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Reply on CC1

Georg J. Houben and Okke Batelaan

Author comment on "The Thiem team – Adolf and Günther Thiem, two forefathers of hydrogeology" by Georg J. Houben and Okke Batelaan, Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-427-AC3>, 2022

RESPONSE

An excellent paper, which reveals and inspires.

Response: Thank you very much for your kind words

a) New historical facts and Thiems' papers (in German) in subsurface mechanics, commingled with the history of science- hydrologic engineering in Europe, are super-interesting. In particular, I was amazed to learn about the "battle of ideas", related to the Darcy law and its applications to groundwater hydrology- well hydraulics. Before reading this review, I had a misconception that this law is a mathematically derived approximation, which followed from a relation between the hydraulic gradient and Darcian velocity.

Response: indeed, several laws were proposed to describe the flow of water in porous media at the end of the 18th and the beginning of the 20th century. The empirically derived Darcy law, which turned out to be the most adequate one, was luckily one of the earliest and thus dominated from early on. Only much later was its validity shown mathematically.

Darcy himself had already noticed that his law is not valid for very high gradients (or flow velocities) but had correctly assessed that this would be almost irrelevant for standard conditions in aquifers. Later authors, like Smreker added this missing velocity component, but overestimated its importance and considered the Darcy law to be utterly useless, which it - of course - is not. Ironically, the problem had already been solved by Forchheimer in his seminal 1901 paper, who had expanded the Darcy law to the Forchheimer law. This approach expanded the limits of the Darcy law, while retaining its core character. The Thiem-Smreker controversy was almost exclusively fought on in the German speaking world. It would be interesting to see whether Darcy also met opposition from authors outside of Germany.

b) The fate of the Thiems is tragic. In the Nietzschean sense: around the hero everything turns into a tragedy. The tragedy of oblivion of the Thiem's legacy is now converted by HESS into revelation. How? By meticulous revisiting Thiems' work. And by the spirit of the authors, viz. Houben and Batelaan. Scientific texts are forced to be written distilled, viz. "neither hot nor cold". In the Houben-Batelaan paper, I feel that they heard the

message of the Angel of Laodicea.

Response: thank you for this literary assesment. It is indeed a bit tragic to see that several methods the Thiems devised or pioneered do not bear their names, with the exception of the Dupuit-Thiem law. It was the intention of our manuscript to raise awareness of their contributions. But the best legacy for these methods is that they are still being used today! They have stood the test of time!