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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.

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Anonymous Referee #2

Anonymous referee #2, the authors are grateful for your positive review. Technical corrections will be applied to the final manuscript.

Addressing specific comments:

1) 2-D readings were conducted as once-off measurements, however the late winter (dry season March-October/November) period was preferred as soil moisture contents

were at their minimum and therefore variability in electrical resistivity measurements were assumed to have been minimally affected by soil moisture content. This information has been added to the text on p1975.

2) This information and its reference is probably not pertinent to the study and has been removed from the manuscript, the description of the wetlands position at the foothills of the southern African escarpment should suffice for the reader.

3) Prior to the complete data inversion the raw electrical resistivity data was assessed for its quality according to the methods of Loke (2004), where bad data points are removed from a preliminary inversion array according to high RMS error, and are therefore excluded from the final data inversion process. This is now discussed in Section 3.1 Overall approach and reiterated in Section 3.2 3-D approach.

4) Re-worded: Since it is known that the dominant geology of the catchment is granitic, the associated resistivity ranges for this bedrock type are used for ERI interpretation based on geological resistivity ranges provided by Sharma (2008).

5) The hydrometry nomenclature has been updated along with sketch-map (Fig 1. attached) Included a new table, Table 2 (Fig 2 attached) which include mean monthly measures of soil moisture tension, shallow groundwater levels, soil texture (Fig. 3 attached) and an antecedent precipitation index using method of Kohler et al., 1951 (Fig 4 attached) for the months of October to November 2006 – as also suggested by Anonymous Referee #3. A sentence describing this has been added to the methods in section 3.3.

Despite the mechanical alteration of the wetland substrate through subsistence farming, very little to no agricultural inputs organic or inorganic are applied to these fields, in fact these fields are frequently burnt to burn off vegetation. This area of the wetland had in fact remained fallow for at least 1 year prior to these investigations – but the effects of substrate dis-aggregation by the large scale redistribution of sediments to create ridge and furrow systems will certainly have caused this significant difference in conductivity.

The impact of inputs and nutrient storage was not considered when investigating the ERI images as it was assumed to be negligible at the scale of interest.

6) Yes, the resistivity and IP data originate from the 4 point measurements and not from the inverted pseudosection. The sentence has been adjusted accordingly.

References:

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

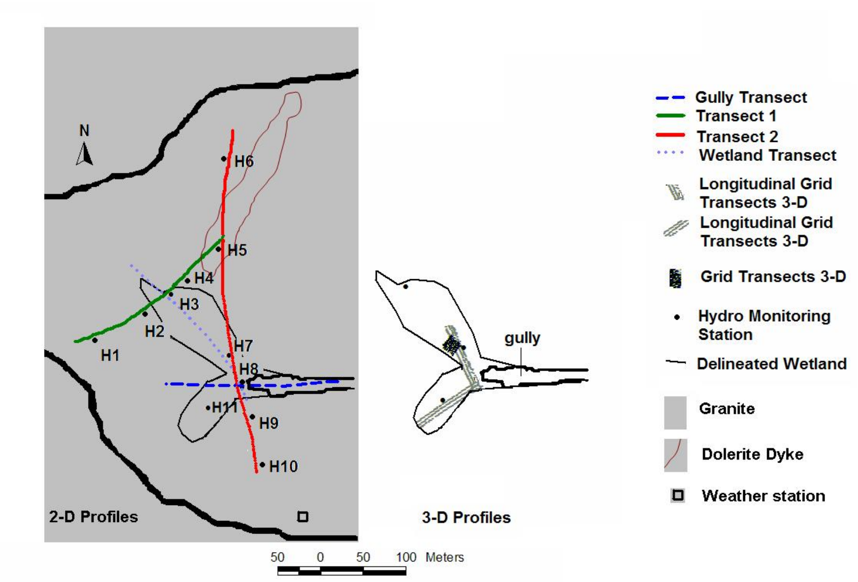


Fig. 1.

