TECHNICAL SPECIFICATIONS

DionisosFlow®

Stratigraphic Modeling

Software Presentation

DionisosFlow® is a 3D forward stratigraphic modeling software which aims at helping petroleum geologists to better quantify the architecture and distribution of sediments in siliciclastic, carbonate, and mixed environments, while also simulating the preservation of organic matter. DionisosFlow® applicability ranges from fluvial to deep offshore environments, at exploration and appraisal scales.

DionisosFlow®'s workflow offers the following key stages:

- Accommodation space definition through subsidence and sea level variations
- Sediment supply definition through:
  - fluvial input
  - in-situ marine or lacustrine carbonate production
  - marine and terrestrial organic matter production
- Diffusive transport and erosion laws definition
- Simulation & calibration
- Post-processing & facies definition

The main DionisosFlow® output is a 4D geometrical and facies model which allows a detailed 3D quantification of sedimentary units geometry (location, thickness, extension...) and of facies and source rock potential inside these units (sand/shale ratio, depositional bathymetry, slope, initial TOC/HI...). DionisosFlow® also provides a quantification of physical parameters such as subsidence and eustasy, sediment source location and intensity, water-charge and wave energy, which allows testing several geological assumptions.

Functionalities & Algorithms

MULTIPLE ENVIRONMENTS

- Clastics
- Carbonates
- Mixed

MODEL BUILDING FACILITIES

- Map creator & editor
- Easy data formatting
- Automated QC

EUSTASY VARIATION DEFINITION

- Definition of the evolution of the sea level through time
- Initialized with a Miller Curve or a Long Term or Short Term Haq curve
- Tuned through a User-defined curve

CLASTIC SEDIMENT SUPPLY

- Several sources around the model and through time
- Constrained by their supply and fluvial discharge
- Variation of the clastic input composition through time

CARBONATE PRODUCTION LAWS

- Function of a reference production through time, bathymetry, wave influence and ecology
- Integrated empirical carbonate production curves
- Seafloor and transported sediment content constraints
- Sea temperature and salinity constraints
- Carbonate dissolution and transformation into bioclasts
- Land derived nutrient supply constraint through tracers

MARINE ORGANIC MATTER ESTIMATION

- Primary production according to the distance to shore and/or upwelling
- Degradation in the water column with the oxygen content (Martin law)
- Nutrient supply from terrestrial domain through leaching of sediments, tracer river transport and ground water infiltration into the marine domain
- Transport through classic diffusive processes

TERRESTRIAL ORGANIC MATTER ESTIMATION

- Brought through the clastic sediment sources
- Transport through classic diffusive processes

EARLY DIAGENESIS MODELING

- Sensitivity to sediment and characteristic time for diagenesis processes
- Diagenetic potential available for diagenetic facies definition

EVAPORITIC MODELING

- Precipitation and dissolution of in situ elements
- Calculated sea water salinity and temperature

DIFFUSIVE TRANSPORT PROCESSES

- Linear & non-linear diffusive equations
- Automated calculation of diffusion coefficients based on grain size
- Depend on slope, water discharge and paleo-environment
- Low energy long term processes for slow gravity permanent fluvial transport
- High energy short term processes for hyperpycnites and fine turbidites

EROSION MODELING

- Uniform erosion law for continental environment
- Lithology-dependent erosion law for both continental and marine environments
- Advanced erosion law integrating uniform or water weathering (erosion is a function of water discharge)

WAVES IMPACT

- Definition of several waves characterized by energy, speed, frequency, and height
- Variation of the wave energy with depth and time
- Wave propagation following Snell's law

CLIMATIC CYCLES

- Creation of cyclic phenomenon
- Impact on supply, fluvial discharge and carbonate production and organic matter primary production

STRUCTURAL FEATURES

- Subsidence
- Salt diapirism
- Flexure

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COMPACTION
- Empirical or user-defined porosity-depth laws
- Compatibility with basin simulators

