GEOSCIENCE ANALYSIS, INTERPRETATION, AND ASSESSMENTS
COMPUTATIONAL FACILITIES

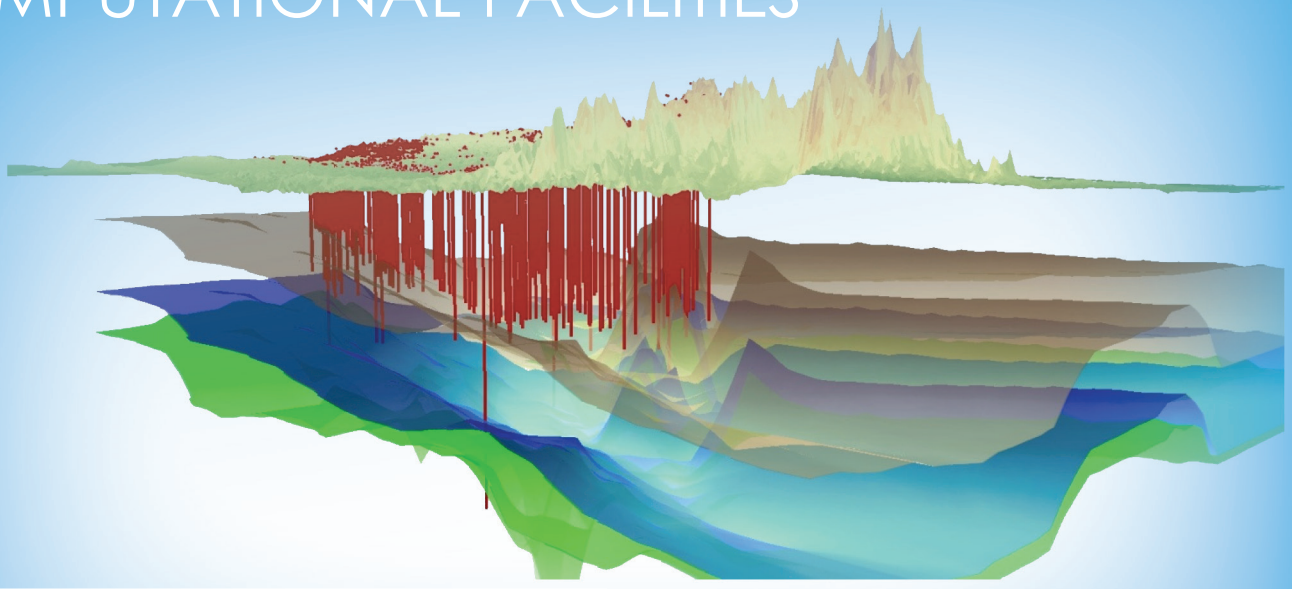

Image shown: 3D visualizations of topography and subsurface layers/intervals in the Appalachian Basin can be created using the GAIA facility. These interpretations support geospatial and geo-statistical evaluations associated with carbon storage assessments, as well as subsurface risk and impact studies associated with hydrocarbon systems and underground injection and storage.

NETL

NATIONAL ENERGY TECHNOLOGY LABORATORY

DESCRIPTION

Researchers use the U.S. Department of Energy's National Energy Technology Laboratory's (NETL) Geoscience Analysis, Interpretation, and Assessments (GAIA) Computational Facilities to perform a range of computational research across the Albany, Oregon; Morgantown, West Virginia; and Pittsburgh, Pennsylvania sites. The GAIA facilities provide access to terabytes of geologic and environmental datasets on high-end computational workstations loaded with advanced tools, models, and software. In addition, the desktop and video sharing capabilities within the GAIA facilities support real-time research collaboration and analysis across all NETL sites and with outside collaborators.

