Updating the soil map of Réunion island: Methodology and problems to be overcome

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When old soil maps are updated to answer present environmental concerns, many problems of interpretation can appear. The assessment of the groundwater vulnerability on the western slope of la Réunion Island (Indian Ocean) led us to review and evaluate the available data on soils. At the end of this census, the critical analysis of the existing soil maps and data showed that they were not directly utilizable for our study and that was primarily due to pedological concepts and associated classifications which are no more used (old French classification, CPCS) on the one hand, and to the lack of georeferenced data on the other. We therefore carried out a new soil survey of our study area covering 428 km^2 (ca. 20 % of the total island area; Figure 1). We identified 30 types of soils corresponding to subdivisions of the reference groups (RSGs) of the WRB, which we have grouped into fourteen pedopaysages (Figure 2).

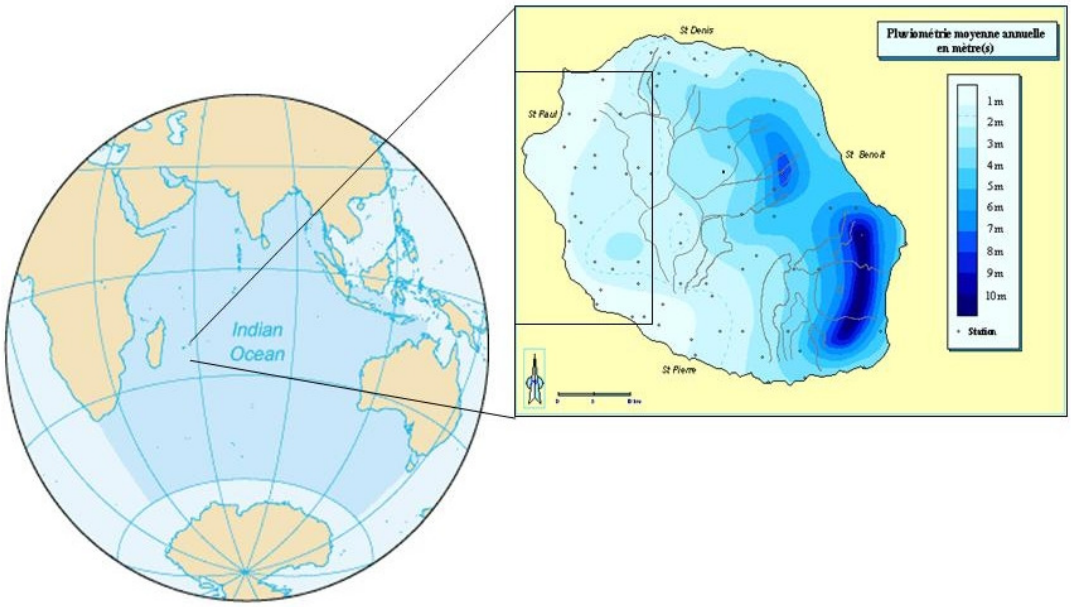

Figure 1. Localisation of Réunion island (Indian Ocean) and the studied area on the western slope of Piton des Neiges.

The upper part of the slope is marked, from the top to about 900 m, by the process of andosolization. The process of podzolization is superimposed on it under forest between 1600 and 1800 m. The remaining part of the slope is characterized by large organic matter contents, decreasing downwards (Table 1). The degree of saturation of the soil exchange capacity makes it possible to distinguish a mid-altitude zone, where Umbrisols dominate, from a lower zone, with Phaeozems and associated soils. To each altitudinal section thus corresponds a well developed type of soil associated with an incompletely developed type (Cambisol) presenting the same pedogenic tendency (Figure 2).

Recent changes in the knowledge and classification of the soils developed on volcanic materials under topical climate, as well as progress in the dating of the volcanic events explain both the fast obsolescence of the old soil maps in the case presented here (Table 2). Some of the problems encountered during this study will probably again arise during the completion of the soil map of la Réunion island (the regional computerized soil data base) and possibly for those of other overseas French territories.

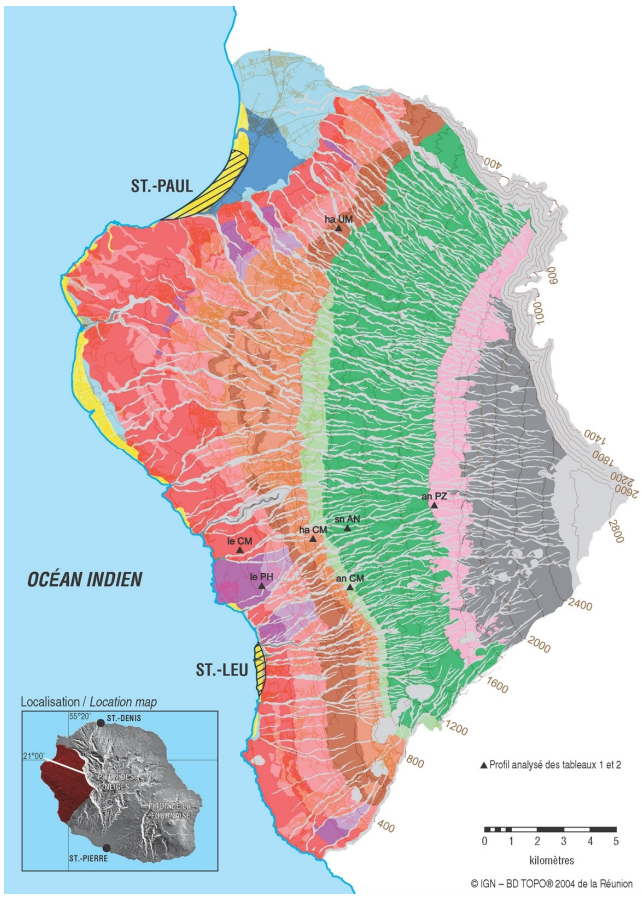

Figure 2. The new soil map.