LACUSTRINE SYSTEMS
- Estimation of lake levels alongside with sea level variation
- Balancing rain falls and evaporation
- Carbonate production within lakes

PARALLELIZED AND REMOTE SIMULATIONS
- Parallelization on several processors
- Simulation on remote machines or clusters

SENSITIVITY & RISK ANALYSIS
- Based on an experimental design methodology (linear, quadratic, Latin hypercube, user defined...)
- Parametric or non-parametric response surface models
- Analysis on scalars, pseudo-wells, maps, and objective functions
- Global Sensitivity Analysis to determine the contribution of uncertain parameters on an output property
- Propagation to determine the range of possible values for a property given some uncertain inputs (P10, P50, P90)

ASSISTED CALIBRATION
- Definition of an objective function per well and sequences
- Optimization through a gradient descent or probabilistic approach algorithm

INTEGRATED LINK TO TEMISFLOW®
- Automated extraction of sequences information to populate a basin model
- Automated conversion of DionisosFlow® model to TemisFlow® model

Results Analysis

OUTPUT STRATIGRAPHIC PROPERTIES
- Sediment Proportion
- Paleobathymetry
- Thickness
- Sedimentation Rate
- Slope
- Water Flow
- Exposure Time
- Ground Water Properties
- Drift Current Energy
- Porosity
- Lake Level
- Sediment Turbidity Indicator
- Initial TOC/HI
- Dysoxic/anoxic conditions
- Tracer Properties
- Diagenetic Reactivity

FACIES DISTRIBUTION
- Facies definition according to sediment ratios, bathymetry and other output properties
- Facies distribution maps extractions
- Reservoir and source rocks location and extension

SYNTHETIC SEISMIC GENERATION
- 1D convolution between the impedance vertical variation and a seismic wavelet (Ricker)
- Outputs: seismic amplitude, seismic velocities, and impedance

BUNCH OF VISUALIZATION TOOLS
- 3D Viewer (with Wheeler mode)
- Cross Section Editor
- Map Viewer
- Log Viewer
- Cross Plot Viewer
- Statistics Viewer

DATA EXTRACTION & CALIBRATION
- Map extractions
- Well extractions
- Burial analysis
- Section extractions
- Time markers management
- Pseudo-simulation
- Automatic comparison with observed data
- Automatic error maps computation
- Automatic NTG maps computation
- Automatic downscaled grid generation for reservoir scale

FILTERING & REPORTING
- Filtering capabilities on simulated output
- Synchronization between views
- Statistics on areas of interest

Data Management

DATA IMPORT/EXPORT
- Dionisos 4.2 & 4.93 projects and results (*.pro, *.sav)
- Horizons in ASCII cloud of points, CPS3 ASCII and binary, Fraca, GMap, gOcad TSurf and Z-Map+
- Property maps in ASCII cloud of points, CPS3 ASCII and binary, Fraca, GMap and Z-Map+
- 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
- Faults in CPS3 ASCII and binary, Fraca, EarthVision, gOcad TSurf and Z-Map+
- Lithology and geochemical libraries in .xml and .ltds formats
- Seismic in XML and SEG-Y
- 3D Grids in GRDECL Eclipse and RESQML formats
- Templates, preferences and color scales from OpenFlow™
- Groovy scripts and packages
- 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 simulation launcher
- Simulation monitoring
- Online & contextual Help
- Integrated mini-tutorials on clastic and carbonate environments

Extensions & Customization

- Direct link with TemisFlow® for basin modeling
- Direct link with CougarFlow® for uncertainty analysis and optimization
- Petrel link for direct maps, wells and grids exchange
- DSIS link for direct maps and wells exchange
- Scripting facility based upon Groovy language

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, 38Gb 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

Beicip-Franlab Headquarters
232, avenue Napoléon Bonaparte
92500 Rueil-Malmaison - France
Tel.: 33 1 47 08 80 00
Email:info@beicip.com

BeicipFranlab
An IFP group company