Geophysical Research Abstracts
Vol. 17, EGU2015-8292, 2015
EGU General Assembly 2015

Building a geological reference platform using sequence stratigraphy combined with geostatistical tools

Bernard BOURGINE (1), Éric LASSEUR (1), Aurélien LEYNET (1), Guillaume BADINIER (1), Carole ORTEGA (1), Benoit ISSAUTIER (1), and Valentin BOUCHET (2)

(1) BRGM, Georessource Division, Orléans, France (b.bourgine@brgm.fr), (2) ISTO - Orléans, France

In 2012 BRGM launched an extensive program to build the new French Geological Reference platform (RGF). Among the objectives of this program is to provide the public with validated, reliable and 3D-consistent geological data, with estimation of uncertainty. Approx. 100,000 boreholes over the whole French national territory provide a preliminary interpretation in terms of depths of main geological interfaces, but with an unchecked, unknown and often low reliability. The aim of this paper is to present the procedure that has been tested on two areas in France, in order to validate (or not) these boreholes, with the aim of being generalized as much as possible to the nearly 100,000 boreholes waiting for validation. The approach is based on the following steps, and includes the management of uncertainty at different steps:

(a) Selection of a loose network of boreholes owning a logging or coring information enabling a reliable interpretation. This first interpretation is based on the correlation of well log data and allows defining 3D sequence stratigraphic framework identifying isochronous surfaces. A litho-stratigraphic interpretation is also performed. Be “A” the collection of all boreholes used for this step (typically 3 % of the total number of holes to be validated) and “B” the other boreholes to validate,

(b) Geostatistical analysis of characteristic geological interfaces. The analysis is carried out firstly on the “A” type data (to validate the variogram model), then on the “B” type data and at last on “B” knowing “A”. It is based on cross-validation tests and evaluation of the uncertainty associated to each geological interface. In this step, we take into account inequality constraints provided by boreholes that do not intersect all interfaces, as well as the “litho-stratigraphic pile” defining the formations and their relationships (depositing surfaces or erosion). The goal is to identify quickly and semi-automatically potential errors among the data, up to the geologist to check and correct the anomalies,

(c) Consistency tests are also used to verify the appropriateness of interpretations towards other constraints (geological map, maximal formation extension limits, digital terrain model ...),

(d) Construction of a 3D geological model from “A”+ “B” boreholes: continuous surfaces representation makes it possible to assess the overall consistency and to validate or invalidate interpretations. Standard-deviation maps allow visualizing areas where data from available but not yet validated boreholes could be added to reduce uncertainty. Maps of absolute or relative errors help to quantify and visualize model uncertainty.

This procedure helps to quickly identify the main errors in the data. It guarantees rationalization, reproducibility and traceability of the various stages of validation. Automation aspect is obviously important when it comes to dealing with datasets that can contain tens of thousands of surveys. For this, specific tools have been developed by BRGM (GDM/ MultiLayer software, R scripts, GIS tools).