Monitoring of Dutch peat soils and the EUROPEAT project

Jan J.H. van den Akker

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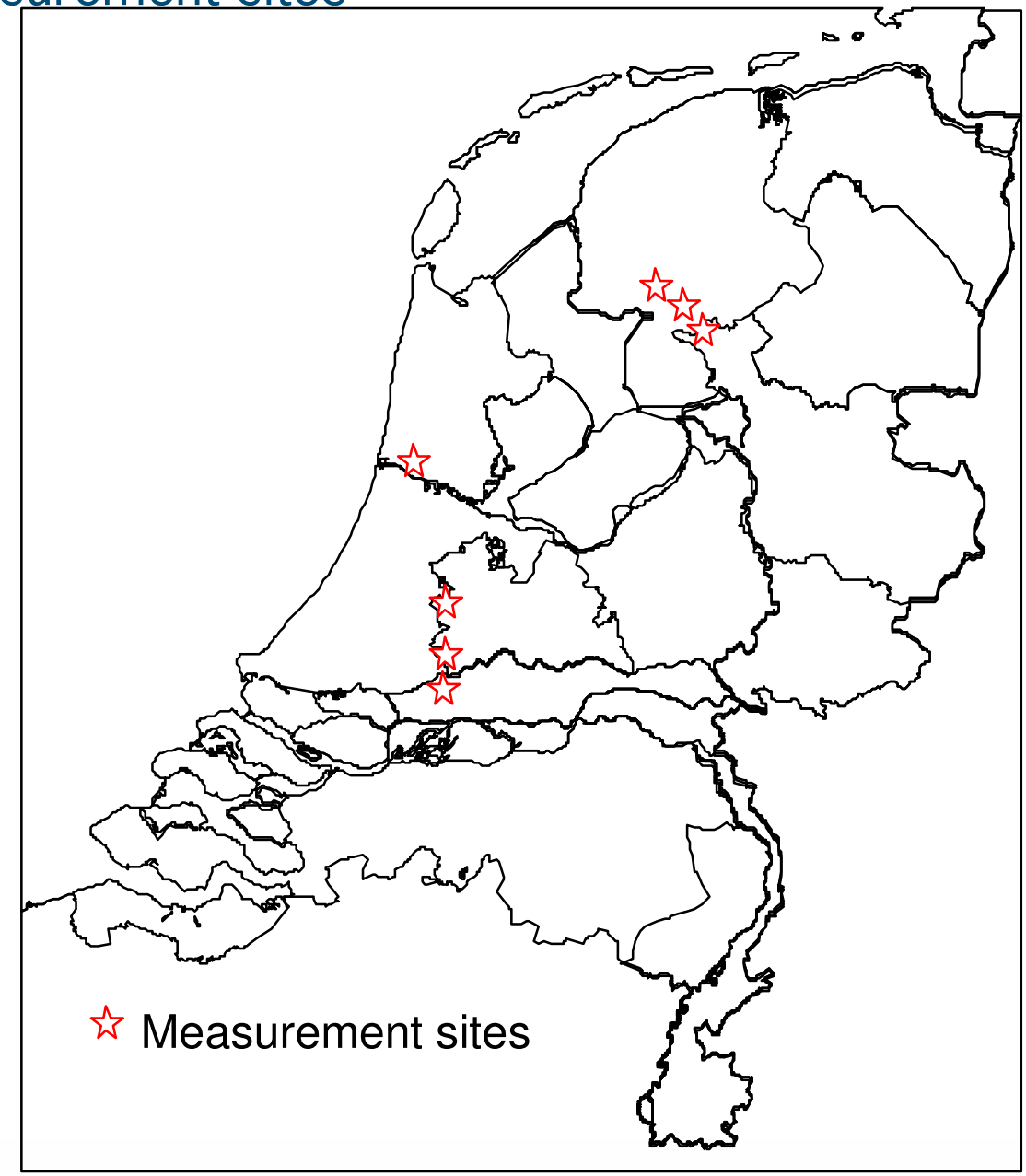
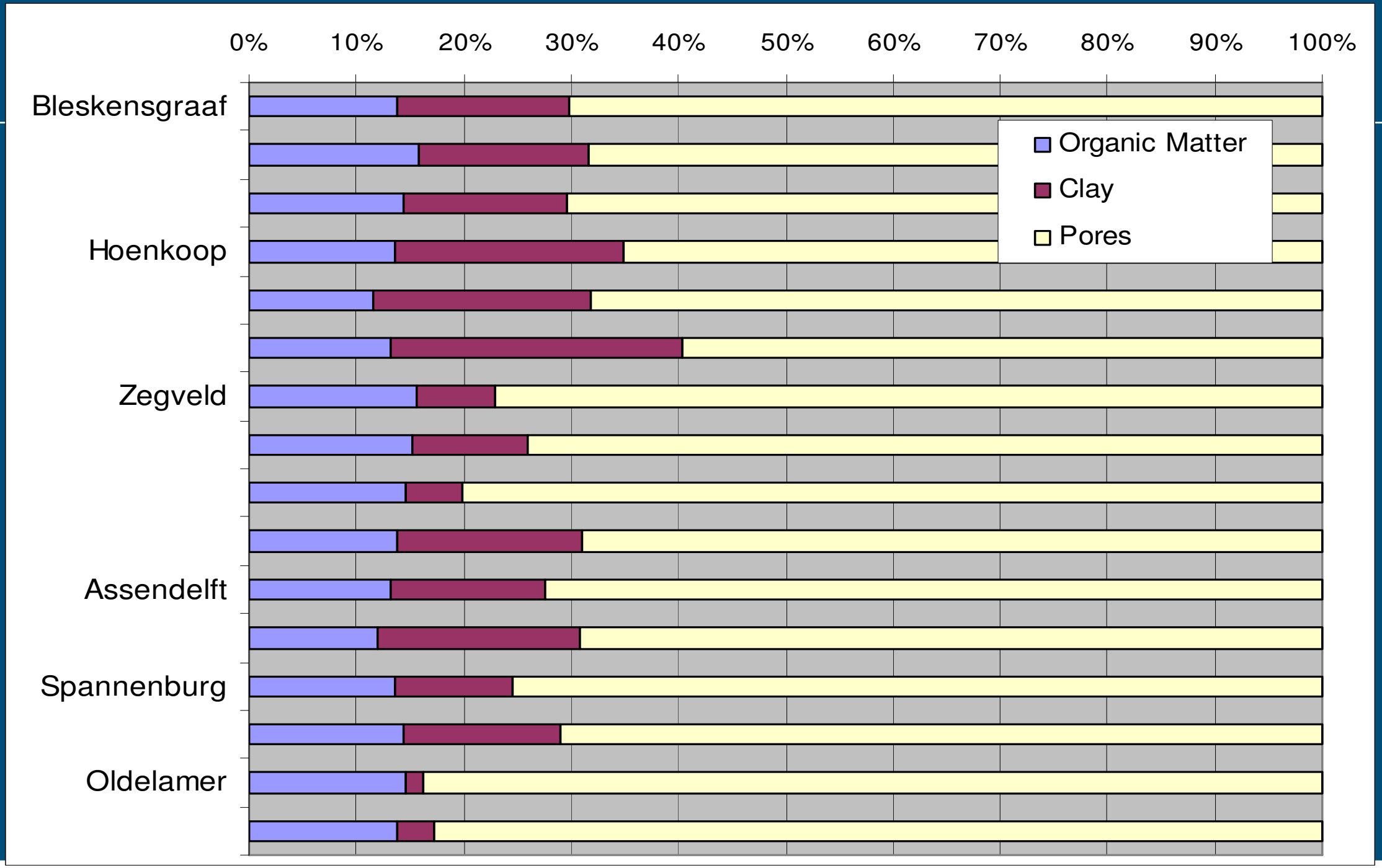
Problem: Degradation of peat soils by oxidation

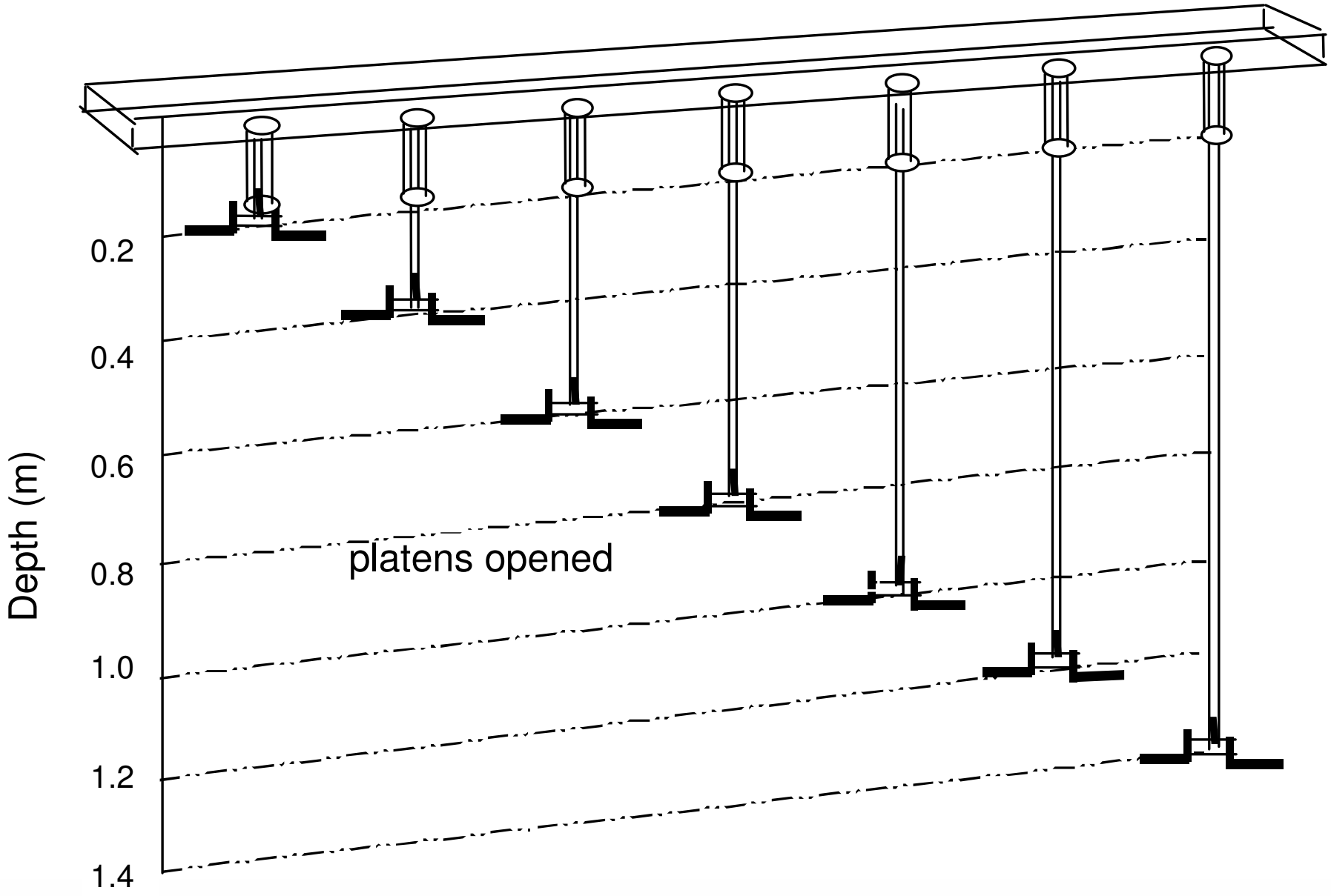
- Subsidence (NL: 0 – 2.5 cm per year)
- Damage to buildings and infra structure
- Increasing costs of water management
- Drainage of nature reserves to lowered agricultural land
- Water polution
- Green House Gas emissions (NL: 2 – 3 % total CO_2)
- Loss of peat soils (NL: 2 % per year)

Polders with measurement sites




0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Bleskensgraaf
Hoenkoop
Zegveld
Assendelft
Spannenburg
Oldelamer
Organic Matter
Clay
Pores

