TECHNICAL SPECIFICATIONS

TemisFlow™
Petroleum System Modeling
2D Complex Tectonics

Software Presentation

TemisFlow™ 2D Complex Tectonics is a specific module of TemisFlow™ dedicated to 2D basin modeling in structurally complex environments. It features a unique simulator able to take advantage of an accurate description of the basin structural evolution through time while simulating the impact of folding and faulting on compaction, heat transfer, and hydrocarbon generation, migration, and accumulation.

TemisFlow™ unified workflow offers the following key stages:

• Section properties definition (lithology & geochemistry)

• Boundary conditions definition

• Simulations (temperature, maturity, expulsion, pressure, migration)

• Calibration & Post-Processing

Combined with KronosFlow™, TemisFlow™ 2D Complex Tectonics allows conducting 2D basin modeling studies in complex regions where classic tools cannot be applied , whether it is for petroleum system assessment or dedicated studies like pore pressure prediction or geothermal energy potential evaluation.

Functionalities & Algorithms

INITIALIZATION FROM KRONOSFLOW™

• Automated TemisFlow™ scenario creation

• Initialized with:
- Stratigraphy and ages
- Paleo-geometries
- Lithology distributions
- Associated lithology library

2D GEOGRID

• A dedicated 2D Section Editor with:
- Stratigraphy and ages
- Lithologies
- Source rocks and properties (TOC, HI)

• Task manager for quality control and automatic corrections

• Interactive edition with a paiting tool

• Easy to update

• Pre-processing visualization

SCENARIO MANAGER

• Step by step workflow

• Tracking of the modifications and hypothesis through a Scenario Tree

• No duplication of unmodified data

LITHOLOGICAL INFORMATION

• IFPen databank with reference lithologies

• Creation of user-defined or mixed lithologies

• Possibility to tune and define:
- Depth-compaction curves
- Permeability (thanks to Kozeny Carman, log(K) or user defined laws)
- Thermal conductivity and radiogenic production
- Relative permeabilities and capillary pressure curves

DIAGENESIS

• Chemical compaction for sandstone and chalk through pressure-dissoluation phenomenon

• Chemical compaction for mudstone with dissolution of kaolinite or smectite, transport and mineral precipitation of illite

GEOCHEMICAL INFORMATION

• Definition of laterally variable Initial TOC, Initial HI and Net to Gross for each Source Rock layer

• IFPen or BP databanks with reference kerogens, fractions and schemes

• Creation of user defined kerogens (composition, thermal reactivity) and fractions (viscosity, phase behavior, etc.)

• User-defined multi-compositional HC systems and kinetic schemes

• Primary and secondary thermal crackings

• User-defined Vitrinite-Transformation Ratio law

UNCONVENTIONAL RESOURCES

• Computation of adsorbed HC quantities controlled by TOC evolution, pore pressure, temperature, kerogen kinetic, carbon mass balance and HC density

• Organic porosity calculated according to kerogen cracking

• Both processes fully coupled with expulsion and Darcy's migration simulations

BIOGENIC GAS

• Definition of labile (available to microbial activity) and labilizable (requiring a preliminary maturation) organic matter to assess biogenic gas generation

• Adsorption, retention in organic porosity, accumulation in Darcy porosity, and expulsion

• Fully coupled with thermogenic processes

THERMAL BOUNDARIES

• Surface temperature with possibility to derive it from paleobathymetry and paleogeographic position during continental drifting

• Temperature gradient

• Heat flow at base of sediments

• Temperature at base of upper mantle

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ADVANCED THERMAL BASEMENT
- Complete description of the lithosphere accounting for heterogeneities both in structure and nature
- Homogeneous or heterogeneous rifting events (geometric and thermal beta factors)
- Lithology changes through time
- Coupling of the lithosphere with the sedimentation of the model
- Strong thermal conductivities heterogeneities handling
- Blanketing effect modeling