Albany, OR • Anchorage, AK • Morgantown, WV • Pittsburgh, PA • Houston, TX

U.S. DEPARTMENT OF ENERGY | NATIONAL ENERGY TECHNOLOGY LABORATORY

R&D194, February 2019

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CAPABILITIES

The GAIA facilities permit researchers to access, interpret, analyze, visualize, and model data on high-end computational workstations with pre-loaded software, such as ArcGIS, Petra, EarthVision, GoldSim, MATLAB, and other advanced analytical, statistical, modeling, and bioinformatic packages. These computers are equipped with high performance Intel processors, graphics cards, and large amounts of RAM. Real-time collaboration among researchers is facilitated using webcams and video/desktop sharing applications, such as Skype, Join.me, and WebEx.

In the GAIA facilities, researchers can evaluate and utilize their data, whether generated in the field or from laboratory experiments, such as the geomaterial, geoimaging, and geomicrobiology facilities. Additionally, the GAIA facilities help connect scientists to external data, models, and tools, including those available through the Energy Data eXchange (EDX) to process, analyze, and visualize their research to satisfy their project's needs. GAIA workstations also support high-performance and big data computing, allowing researchers to access both NETL's supercomputer, Joule, as well as NETL's big data cluster. The hardware and software accessible at the GAIA facilities are supporting the development of novel approaches, models, and tools that integrate functionality from multiple fields, including advanced 3D & 4D visualization, geostatistics, augmented and virtual reality, data science, data analytics, machine learning, artificial intelligence, and programming.

Ongoing research conducted in the GAIA facilities encompasses a wide range of activities. NETL researchers and collaborators are studying engineered-natural systems related to several research topics, including assessing resource potential, identifying knowledge and technology gaps, analyzing various material's performance, modeling multiphase fluid flow, evaluating infrastructure integrity, analyzing metagenomic and genomic data from various microbial communities, conducting site and study feasibility analyses, and characterizing spatial and temporal patterns to support various research, management, and policy decision needs.

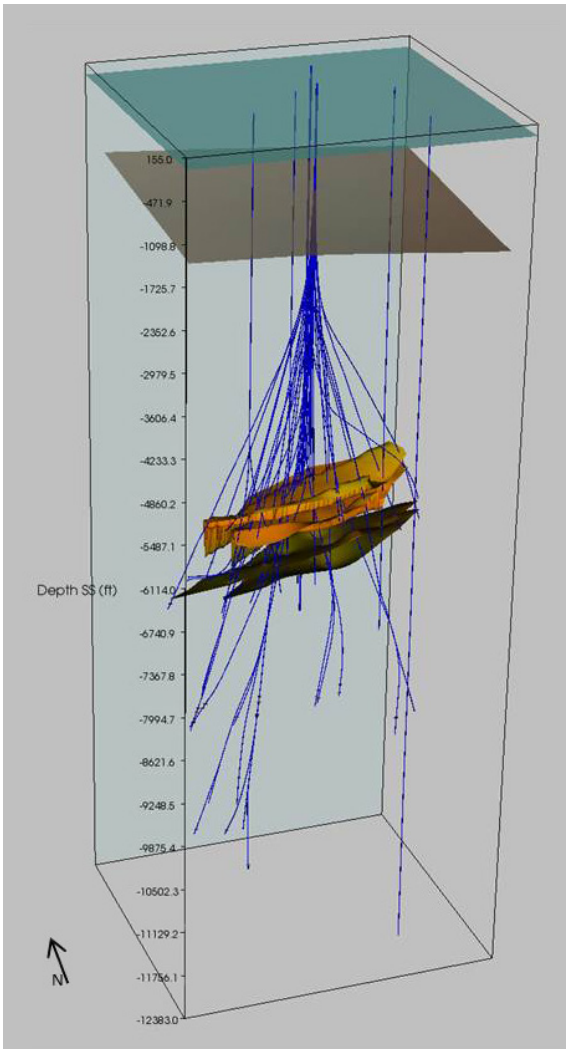

Figure 1. NETL interpretation generated using GAIA facility resources and 3D visualization of directionally drilled boreholes in the Gulf of Mexico showing two reservoir sand intervals.