Measurement of subsidence at 7 depths



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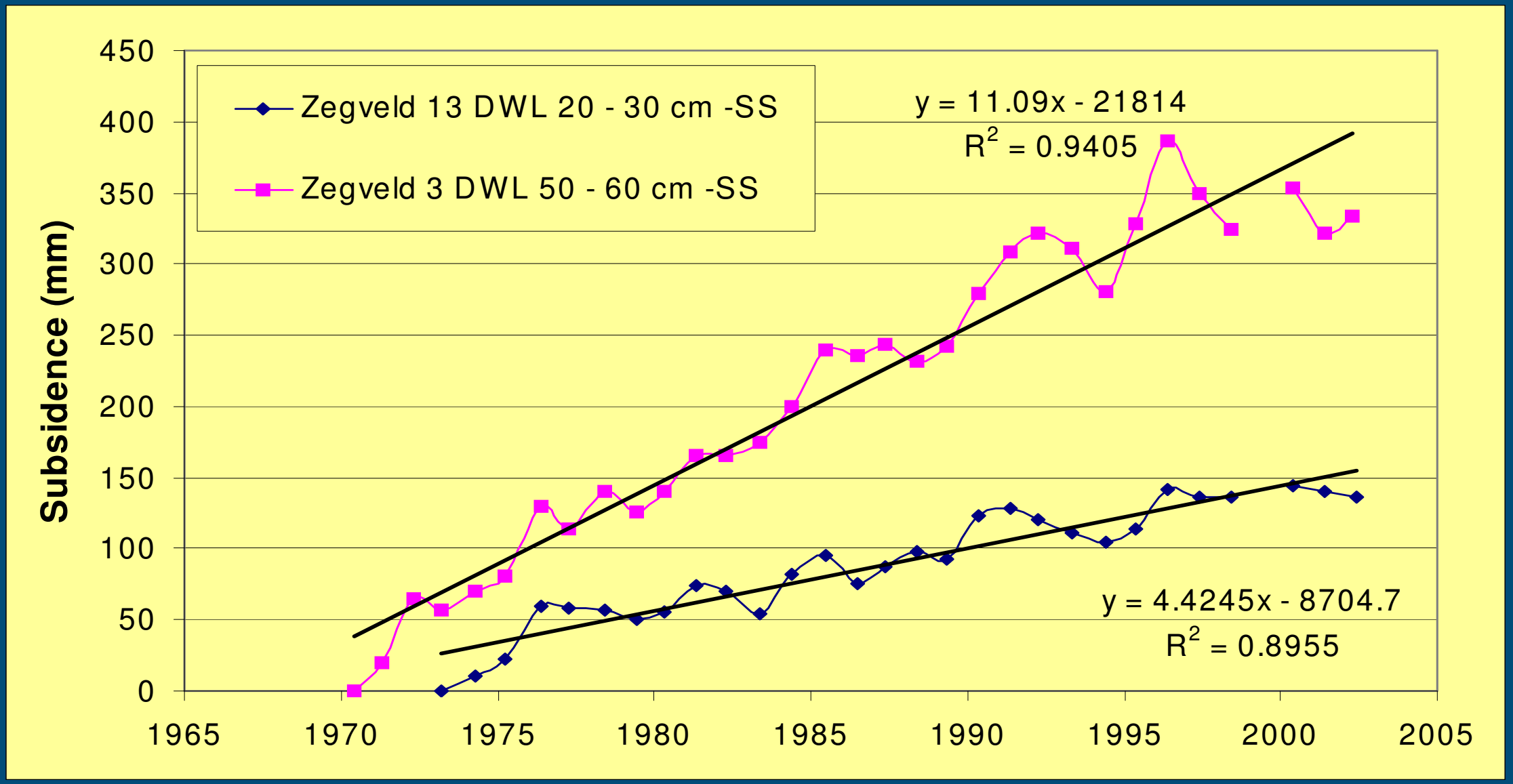
Subsidence in relation to Ditch Water Level



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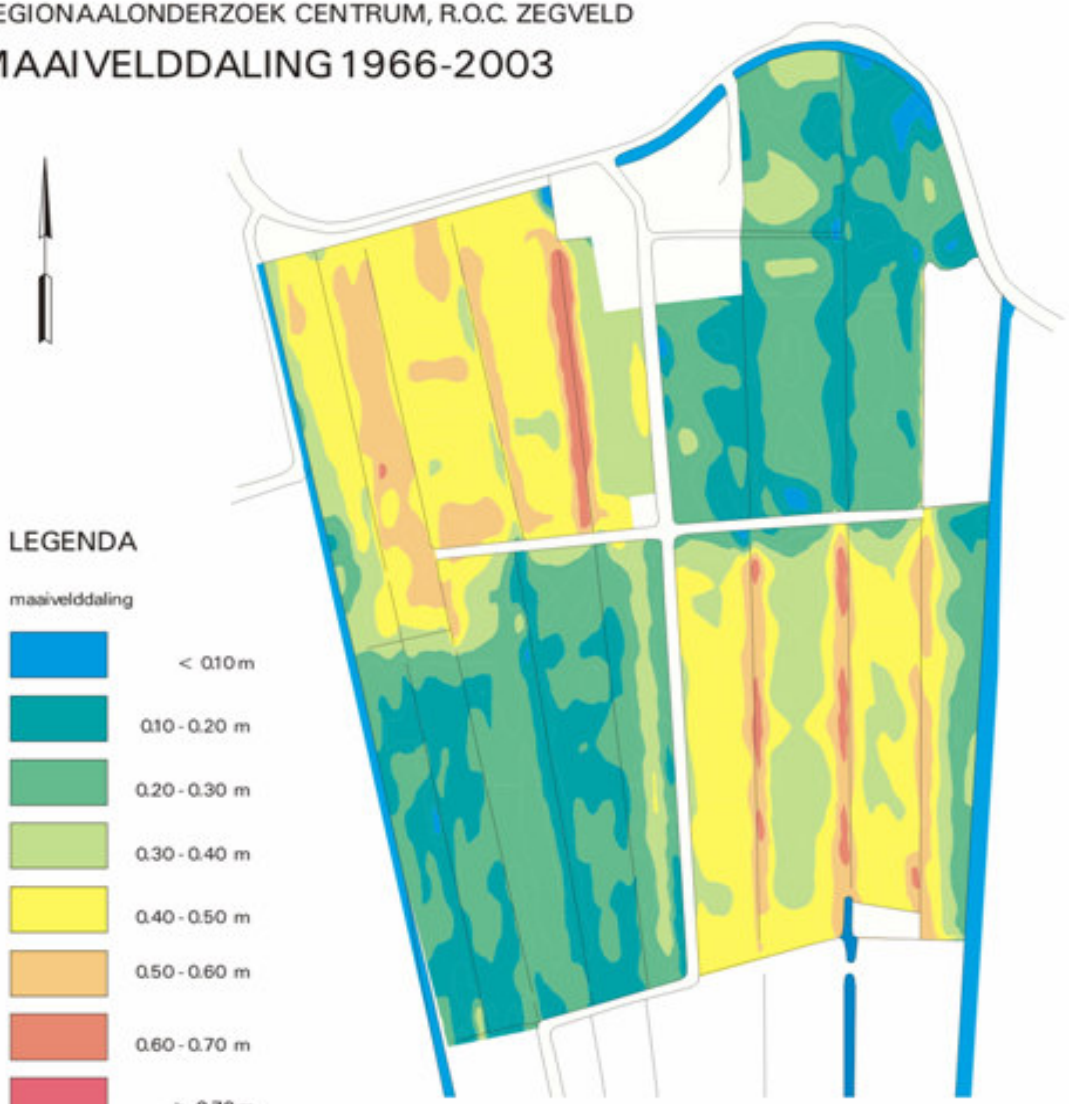
REGIONAALONDERZOEK CENTRUM, R.O.C. ZEGVELD

MAAIVELDDALING 1966-2003



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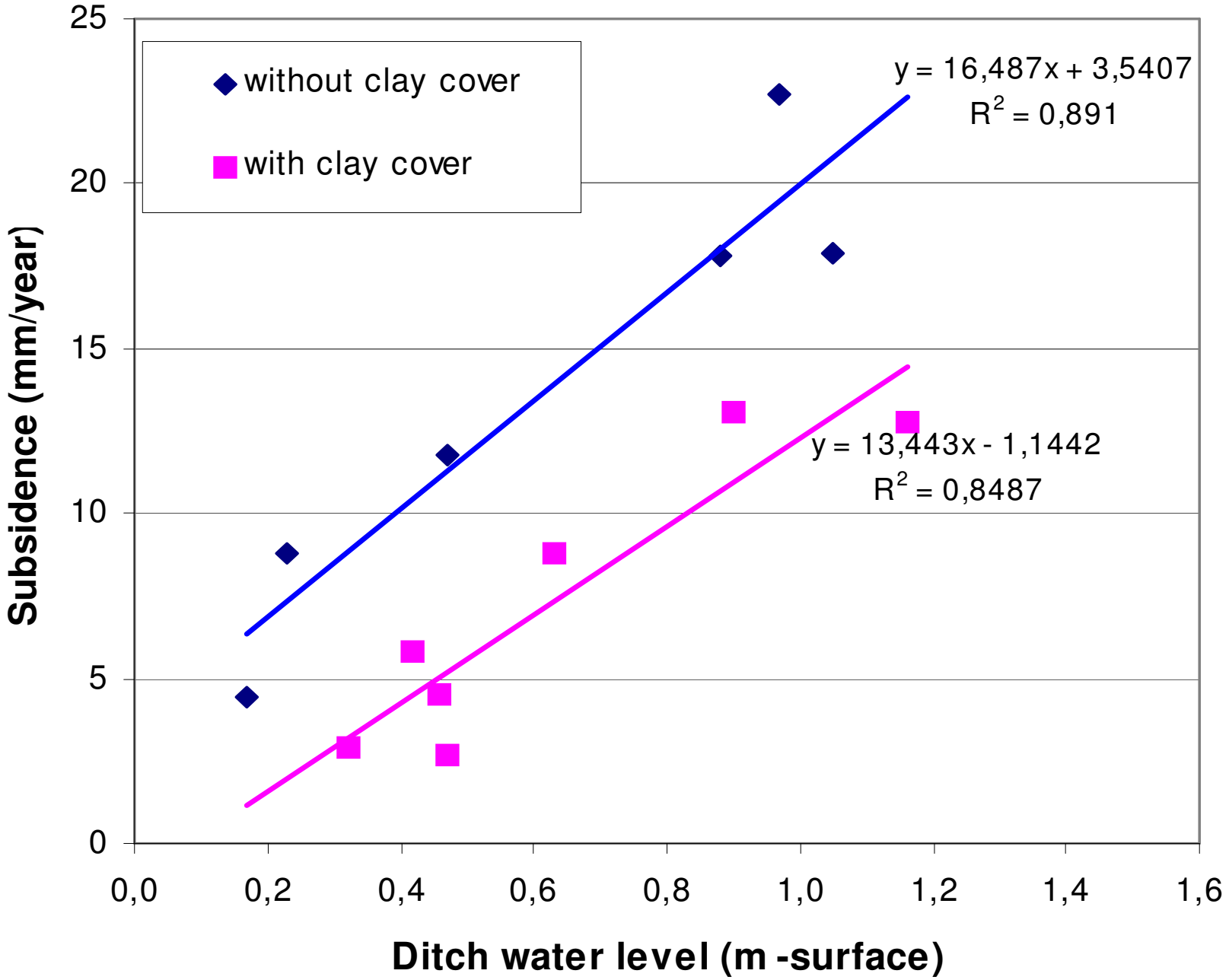
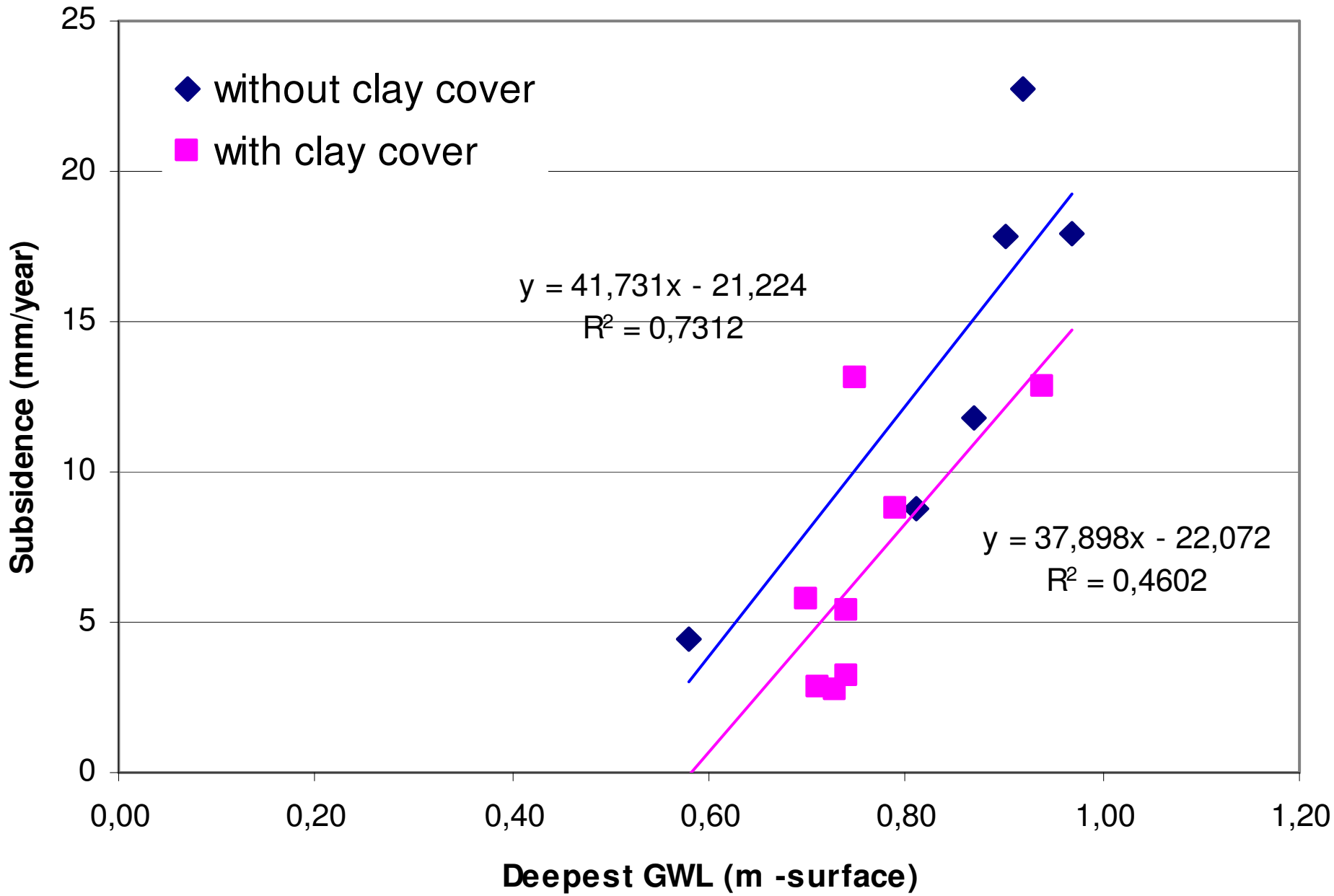