Table 1. general properties of selected pedon: andic Podzol, 1630 m ; silandic Andosol, 1110 m ; haplic Umbrisol, 640 m ; andic Cambisol, 1064 m ; haplic Cambisol, 830 m ; leptic Cambisol, 131 m ; leptic Phaeozem, 262 m.

Catena	pH eau	pH KCl	$C_{org.}$ g/kg	$N_{tot.}$ g/kg	CEC cmol/kg	TS [a] %	Color Munsell
Andic Podzol (1630 m)							
0 – 5/20 cm	4.5	3.6	144	10.8	45.2	5	7.5 YR 3/4
5/10 – 10/30 cm	4.4	3.3	67	4.0	23.8	4	2.5 YR 5/1
10/30 – 20/30 cm	4.3	3.5	141	9.9	52.3	3	5 YR 3/2
20/30 – 70 cm	4.7	4.6	103	5.3	53.5	1	10 YR 4/4
70 – 135 cm	5.1	5.3	19	1.2	26.9	1	10 YR 4/6
Silandic Andosol (1110 m)							
0 – 7/15 cm	6.3	5.3	139	11.4	57.5	30	7.5 YR 3/2
7/15 – 40/50 cm	5.9	5.4	66	3.7	42.8	9	10 YR 4/4
40/50 –130/140 cm	5.4	5.8	16	1.0	22.2	3	7.5 YR 4/4
Andic Cambisol (1064 m)							
0 – 35 cm	5.1	4.5	40	4.4	36.1	24	10 YR 3/4
35 – 95 cm	5.7	5.2	11	0.9	28.6	18	7.5YR43
95 – 135 cm	5.3	4.7	8	0.6	35.7	11	10 YR 4/3
Haplic Cambisol (830 m)							
0 – 40 cm	5.4	4.7	31	3	28.1	19	7.5 YR 4/3
40 – 75 cm	6.0	5.0	29	3.3	25	34	7.5 YR 4/4
75 – 215 cm	6.0	5.6	12	1.1	24	19	7.5 YR 4/4
Haplic Umbrisol (640 m)							
0 – 30 cm	5.2	4.8	31	3.1	26.0	29	10 YR 3/2
30 – 80 cm	5.3	4.8	25	2.7	25.8	28	7.5 YR 3/2
80 – 150 cm	5.7	6.7	6	0.6	24.2	31	10 YR 3/3
Leptic Phaeozem (262 m)							
0 – 50 cm	6.9	6.0	25	2.4	22.7	85	7.5 YR 3/2
Leptic Cambisol (131 m)							
0 – 15 cm	6.6	5.3	20	1.6	26.1	85	5 YR 3/4
15 – 40 cm	7.2	5.8	4	0.4	36.3	76	2.5 YR 3/4
40 – 85 cm	7.1	5.6	2	0.2	36.5	75	2.5 YR 3/6

Table 2. Synthetic comparison of the pedological studies realized on the study area. Used prefix : vi (vitric), an (andic), sn (silandic), ha (haplic), le (leptic). Used Reference Soil Group: AN (Andosols), PZ (Podzols), UM (Umbrisols), CM (Cambisols), PH (Phaeozems).

Altitude (m)	Riquier (1960)	Zebrowski (1975)	Raunet (1988)	Cette étude (2009)
1850 et +	Sols ferrallitiques beiges organiques et sols à mascareignite, lithosols organiques	Podzols	Affleurements et Andosols vitriques	vi AN
1800 - 1850				
1750 - 1800			Andosols désaturés à mascareignite	an PZ
1700 - 1750				
1650 - 1700				
1600 - 1650				
1550 - 1600	Sols ferrallitiques beiges		Andosols désaturés perhydratés	sn AN
1500 - 1550		Andosols		
1450 - 1500				
1400 - 1450				
1350 - 1400				
1300 - 1350				
1250 - 1300				
1200 - 1250			Andosols désaturés	
1150 - 1200				
1100 - 1150				
1050 - 1100				
1000 - 1050				sn AN, an UM et an CM
950 - 1000				
900 - 950				
850 - 900	Sols ferrallitiques bruns et sols ferrallitiques brun-rouges	Sols ferrallitiques andiques		ha UM et ha CM
800 - 850				
750 - 800				
700 - 750				
650 - 700			Sols bruns andiques	
600 - 650		Sols ferrallitiques		
550 - 600				
500 - 550				
450 - 500				ha PH et le CM
400 - 450			Sols bruns et affleurements	
350 - 400	Lithosols			
300 - 350		(no data)	Sols bruns ferruginisés	le PH et le CM
250 - 300				
200 - 250				
150 - 200				
100 - 150				
50 - 100				
0 - 50			Sols vertiques et affleurements	