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BENEFITS

The GAIA facilities provide consistent access to research-caliber work stations at all NETL sites to meet geologic and environmental science research and development needs for a range of projects and users. GAIA facilities also provide a place for visiting scientists and researchers with NETL information technology credentials to efficiently work at any NETL site.

The science-based analyses conducted using GAIA facilities improves our understanding of geologic and environmental systems, exposes knowledge and technology gaps, and drives further research. The integrated and collaborative setting of the GAIA facilities assists knowledge-sharing across projects and disciplines, thus improving NETL's efforts in solving energy issues related to these systems.

Research carried out through the GAIA facilities helps ensure enduring access to domestic energy resources. This research influences the safe and reliable use of our natural resources, development of new energy resources, and protection of the environment.

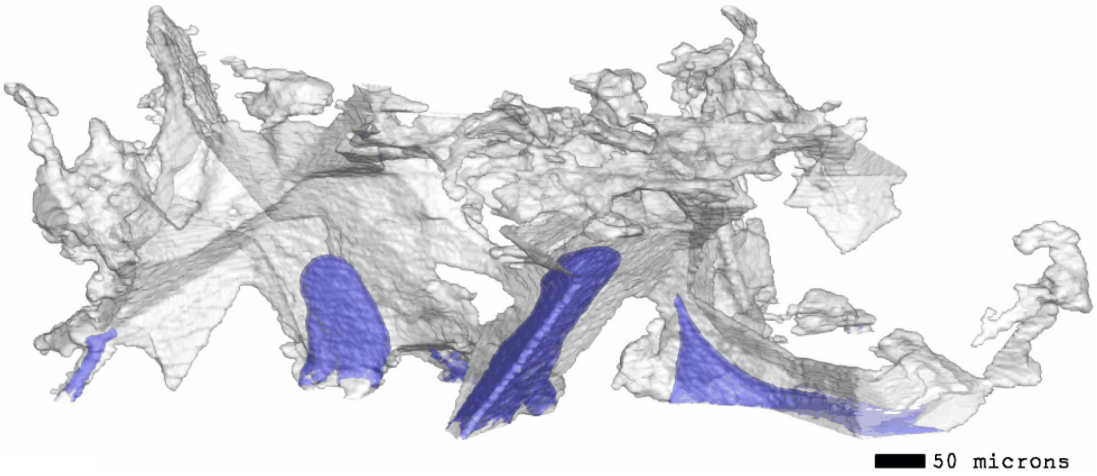

Figure 2. The GAIA facility allows researchers to study multiphase computational fluid dynamics such as this example from a micron computed tomography derived image that shows CO_2 flow in pore space in a Mt. Simon sandstone core.

GAIA Locations

Albany, Oregon
Building 1, Room 315
541.918.4561
Building 28, Room 115
541.967.5964

Morgantown, West Virginia
Building 17, Room 101
304.285.0516

Pittsburgh, Pennsylvania
Building 84, Room 327
412.386.6622

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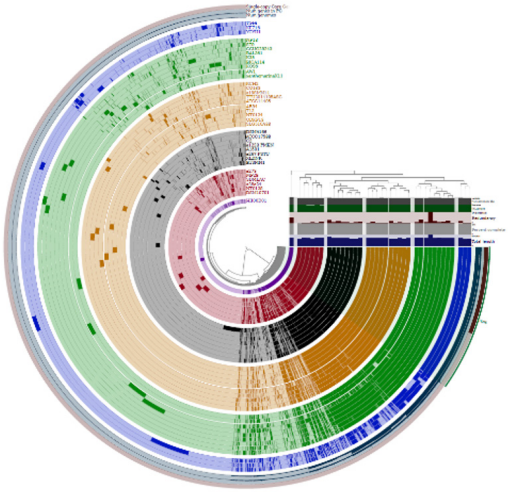

Figure 3. Pan-genomic analysis of Pseudomonas isolated from various hydrocarbon environments allow a comprehensive evaluation of core genomes and accessory genomes.

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