25
20
15
10
5
0
Subsidence (mm/year)
without clay cover
with clay cover
y = 16,487x + 3,5407
R2 = 0,891
y = 13,443x - 1,1442
R2 = 0,8487
0,0
0,2
0,4
0,6
0,8
1,0
1,2
1,4
1,6
Ditch water level (m -surface)



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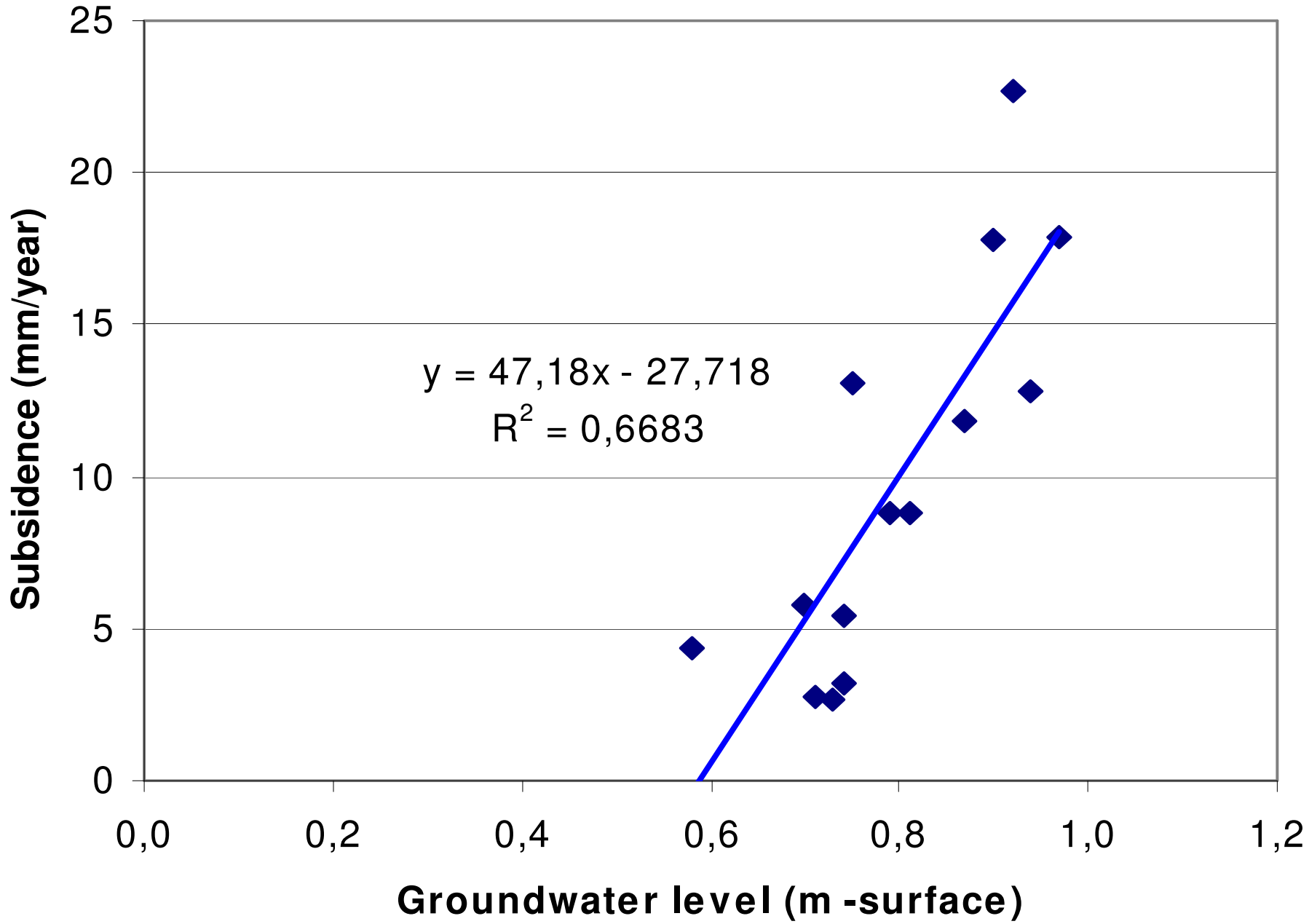

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EUROPEAT

QLRT-2001-01835

Tools and scenarios for sustainable management of European peat soils to protect associated landscapes and natural areas in relation to agricultural production

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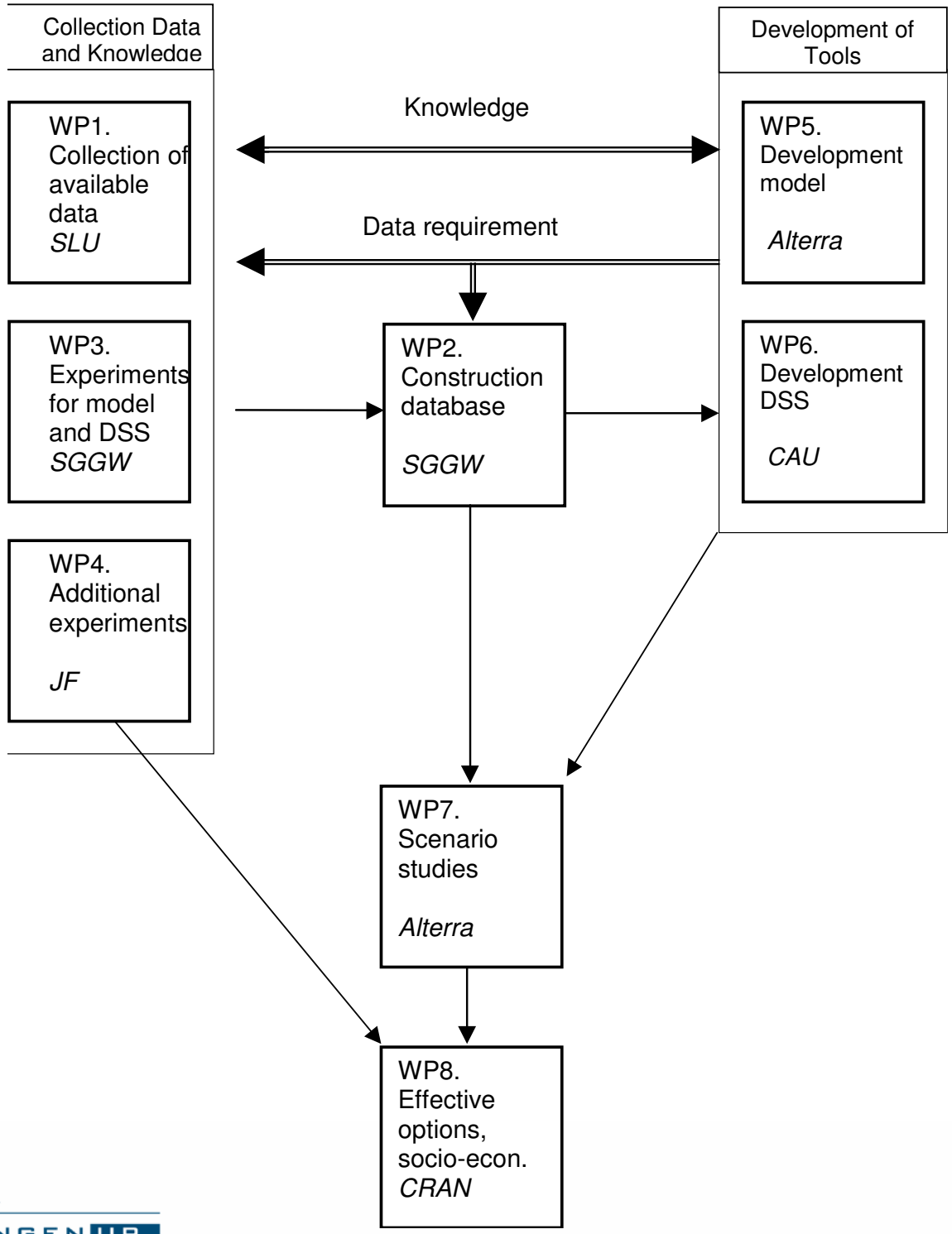
Main objectives

- to elucidate the processes determining the rate of subsidence, oxidation and release of nutrients and greenhouse gasses from peat soils;
- to improve the prediction of the effect of land use and water management and global climatic change on these processes;
- to quantify the effects of peat land deterioration;
- to assess the socio-economic impact of environmentally driven changes in peat soil management;
- to provide the basis for sustainable management of peat soil systems and the selection of peatlands suitable for agricultural or low intensity agricultural purposes, nature reserves or restoration.

Expected achievements

- A model to simulate decomposition, GHG emissions, water- and solute transport of peat soils
- A database on peat soil properties and resulting pedotransfer functions
- A decision support system for assessing sustainable peatland management
- Improved quantification of subsidence, GHG emissions and leaching of nutrients
- Determination of effective landuse and water management options.



