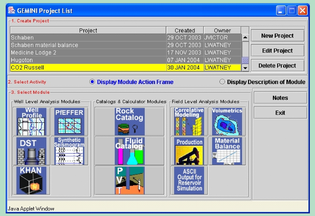


Web page from section of Tutorial on Pay Determination from PIEFFER Concepts Web Page in GEMINI Help. Tool bar on bottom allows user to review the web pages stepwise without having to return to table of contents.

Launching GEMINI



Opening browser dialog. User clicks on <Log on to GEMINI> button to begin a session. Browser can be used to negotiate GEMINI or examine reports and developments in GEMINI.



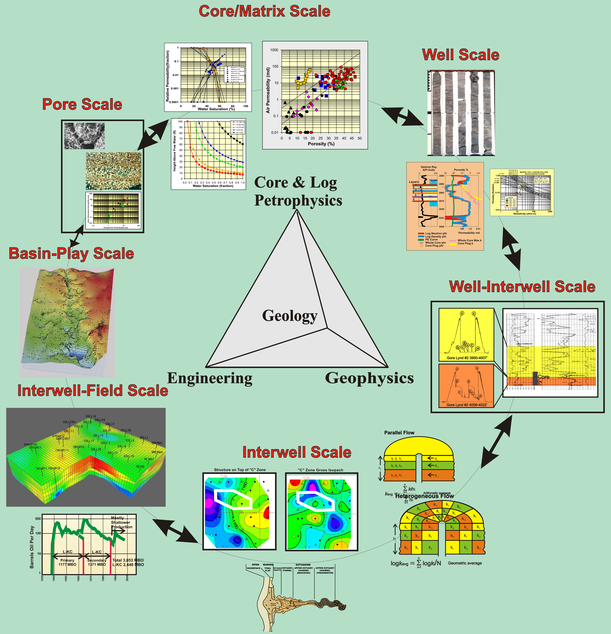
Applet dialog for user to choose particular module. Modules are organized by well level analyses, field level analyses, and catalogs and calculators.

The GEMINI website at http://www.kgs.ku.edu/Gemini/index.html provides the entry point for users.

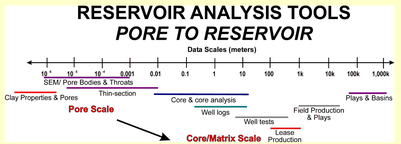
Web-based Reservoir Modeling

1. Accommodates distant collaborations among industry partners and academia.
2. Leverages information on active, updated public-domain petroleum databases.
3. Low cost - free access
4. Provides integrated reservoir analysis tools for the small independent oil and gas producer.

Reservoir modeling involves assimilation of multi-scale information and requires an interdisciplinary approach

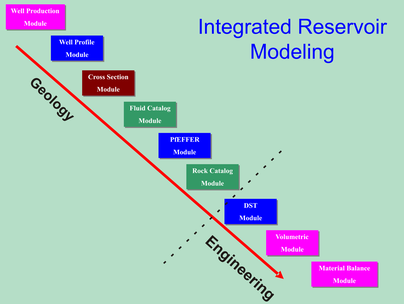


Geo-Engineering Modeling is multi-scale, integrated activity conducted over often long development history of a petroleum province. Recognition of interdependency of scales of reservoir provides the perspectives and insights needed to refine and constrain reservoir models.



Problem or Opportunity

" 12+ orders of scales in reservoir characterization
" Appropriate application of new technologies properly designed to address reservoir complexity
" Devil is in details: solution beyond beyond rules -of-thumb, thickness, and structure



Integrated Reservoir Modeling