ADVANCED FAULT MODELING
- Faults can be transparent, permeable or impermeable through a unique modeling of the core and damage zones properties (thickness, permeability, capillary pressure)
- Faults activity can vary through time
- Each fault may have its specific behavior
- Possibility to model heat transfer in faults through water convection
- Graphic edition with painting tools on a 2D section editor

PIEZOMETRIC SURFACES
- Definition of the water table depth as a function of the topography
- Reference surface for the pressure regime computation

FULLY COUPLED SIMULATIONS
- Temperature and maturity
- Pressure
- Expulsion
- Decoupled Darcy migration
- Non-compositional or multi-component
- PVT computation

PARALLELIZED RUNS WITH ADVANCED OPTIONS
- Parallelization on several processors
- Possibility to run simulations on remote machines or clusters
- Possibility to use temperature regime from a previous simulation
- Tuning of time steps and simulation control criteria

Results Analysis

THERMAL AND MATURITY PROPERTIES
- Temperature regime
- Heat in place
- Maturity indicators: Vitrinite Reflectance, Tmax, S2
- Various TOCs: Current TOC and Residual TOC
- Source Rock Maturity Timing

PRESSURE PROPERTIES
- Water Pressure and Overpressure
- Mud Weight
- Effective Stress
- Hydraulic Fracturing

EXPULSION AND MIGRATION PROPERTIES
- Adsorbed and retained masses
- Expelled and Migrated masses
- Hydrocarbon saturation and composition
- PVT properties: Volumes, API Degree, BO, BG...

BUNCH OF VISUALIZATION TOOLS
- Section Viewer
- 3D Viewer
- Log Viewer
- Cross Plot Viewer
- Statistics Viewer

DATA EXTRACTION & CALIBRATION
- Cell history
- Well extraction and automated comparison to observed data
- Log pressure analysis

GEOLOCATION
- Definition of the section trace with a referenced polyline
- Handles straight, broken, and split traces
- Trimming option

FILTERING & REPORTING
- Filtering capabilities and creation of areas of interest
- Statistics and quantitative report on areas of interest

Data Management

DATA IMPORT/EXPORT
The following formats are available:
- Cultural data in shape files and .leg format
- Polylines in ASCII, CPS3 and Z-Map+
- Well paths and logs in ASCII, LAS 2.0 and 3.0, and OBDAT2
- Lithology and geochemical libraries in .xml and .ltds formats
- Seismic in XML and SEG-Y
- Templates, preferences and color scales from OpenFlow™
- Data exchange between OpenFlow Suite projects

DATABASE
- MySQL or Oracle database
- Improved data security and integrity, reduced data storage
- User and project administration

OTHER PLATFORM FACILITIES
- Colorscale & unit system management
- Remote machines or cluster simulation launcher
- Simulation monitoring
- Online & contextual Help

System Requirements

- **Operating Systems**:
  - Supported on Windows 10, Compatible with Windows 11
  - Linux Red Hat 7 and Red Hat 8 for calculators only (unavailable GUI)
- **RAM**: 48 Gb or more recommended, 32Gb minimum
- **Minimum free disk space**: 5 Gb (for installation files)
- **CPU**: x86-64 processors (Opteron, CoreDuo, Core2Duo, Xeon & EMT64, Nehalem, Westmere, Sandy Bridge, Core i3, i5, i7)
- **Dualcore or Quadcore**: 2 GHz or more recommended
- **Graphics board**: NVIDIA (except Quadro FX 1000, Quadro FX 3500, Quadro NVS 110 M, Quadro NVS 280 SD and NVS 300) with recent driver (at least OpenGL 3.3 -driver 330 or later)
- Openmotif rpm package must be installed on Linux
- **Database**: MySQL 5.5, 5.6.X (with X superior to 22), 5.7 or 8.0 and Oracle 12c, 18c or 19c
- FlexLM 11.16.2 server for licensing

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