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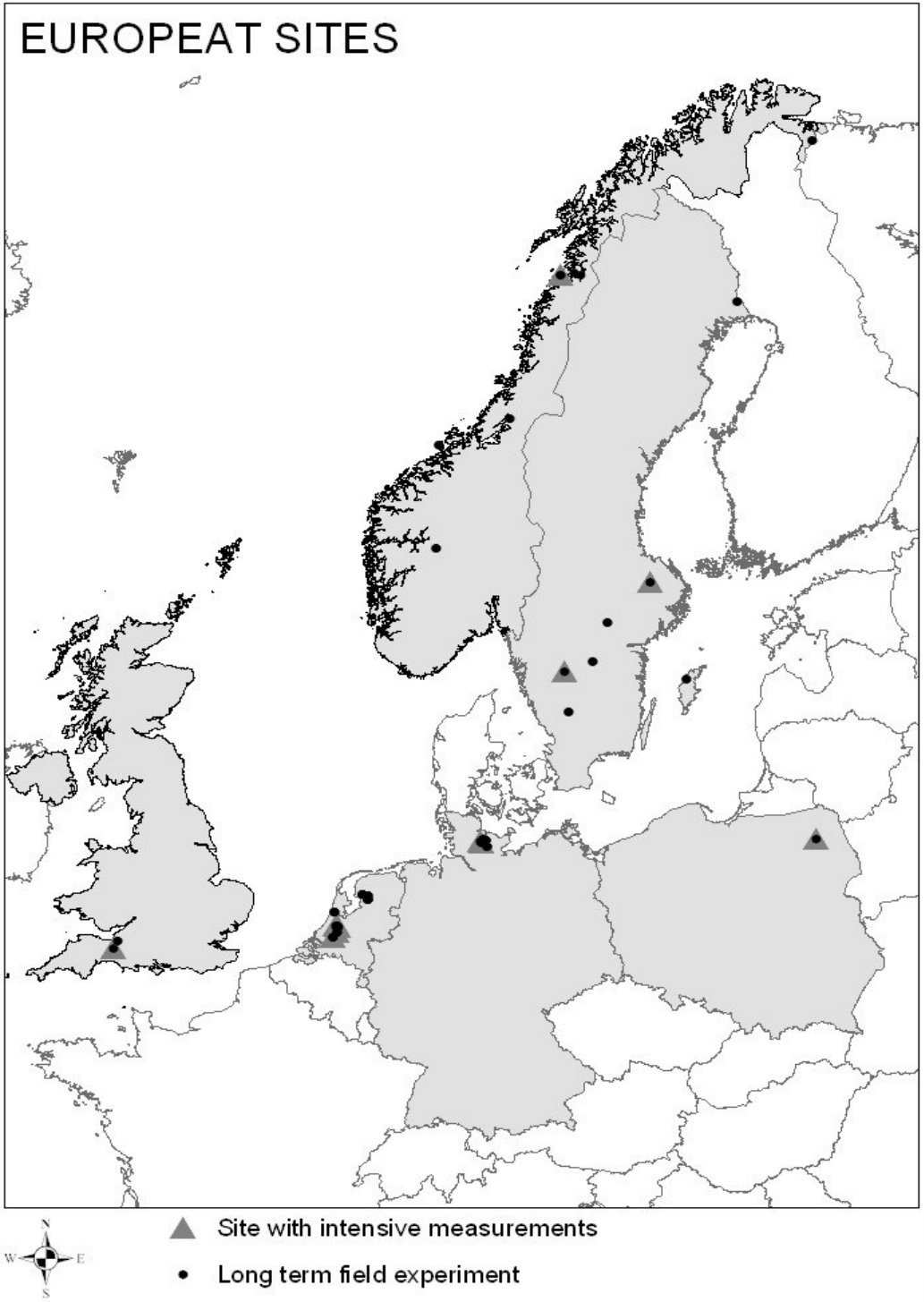

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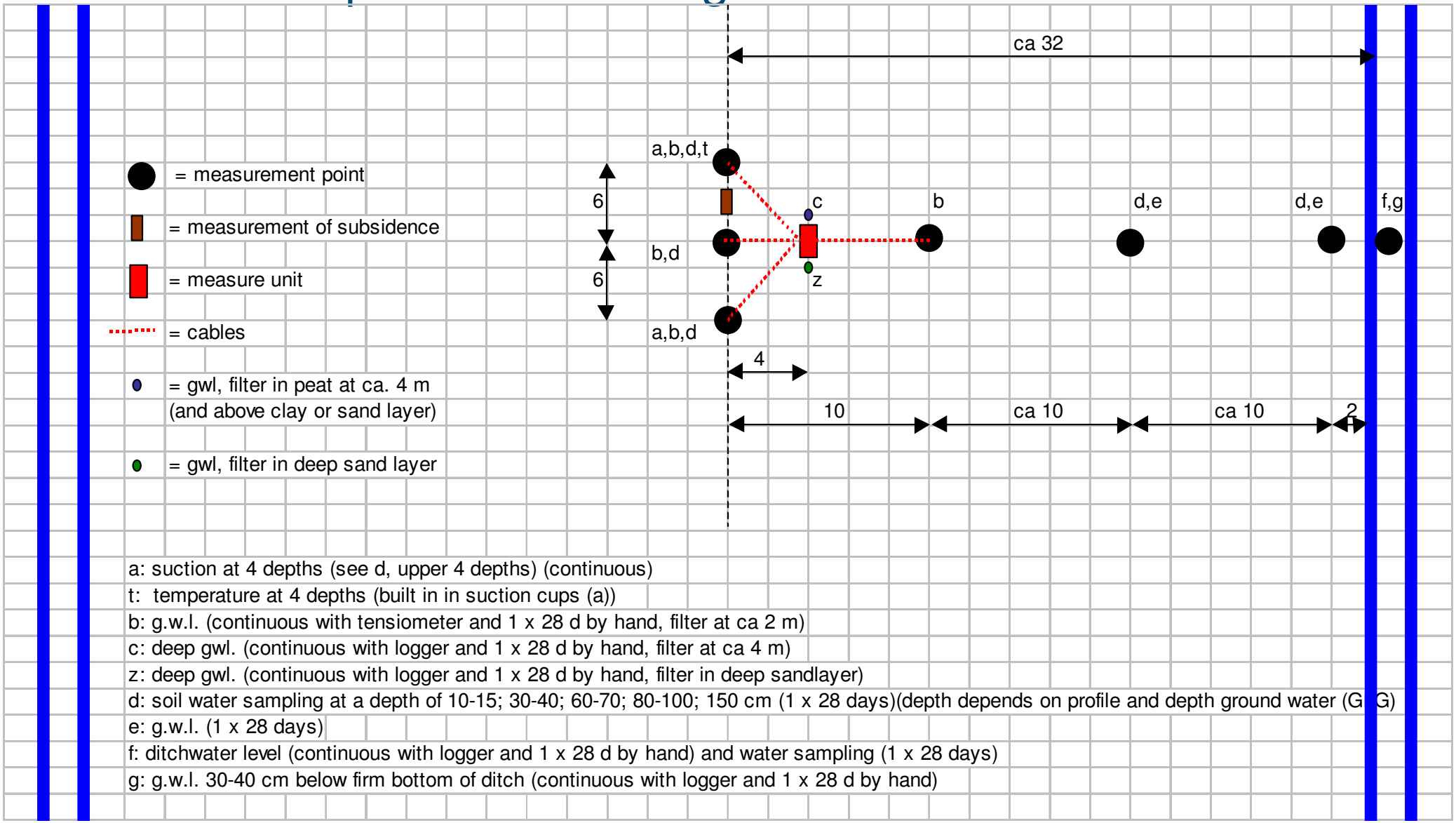
General set-up field monitoring



a: suction at 4 depths (see d, upper 4 depths) (continuous)
t: temperature at 4 depths (built in in suction cups (a))
b: g.w.l. (continuous with tensiometer and 1 x 28 d by hand, filter at ca 2 m)
c: deep gwl. (continuous with logger and 1 x 28 d by hand, filter at ca 4 m)
z: deep gwl. (continuous with logger and 1 x 28 d by hand, filter in deep sandlayer)
d: soil water sampling at a depth of 10-15; 30-40; 60-70; 80-100; 150 cm (1 x 28 days)(depth depends on profile and depth ground water (GLG)
e: g.w.l. (1 x 28 days)
f: ditchwater level (continuous with logger and 1 x 28 d by hand) and water sampling (1 x 28 days)
g: g.w.l. 30-40 cm below firm bottom of ditch (continuous with logger and 1 x 28 d by hand)

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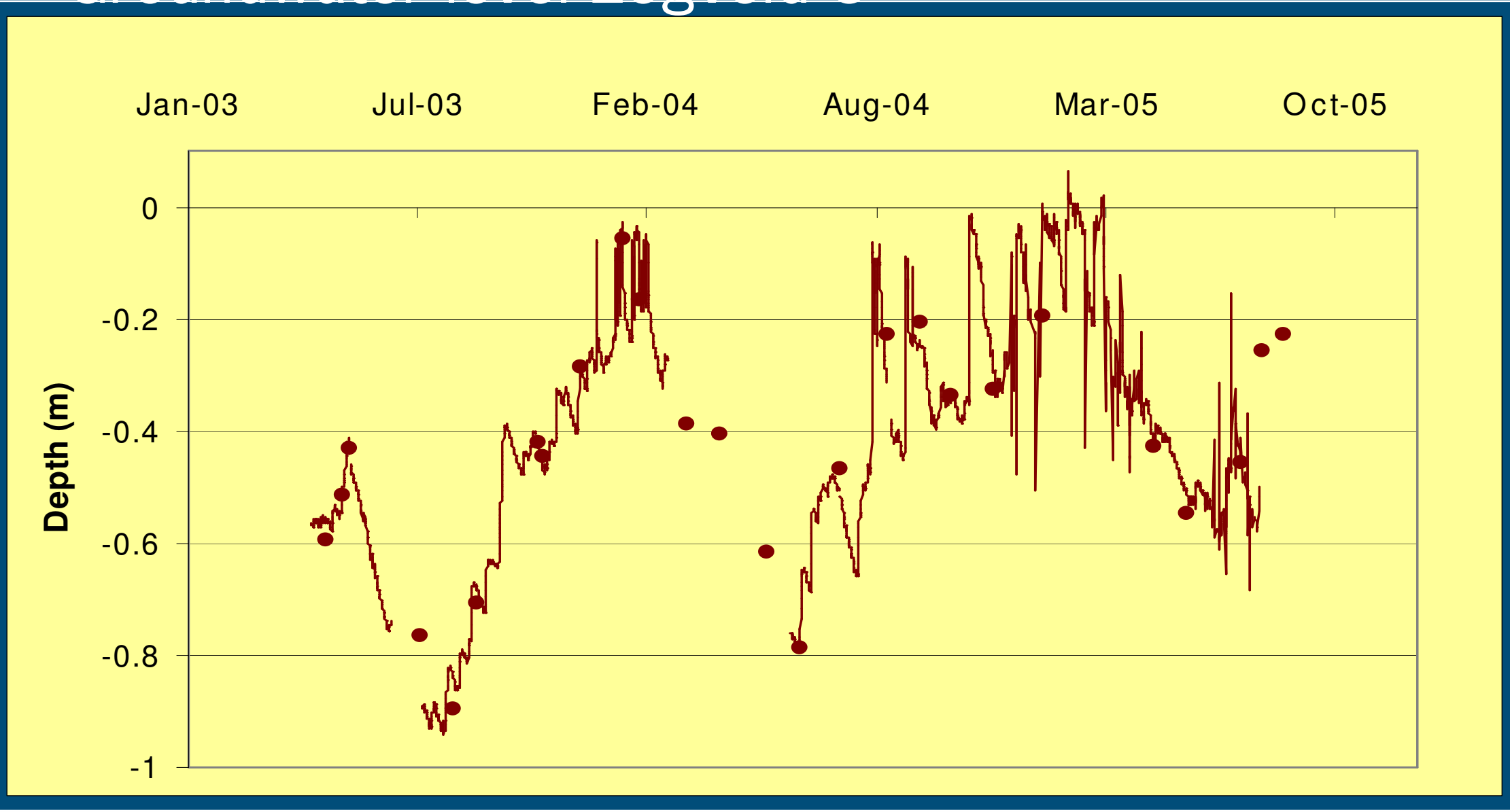
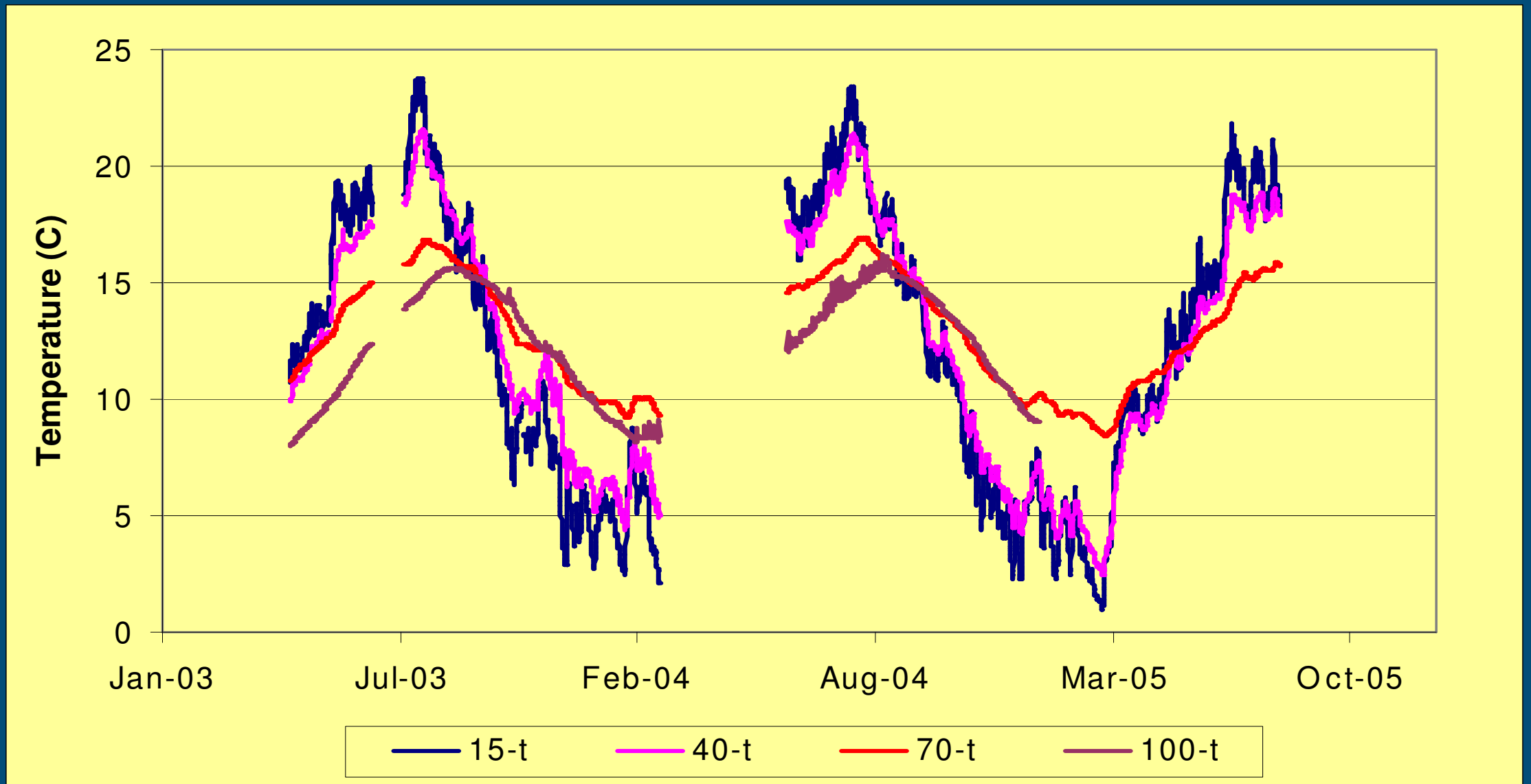
Groundwater level Zegveld 3