	October 2006			0.3	0.6	2	2	4	6
							Sensor Depth (m)		
	Slope Element[+]	SA Soil Form*	WRB[#]	Soil Moisture Tension (m)			Shallow Groundwater level (m)		
H5	Backslope	Oakleaf	Regosol	3.39	4.11	3.22			None. obs.
H6	Shoulder	Glenrosa	Leptosol	15.20	87.80	10.31		None. obs.	
H7	Toeslope (wetland)	Katspruit	Gleysol		4.61	0.41	-2.81	-4.40	
H8	Toeslope (wetland)	Kroonstad	Planosol			3.05	-4.52		
H9	Foot-slope	Oakleaf	Regosol			3.92	None. obs.		None. obs.
H10	Backslope	Oakleaf	Regosol	8.72	25.54	18.26			
	November 2006								
H1	Backslope	Glenrosa	Leptosol	3.00	5.50	4.53		None. obs.	
H2	Foot-slope	Kroonstad	Planosol	0.41	0.63	-0.24	None. obs.		None. obs.
H3	Toeslope (wetland)	Katspruit	Gleysol		1.21	0.31	-2.20		
H4	Foot-slope	Kroonstad	Planosol	2.22		2.02	-5.32		
H5	Backslope	Oakleaf	Regosol	1.38	1.17	4.49			None. obs.
H6	Shoulder	Glenrosa	Leptosol	1.60	4.14	9.45		None. obs.	

[+]Slope Element based on classification by Ruhe (1960)

[*]South African Soil Form classification by Soil Classification Working Group (1991)

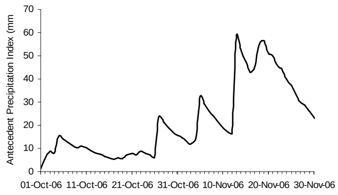
[#] World Reference Base soil classification, FAO (1998)

Fig. 2.

	Horizon	Depth (m)	Texture[×]		Horizon	Depth (m)	Texture[×]
H1	A	0-0.2	sandy loam - sandy clay loam	H6	A	0-0.4	sandy loam
	B	0.2-1.2	sandy clay loam		B	0.4-1.4	sandy clay loam
H2	A	0-0.4	sandy clay loam	H7	A	0-0.4	sandy loam - sandy clay loam
	G	0.4-1.0	clay		E	0.4-0.9	sandy clay loam
H3	A	0-0.3	sandy loam - sandy clay loam		G	0.9-1.7	clay loam
	G	0.3-0.4	clay loam	H8	A	0-0.2	sandy loam - sandy clay loam
	G	0.4-0.7	clay - clay loam		B	0.2-0.8	sandy loam - sandy clay loam
	G	0.7-1.3	clay - clay loam		B	0.8-1.0	sandy clay loam
	G	1.3-1.5	clay		B	1.0-1.9	sandy clay loam
	G	1.5-2.0	clay - clay loam	H9	A	0-0.1	sandy loam - sandy clay loam
H4	A	0-0.3	sandy loam		B	0.1-0.6	sandy clay loam
	E	0.3-0.6	clay loam		B	0.6-1.0	sandy clay
	E	0.6-1.1	clay - clay loam		B	1.0-1.7	clay loam
	G	1.1-1.7	clay	H10	A	0-0.3	sandy clay loam
H5	A	0-0.2	sandy loam		B	0.3-1.1	sandy clay loam
	B	0.2-0.6	sandy clay loam		C	1.1-1.7	clay loam
	B	0.6-1.4	sandy clay loam				
	B	1.4-2.0	clay - clay loam				

[×] United States Department of Agriculture

Fig. 3.



Antecedent Precipitation Index (mm
70
60
50
40
30
20
10
0
01-Oct-06
11-Oct-06
21-Oct-06
31-Oct-06
10-Nov-06
20-Nov-06
30-Nov-06

Fig. 4.