A new approach in skin effect and storativity estimation from pumping test data with low pumping rates

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Pumping test are supposed to be one of the best ways of determining hydraulic parameters of examined aquifer. However, there are many other effects which control measured drawdown in a wellbore. One of the major effects is well clogging and well storage. Well clogging (also called skin effect (van Everdingen 1953)) causes additional drawdown in the well and well storage (Papadopulos & Cooper 1967) causes distortion of data in the first part of pumping test. The author shows that both these effects can be estimated from measured drawdown when two special approaches are used – first, the drawdown must be measured at very short intervals (0.5–1.0 second), and second, the pumping rates must be rather low, so the examined aquifer is not stressed enough (the drawdown in the aquifer is very small) and the skin effect/well storage influence is more significant in this case. This approach also eneables the interpreter to estimate more exact storativity coefficient, because evaluation of skin effect leads to better wellbore screen hydraulic losses estimation. Hydraulic losses caused by wellbore skin leads to the shift of Jacob's line (Cooper & Jacob 1946) which is connected with storativity misinterpretation. A formula for eliminating this problem is also presented. Using this formula can help to estimate storativity coefficient by using measured data from pumped well. Drawdown measured in pumped well is rarely used for storativity interpretation precisely because of wellbore clogging. The formula partly eliminates that problem. In the end, application of presented approach is shown on several pumping test conducted in very permeable sand – gravel quaternary sediments of the Jizera River and the Elbe River. The pumping tests are first interpreted by casual methods – Theis (1935) and/or Moench (1997) – and then the new presented method is used. It is shown that closer to real values of storativity are gained when the newly derived formula is taken into account.

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