Soil Temperature Zegveld 3



EUROPEAT presentations and posters in W3M

- Szatylowicz J. et al: Monitoring of vertical soil movement in low decomposed deep peat soils
- Oleszczuk R. et al: Calibration of TDR for moisture content monitoring in moorsh layer
- Gnatowski T. et al: Moisture content variability in drained fen soil
- Hendriks R.: Modeling of subsidence, nutrient releases and emission of greenhouse gasses in peatlands in agricultural use in the EUROPEAT project
- Kniess A. and Trepel M.: A Decission Support System for sustainable peatland management regarding long-term changes in ecosysten functions
- Berglund O. and Berglund K.: Effect of water management on greenhouse gas emissions from cultivated organic soils in Sweden
- Holsten B. and Trepel M.: Modelling vegetation-succession on peat lands for land use planning
- Klauder W. and Trepel M.: Water flow patterns withn wetlands
- Leeds-Harrison P. et al: The implications of water management for physical and socio-economic sustainability of peatlands in the Somerset levels and moors

Infiltration by drainage tubes to limit subsidence

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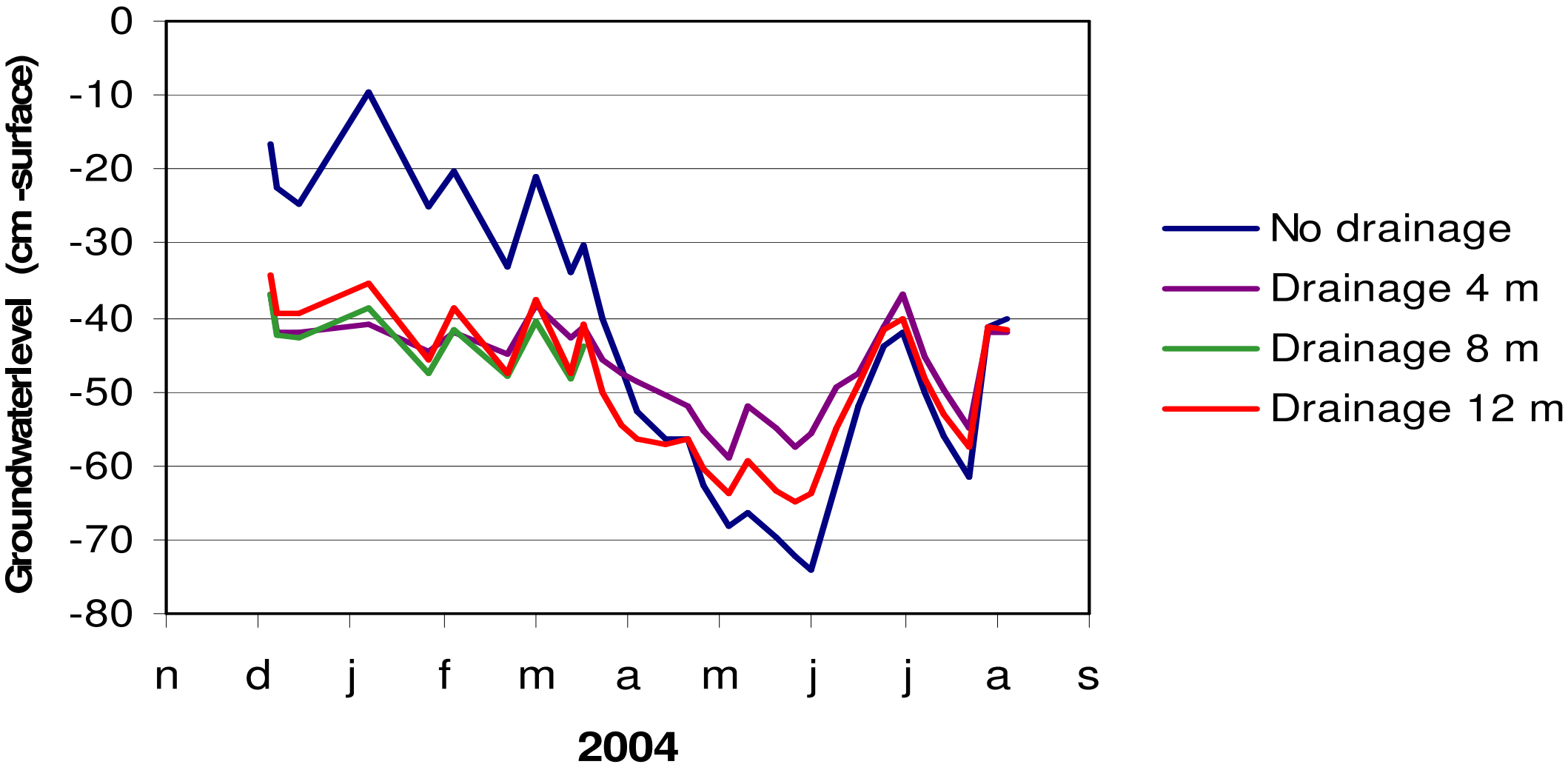
Field experiment

- Period: 2004 - 2007
- Treatments:
  - High (30 cm –surface) and low (60 cm -surface) ditchwater level
  - No drains, tube drainage, mole drainage
  - Drain distances: 4, 8 and 12 m
- Measurements:
  - Groundwater levels (1 x week)
  - Moisture content
  - Subsidence
  - Water quality
  - traffic ability
  - Yield

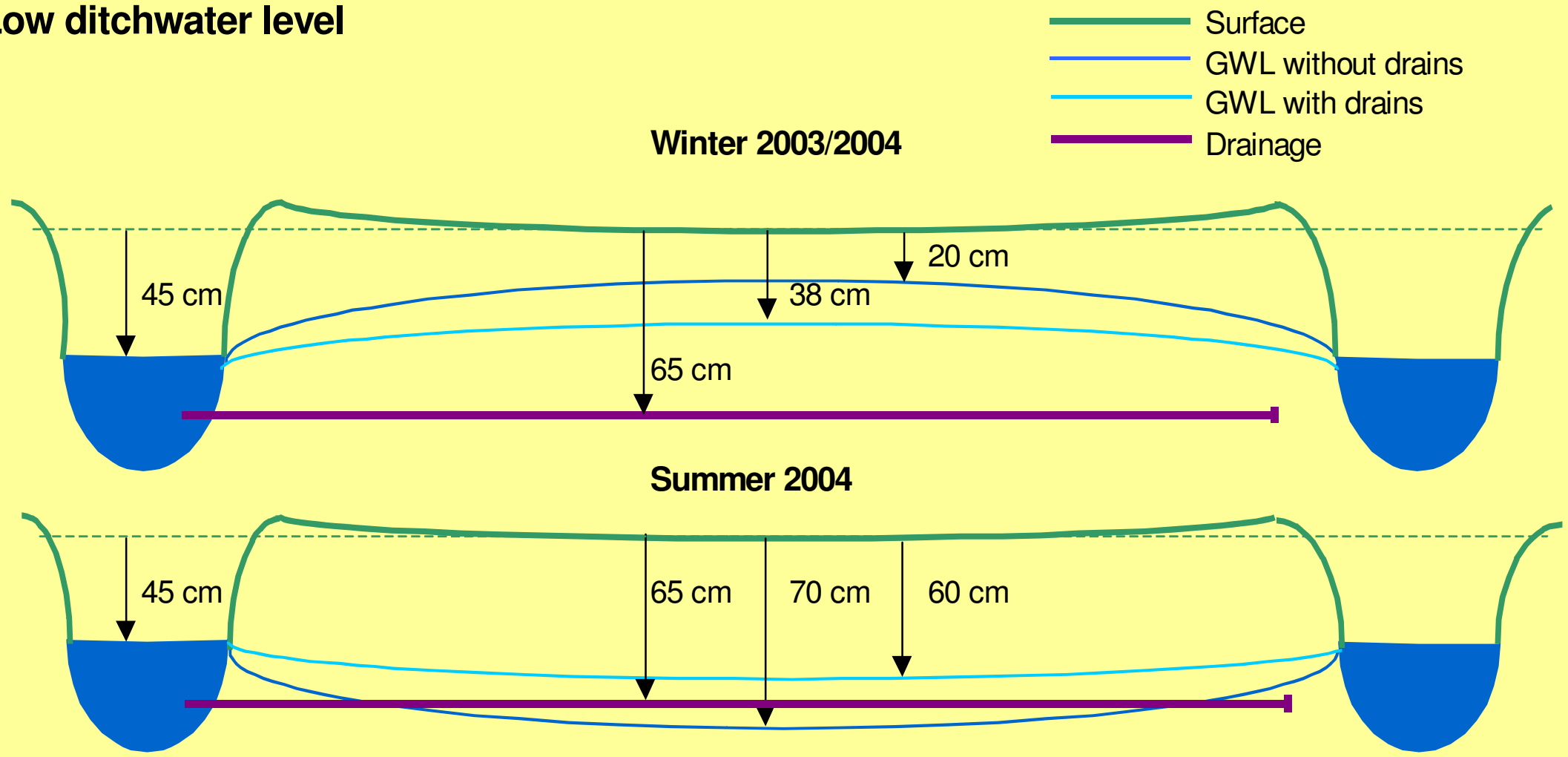
Moldrainage

Buisdrainage

Ditch water level 60 cm -surface



Low ditchwater level



Conclusions now

- Significant increase of groundwater level in summer in 2004
- In potention reduction of subsidence by 50 %at drainage distances of 8 m
- Significant improvement of water discharge in winter



