Hydrol. Earth Syst. Sci. Discuss., 7, C1093–C1097, 2010
www.hydrol-earth-syst-sci-discuss.net/7/C1093/2010/

Hydrology and Earth System Sciences Discussions

Interactive comment on "A geophysical analysis of hydro-geomorphic controls within a headwater wetland in a granitic landscape, through ERI and IP" *by* E. S. Riddell et al.

Anonymous Referee #3

Received and published: 9 June 2010

The paper of Riddle et al. is an interesting study, with high relevance for the audience of HESS. By linking geophysical methods and hydrological measurements the authors investigate geomorphologic subsurface processes and structures in a wetland area, South Africa. The geophysical methods of electric resistivity tomography and induced polarisation in 2D and 3D mode were combined with data of different piezometeres. The quality of the text is excellent except the case of too long sentences as reviewer 2 has already mentioned. The organisation is good except for the results and discussions part. Chapter 4.2 is a mixture of results of 3D and overall discussion. A reorganisation of that part would be helpful into two different chapters 4.2 Results 3D and 5 Discus-

sions. The authors should give additional information of transects soil types, texture and vegetation cover in chapter 2. Could be the information of vegetation coverage an additional explanatory variable for geomorphologic structures as Lindenmaier et al. (2005) have presented? The source of the clay plugs needs more explanation to prevent the reader from misunderstanding about illuvation processes through the sand and the weathering product of dykes. The auger samples and the 3D IP measurement must be discussed in more detail. How good is the quality of the IP to detect the clay, what is the error rang. In chapter 4.2 it is instanced that validation was successful but without quantification.

Most of the figures are of low quality and need some improvements.

The consistence between Figure and Fig. has to be checked.

I suggest the paper could be published in HESS after the revision.

Page 1976 Line 13: Several other authors have focused on that topic and should be cited like Slater and Lesmes, 2002 and Slater and Reeves, 2002.

Page 1978 Line 8: Can you shortly specify the vegetation type “Lowveld” and which dominant plants were represented by it. The mean temperature at the study side would be interesting to make a general classification. The authors should focus on the description of their study area and not on the complete catchment.

Page 1978, Line 12: The study focuses only on the head catchment, and for that the decreasing precipitation is unimportant and can be left.

Page 1978 Line 13: The authors should although explain which geology are the possible sources of clay and could give a first link to the important illuvation process. Here would be a good place to explain the dominant soil types.

Page 1979, Line 12-14: A wetness measure of transects would be important to know how comparable the data sets are. Please give a measure of the mean water content as a quality measure how comparable the wetness conditions of transects are. Pleas

HESSD

7, C1093–C1097, 2010

add information about 3D-ERI in the table.

Page 1982-1983: Can you give information about the landuse and vegetation differences of the surface? Is vegetation explaining anything? In Fig. 4 is the structure at -60 m a drainage ditch? Which part is under agricultural usage which not.

Page 1983 Line 3-11: In the transects of Fig. 5 and 6 the doleritic dyke is of importance, would be a geological map of the locations of granite and dykes improve the understanding of that problematic? Or can the authors present ground truth data about the position of the dykes possibly in the inverted profiles.

Page 1983 Line 18-23: The authors discuss here that the measured hydrological response could be linked to geology and pedology. It would be interesting to present that with the valuable data and not only by citing an internal report of the authors themselves. The sentence is too long.

Page 1984, Line 1-3: Again the sentence is too long. Is the practice of “ridge and furrow systems” going down to a depth of 3-4 m? That is quite deep for agricultural practices. Is the area drained? Additional data of landuse would be important to interpret that profile. Page 1984 Line 20: Fig. 8 instead of Figure 8. Details about the location of the rain gauge and its position are missing and should be integrated into Fig. 2.

Page 1984 Line 20-29: The authors discuss only the 3 main piezometeres. They have also to discuss the differences in the piezometeres type 2000 mm and 4000 mm.

Page 1985, Line 12-13: The sentence is not clear. Do the authors mean close to the origin?

Page 1988, 23-28: Quantity of the relationship between K and resistivity and chargeability would be helpful.

Page 1989-1990 The consistent use of the terms elluviation and illuviation have to be checked.

HESSD

7, C1093–C1097, 2010

Page 1990: The description of soils should be moved into chapter 2.

Page 1992, 5-19: The authors should also discuss the uncertainty of the inverted profiles and the importance of ground truth data.

Table1: A general measure of the wetness conditions would be interesting like the antecedent precipitation index to have an idea how important the influence of soil moisture is and how comparable the transects are.

Figure 1 and 2: The figures can be combined to one. The focus of the figure should be more on the experimental side and not on the orthophotograph of the catchment can be neglected. T1_3, T2_2_T2_3 and MP1 are on the first view not clear. Pleas explain the piezometer nomenclature in the figure's description. A simpler nomenclature would be better. Transect 1 and 2 are not distinguishable. By switching between the different profiles Fig. 2 should be the central figure to guide the reader through the different profiles. Numbering of the profiles (2D and 3D) would be helpful.

Figure 4-7: Is it possible to integrate into the ERI profiles the position of the piezometers and ground truth data points if there were some in a similar way as the authors have done in Riddell et al. (2007). Explain Wenner short long and Schlumberger short. A consistent colour bar would make the interpretation much easier.

Figure 8: Please explain the name convention of the piezometers length units. The authors should deliver a better quality. It is hard to distinguish between T1_3 2000 mm and T2_2 4000 mm.

Figure 15: Pleas add the depth of the horizons/layers and the soil type for the head cut and explain in the figure description the depth of the samples A to H. Each figure should be self-explanatory.

Figure 16: The plots of hydraulic conductivity look too smooth for view measurements. How many measurements were performed in each piezometer? A scatter plot of K versus chargeability and resistivity would make the comparison easier. What is the

HESSD

7, C1093–C1097, 2010

correlation coefficient?

References:

Lindenmayer, F., Zehe, E., Dittfurth, A., Ihringer, J.: Process identification at a slow-moving landslide in the Vorarlberg Alps, Hydrological Processes 19, 1635-1651, 2005.

Riddell, E. S., Lorentz, S. A., Ellery, W. N., Kotze, D., Pretorius J. J., and Nketar, S. N.: Water Table Dynamics of a Severely Eroded Wetland System, Prior to Rehabilitation, Sand River Catchment, South Africa, Proceedings of the XXXV IAH Congress on Groundwater and 30 Ecosystems, 17–21 September, Lisbon, Portugal, 2007.

Slater, L.D., and Lesmes, D.: IP interpretation in environmental investigations, GEOPHYSICS, 67(1); 77-88, 2002.

Slater, L.D. and Reeve, A.: Investigating peatland stratigraphy and hydrogeology using integrated electrical geophysics, GEOPHYSICS, 67(2); 365-378, 2002.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 1973, 2010.