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HYPE: a WFD tool for the identification of significant and sustained upward trends in groundwater time series

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The Water Framework Directive 2006/11/CE (WFD) on the protection of groundwater against pollution and deterioration asks Member States to identify significant and sustained upward trends in all bodies or groups of bodies of groundwater that are characterised as being at risk in accordance with Annex II to Directive 2000/60/EC. The Directive indicates that the procedure for the identification of significant and sustained upward trends must be based on a statistical method. Moreover, for significant increases of concentrations of pollutants, trend reversals are identified as being necessary. This means to be able to identify significant trend reversals.

A specific tool, named HYPE, has been developed in order to help stakeholders working on groundwater trend assessment. The R encoded tool HYPE provides statistical analysis of groundwater time series. It follows several studies on the relevancy of the use of statistical tests on groundwater data series (Lopez et al., 2011) and other case studies on the thematic (Bourgine et al., 2012). It integrates the most powerful and robust statistical tests for hydrogeological applications.
HYPE is linked to the French national database on groundwater data (ADES). So monitoring data gathered by the Water Agencies can be directly processed. HYPE has two main modules:
- a characterisation module, which allows to visualize time series. HYPE calculates the main statistical characteristics and provides graphical representations;
- a trend module, which identifies significant breaks, trends and trend reversals in time series, providing result table and graphical representation (cf figure).
Additional modules are also implemented to identify regional and seasonal trends and to sample time series in a relevant way.

HYPE has been used successfully in 2012 by the French Water Agencies to satisfy requirements of the WFD, concerning characterization of groundwater bodies' qualitative status and evaluation of the risk of non-achievement of good status.

Bourgine B. et al. 2012, Ninth International Geostatistics Congress, Oslo, Norway June 11 – 15.
Lopez B. et al. 2011, Final Report BRGM/RP-59515-FR. 166p.