Calculatiom of CO_2 emissions from subsidence

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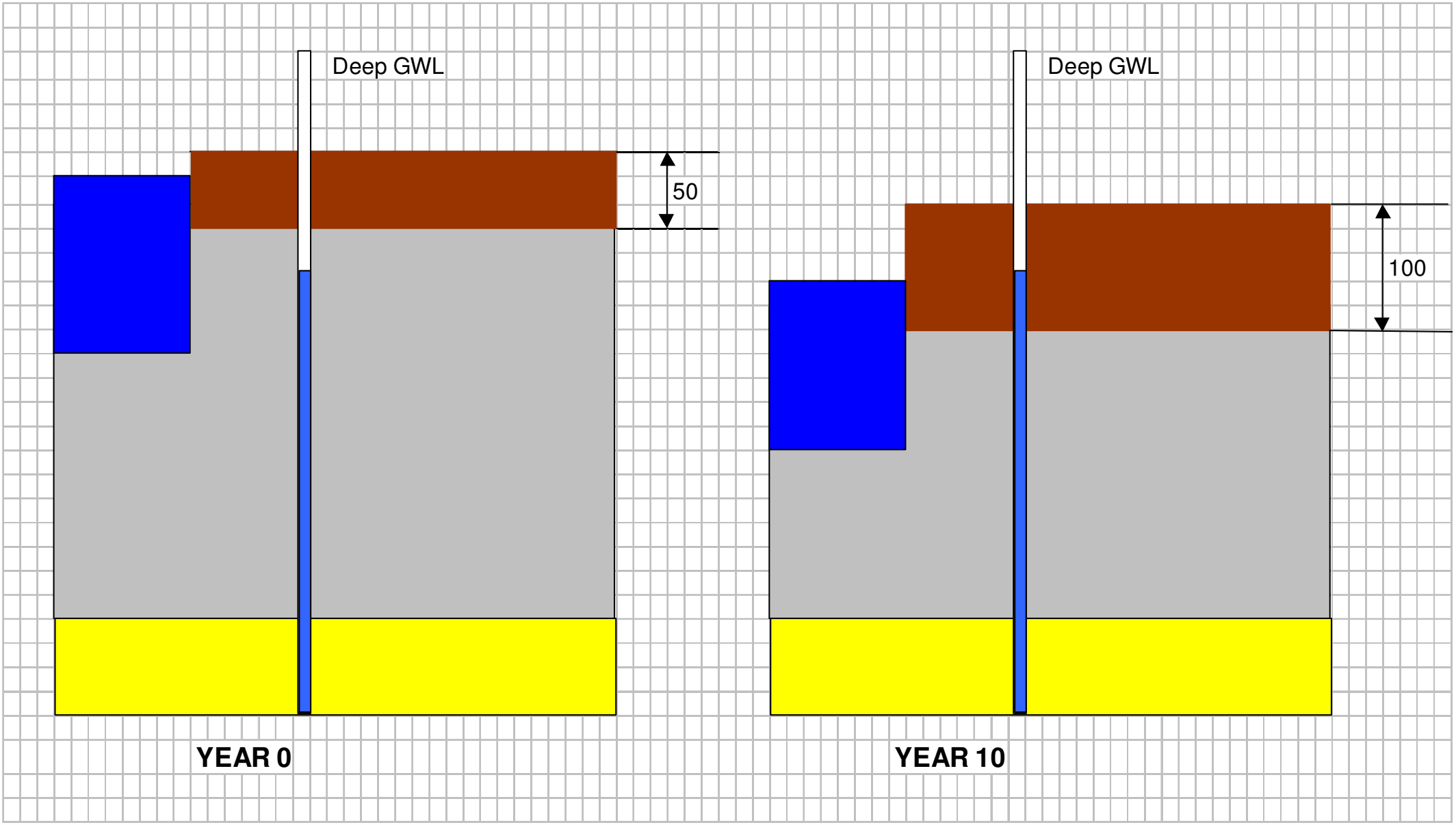

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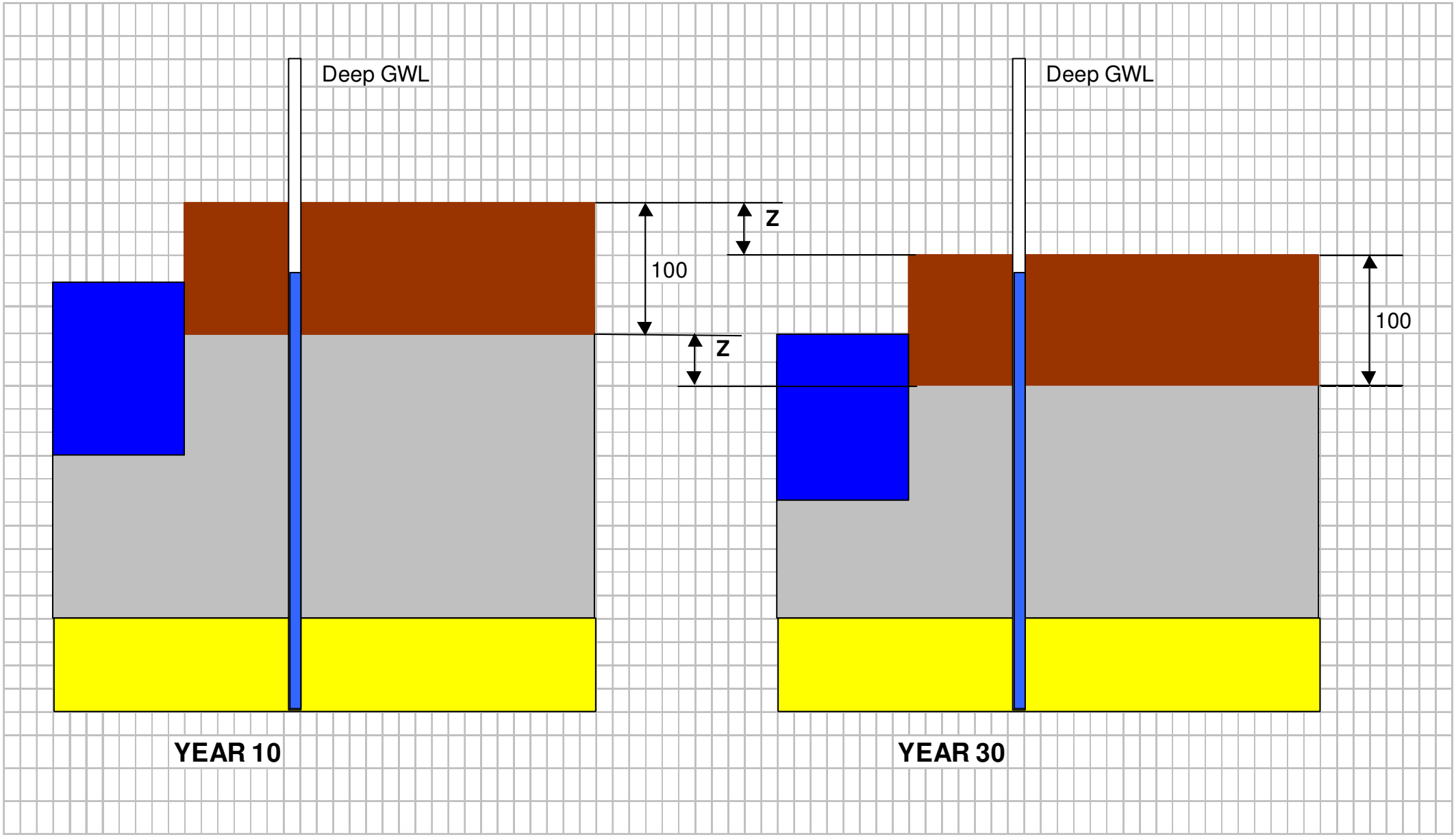

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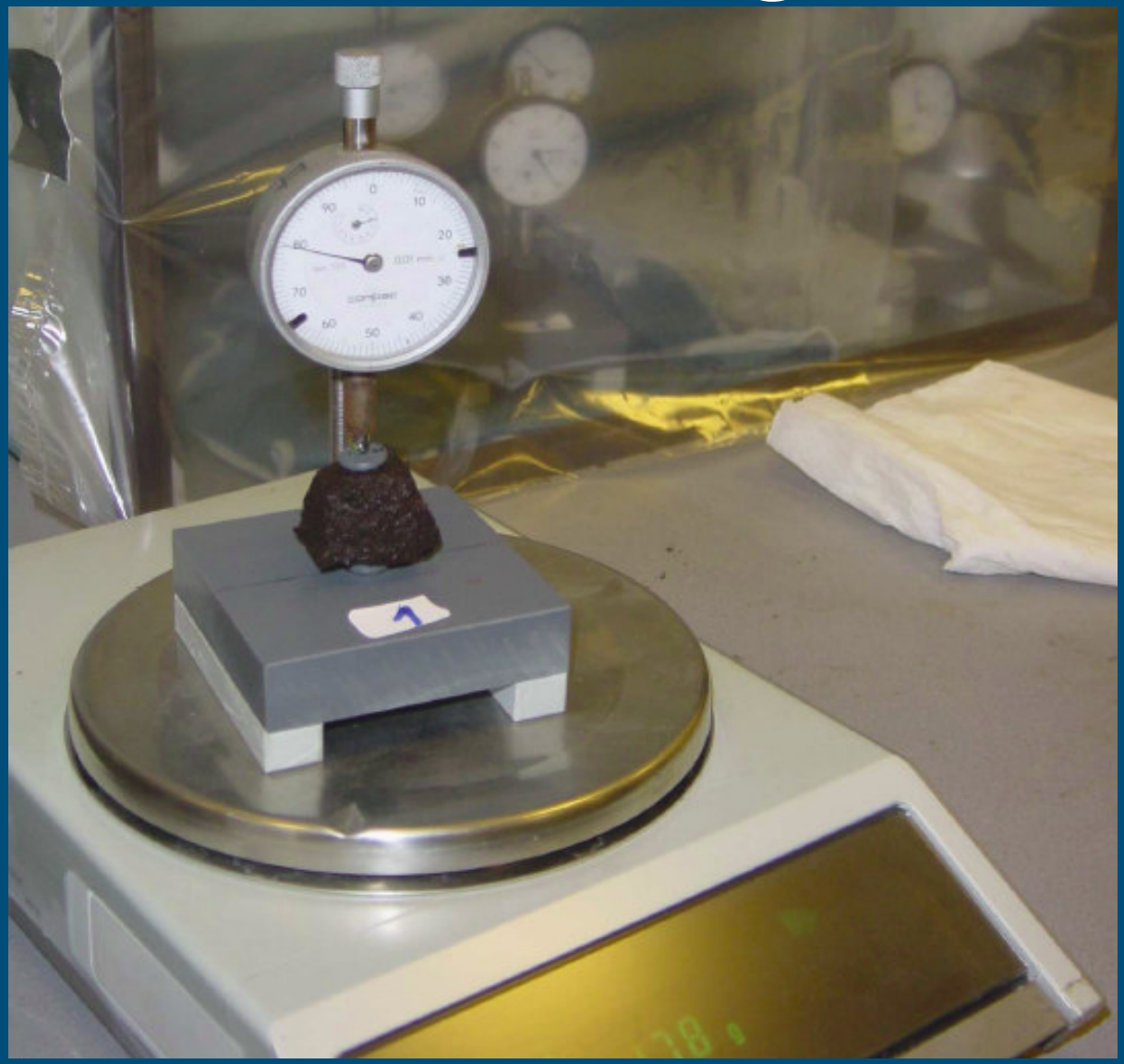
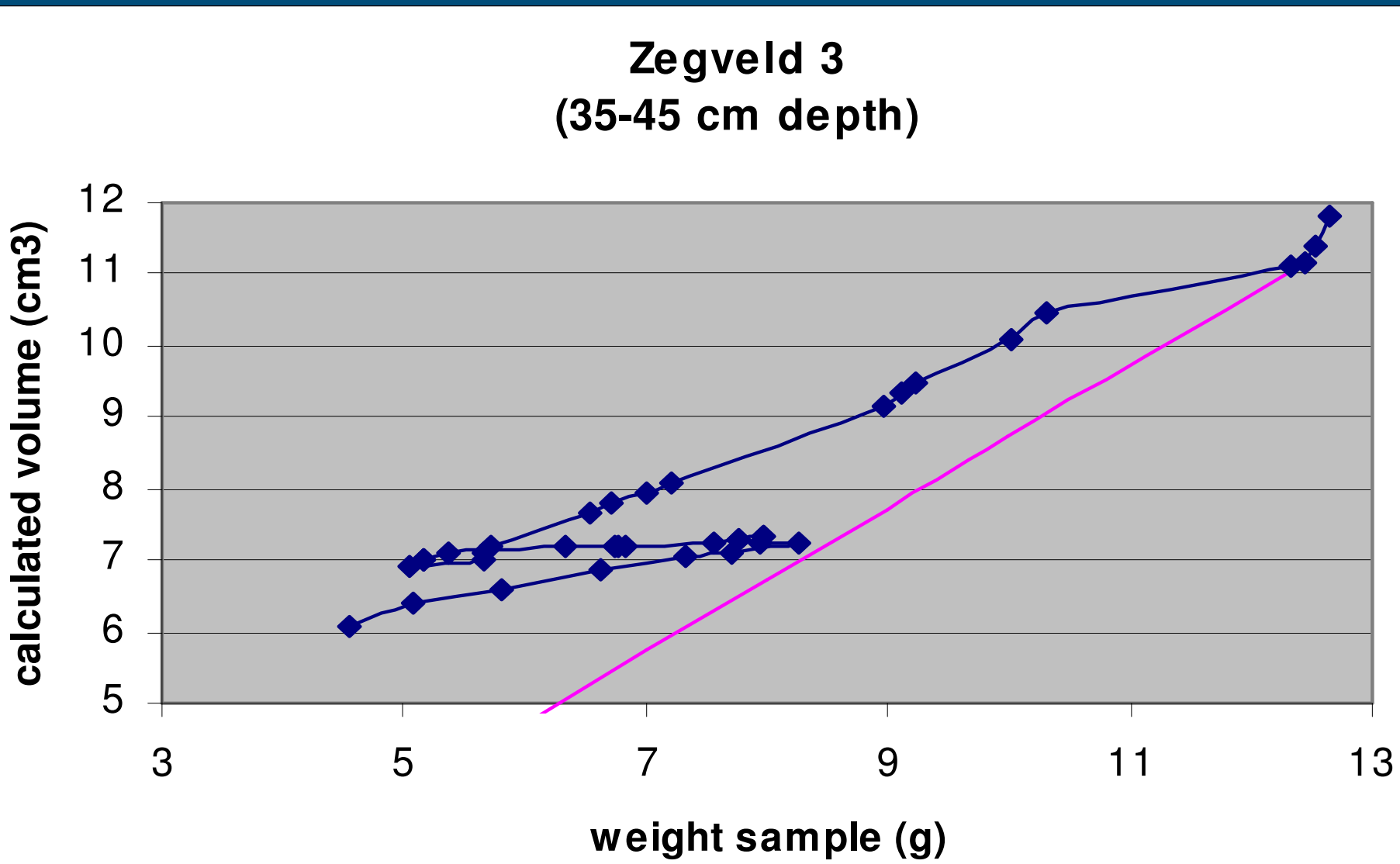
CO_2 and N_2O emissions in CO_2 equivalents

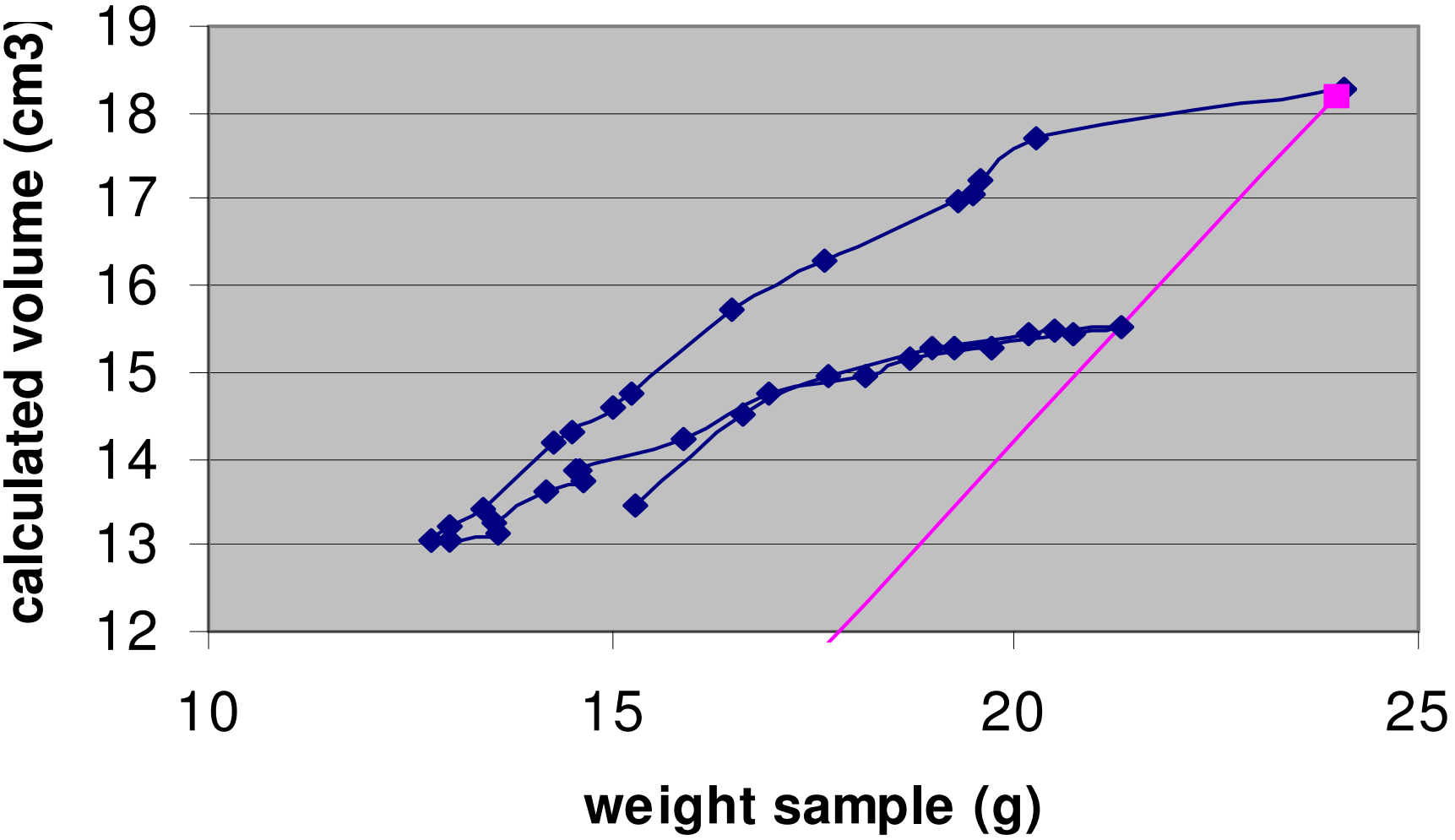
CO_2 equivalents	Emission in Mton CO_2
CO_2	4.24
N_2O	0.51
Total	4.76

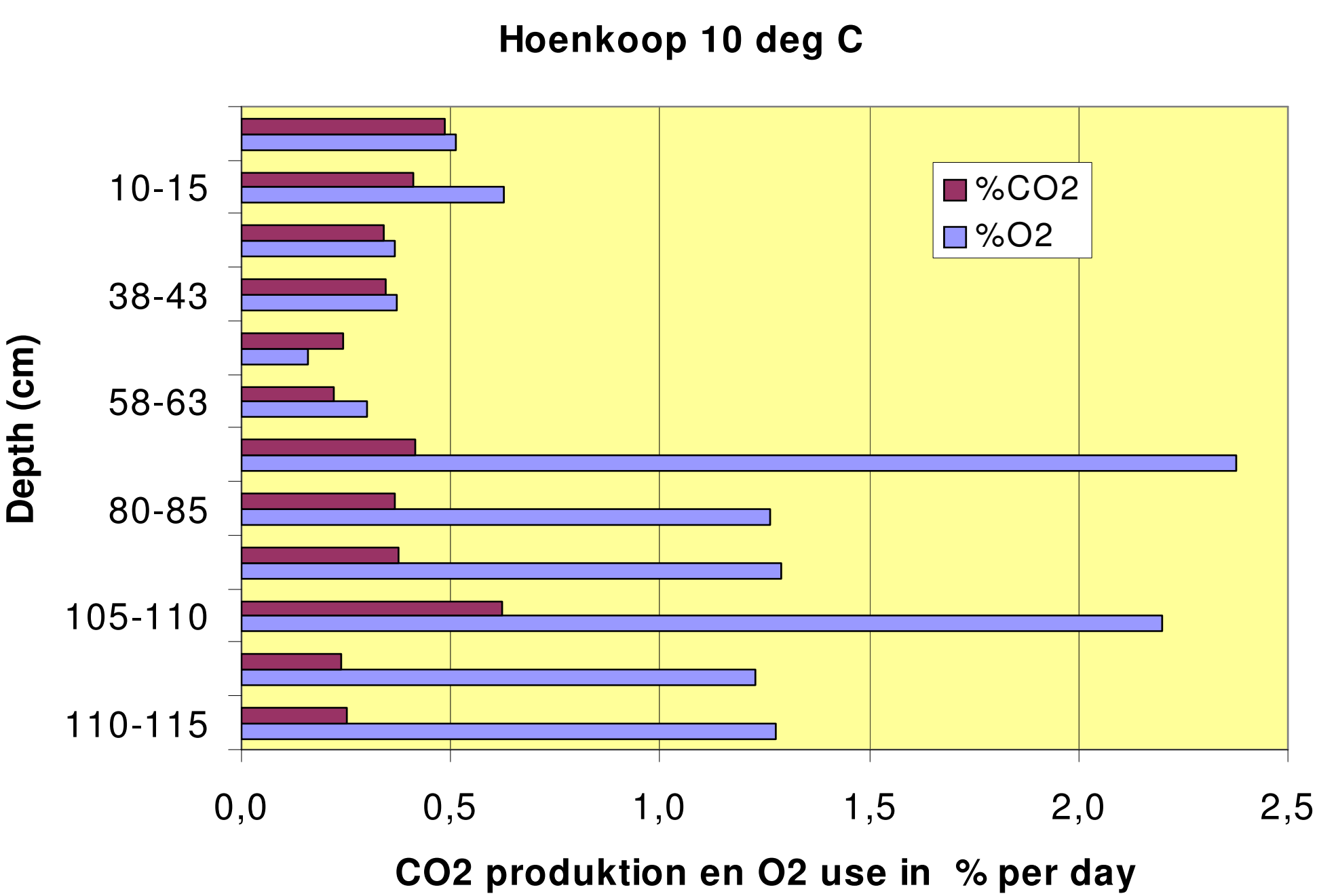
Measurement vertical shrinkage and swell

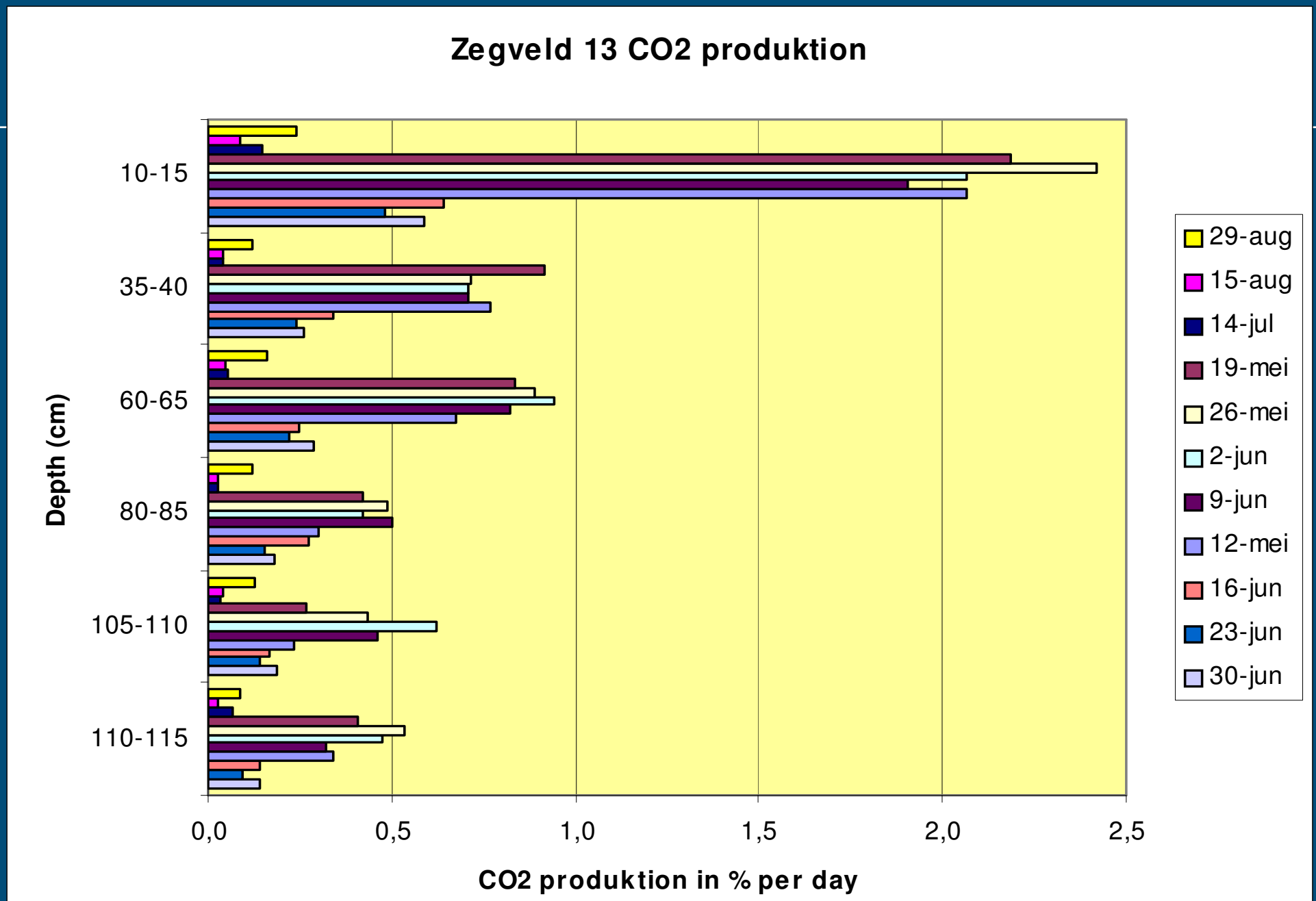



Zegveld 3
(35-45 cm depth)
calculated volume (cm3)
12
11
10
9
8
7
6
5
3
5
7
9
11
13
weight sample (g)

Zegveld
(10-20 cm depth)




Hoenkoop 10 deg C
%CO2
%O2
Depth (cm)
10-15
38-43
58-63
80-85
105-110
110-115
0,0
0,5
1,0
1,5
2,0
2,5
CO2 produktion en O2 use in % per day



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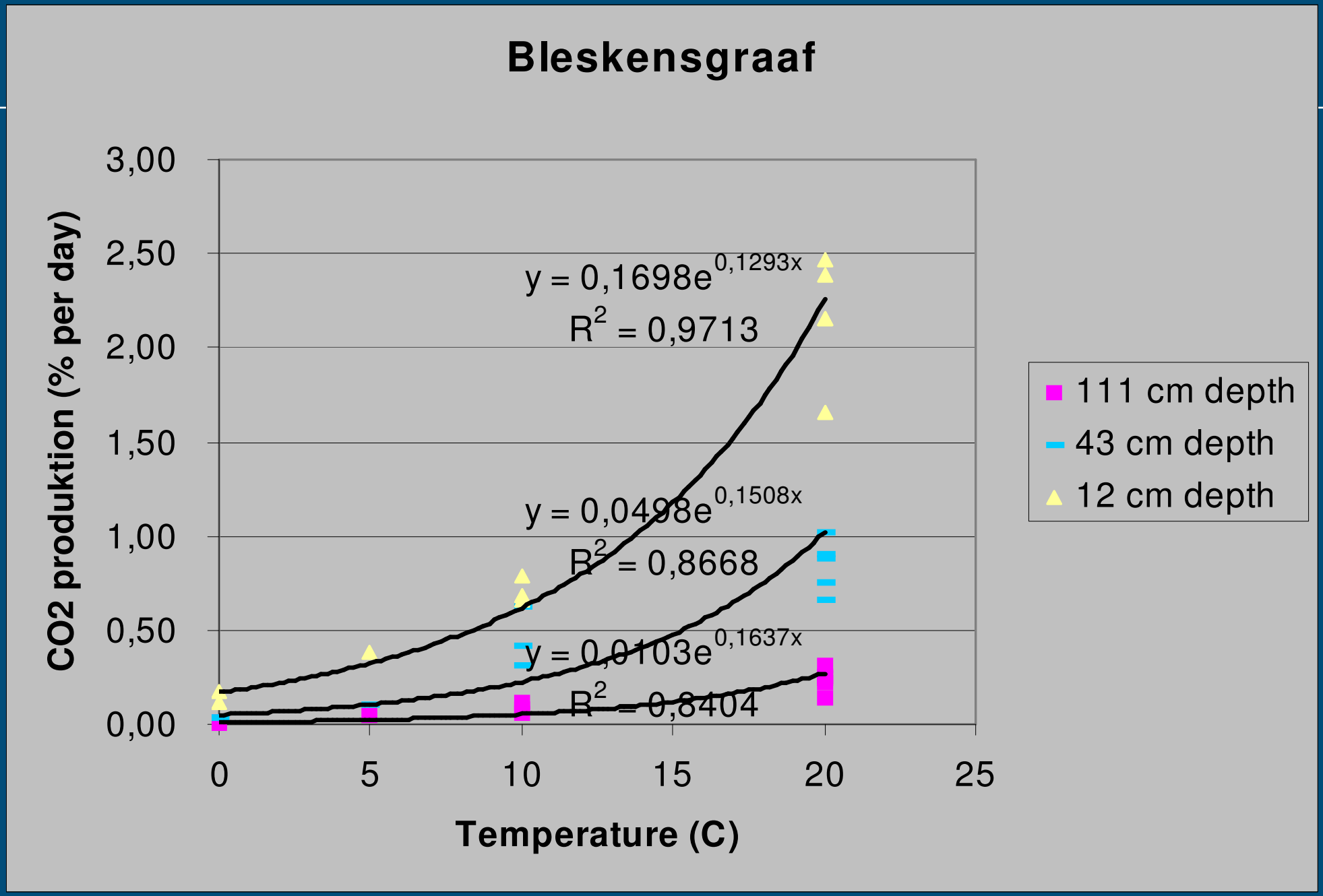
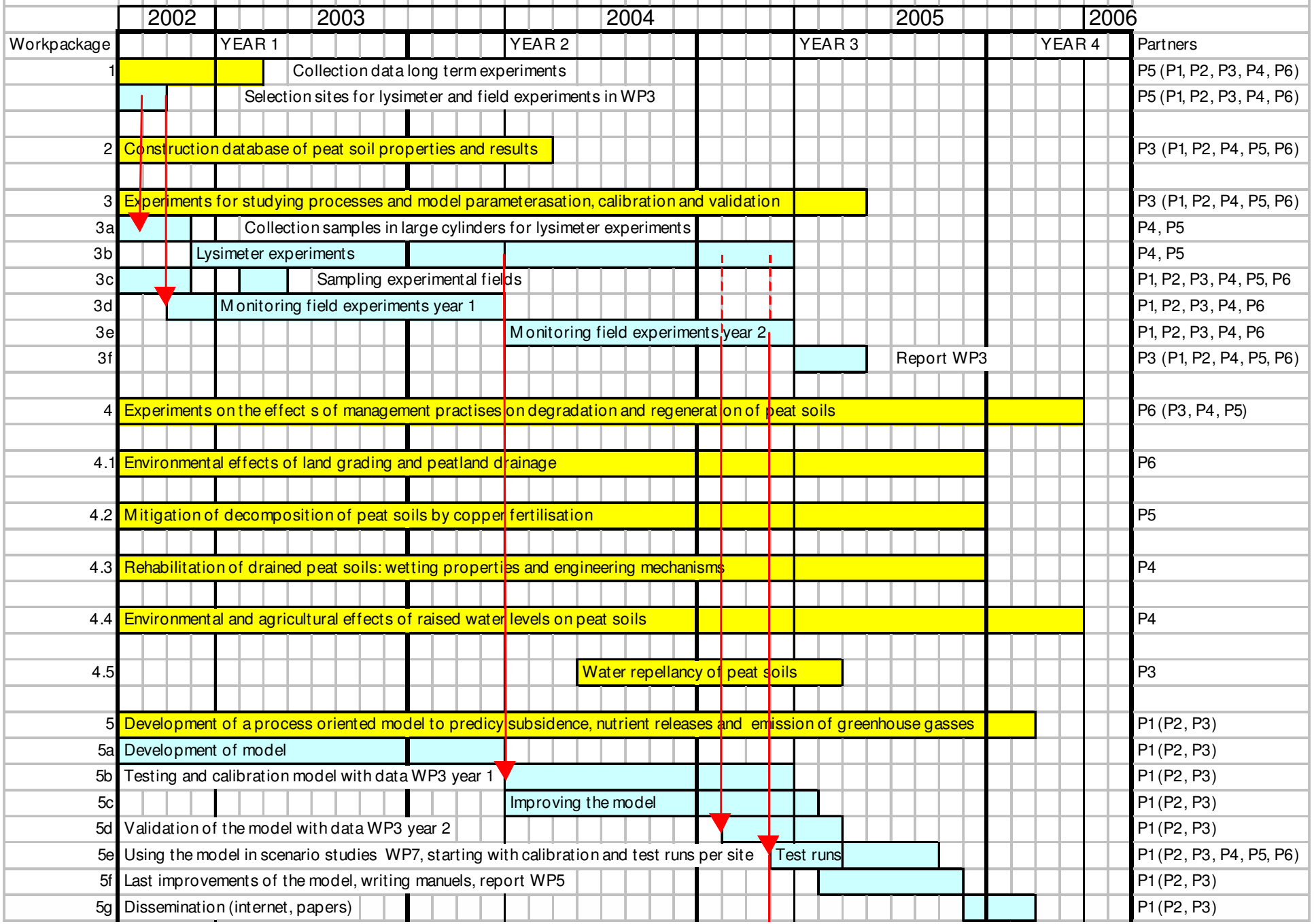

Bleskensgraaf
CO2 produktion (% per day)
3,00
2,50
2,00
1,50
1,00
0,50
0,00
0
5
10
15
20
25
Temperature (C)
y = 0,1698e^0,1293x
R2 = 0,9713
y = 0,0498e^0,1508x
R2 = 0,8668
y = 0,0103e^0,1637x
R2 = 0,8404
111 cm depth
43 cm depth
12 cm depth

EUROPEAT: Timetable with critical path



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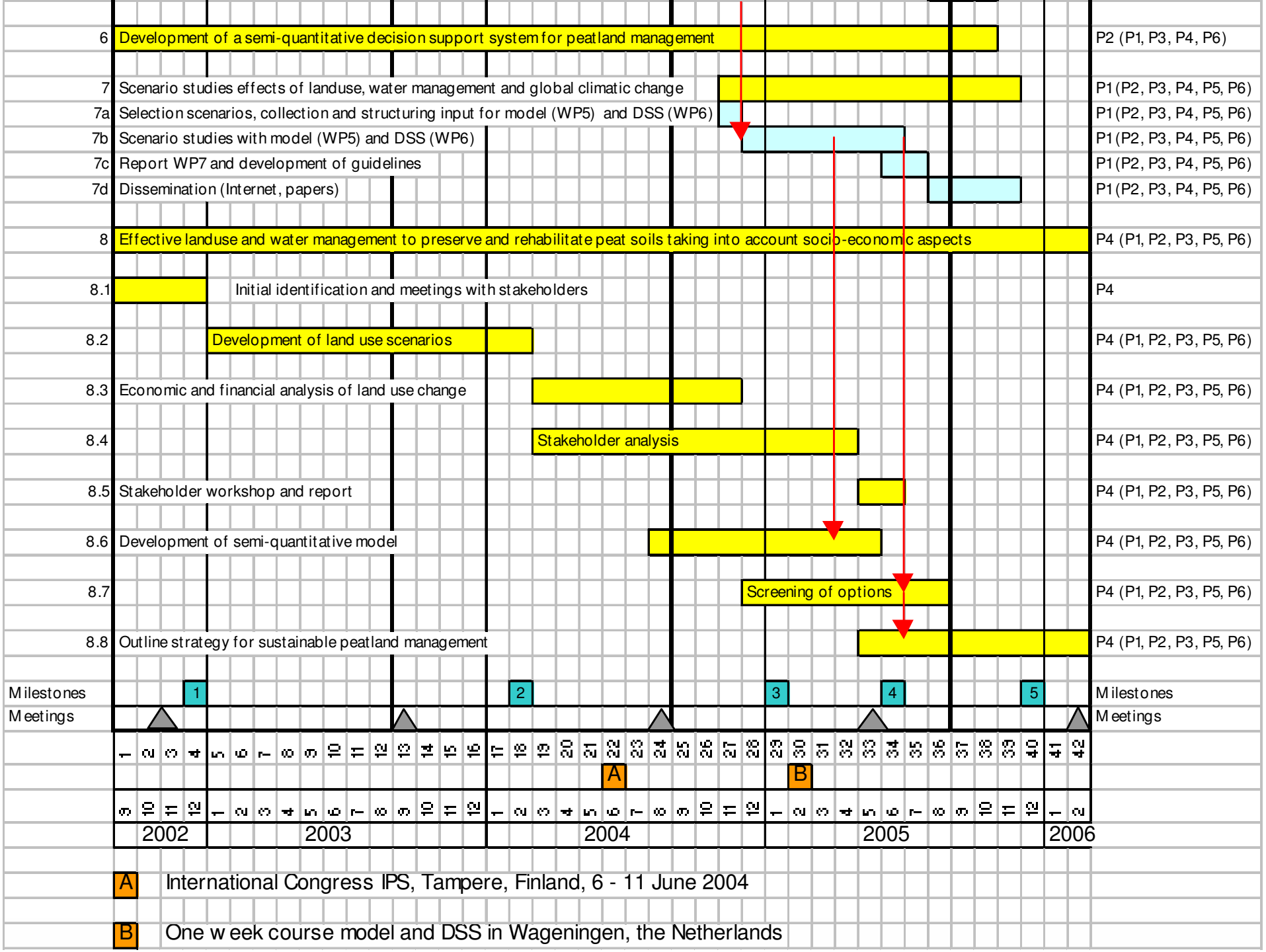

A International Congress IPS, Tampere, Finland, 6 - 11 June 2004

B One week course model and DSS in Wageningen, the Netherlands

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