



43rd IAH CONGRESS

25-29th September, 2016

le Corum , Montpellier, France



Nitrate trends in groundwater of the Campania region (southern Italy)

*Ducci Daniela¹, Della Morte Renata², Mottola Adolfo³,
Paschitto Giuseppe², Onorati Giuseppe³*



¹ Department of Civil, Architectural and Environmental Engineering (DICEA) – University of Naples ‘Federico II’ - daniela.ducci@unina.it



² Department of Engineering - Parthenope University of Naples



³ Regional Environmental Protection Agency of Campania (ARPAC)

Italy

Abstract 2700

Located in southern Italy

13,600 km²

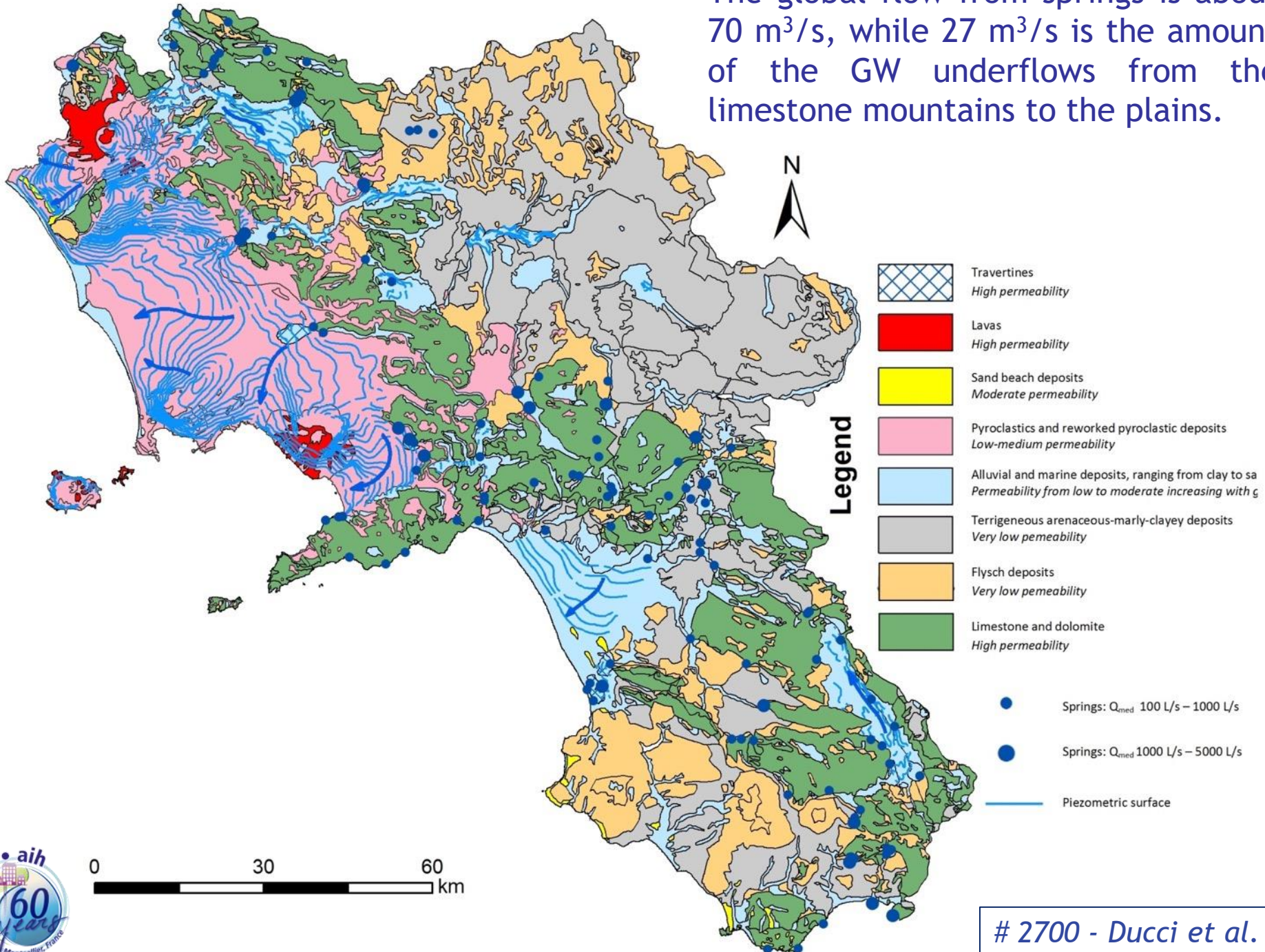
about 6 million of
inhabitants



2700 - *Ducci et al.*

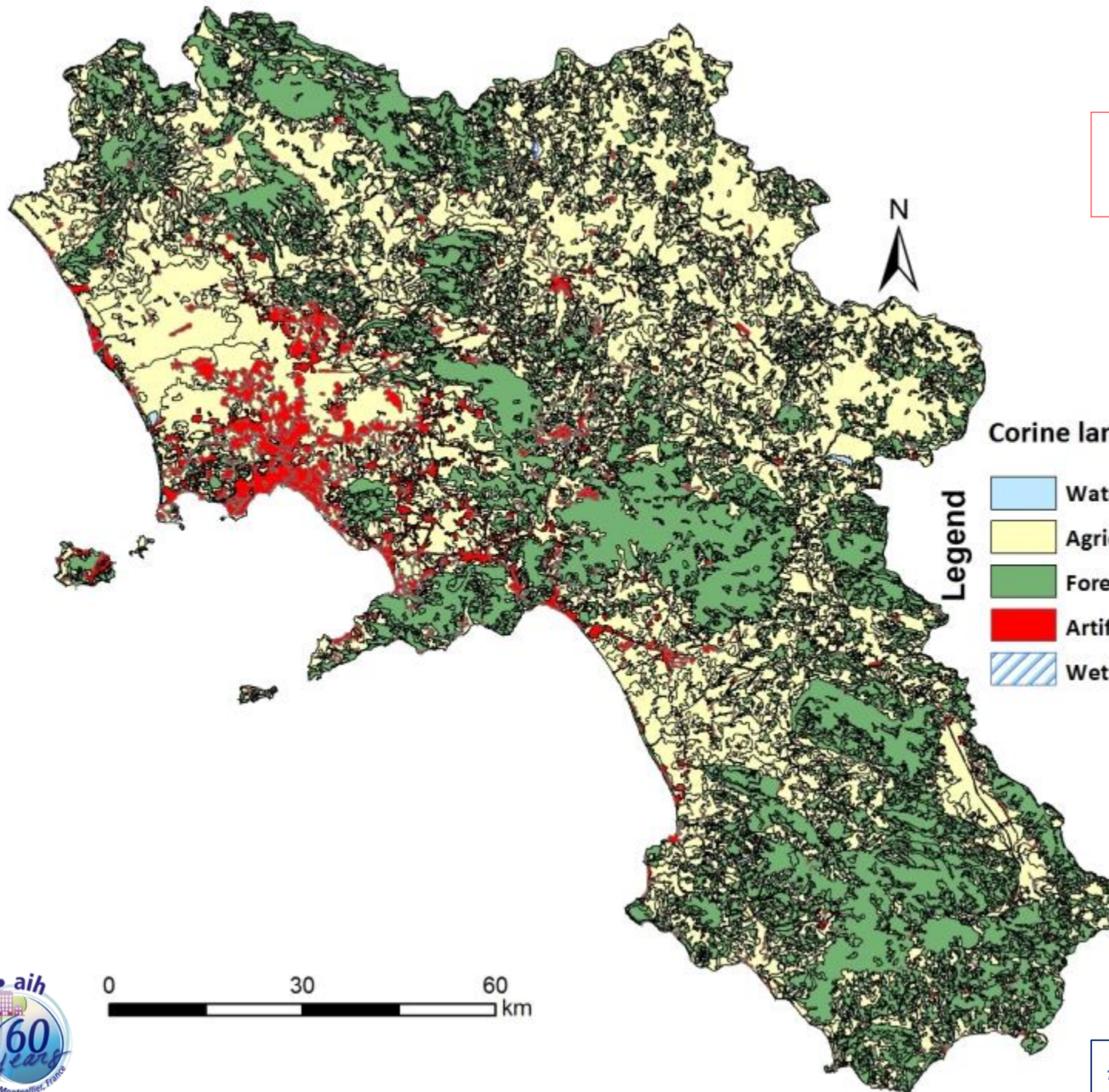


The global flow from springs is about $70 \text{ m}^3/\text{s}$, while $27 \text{ m}^3/\text{s}$ is the amount of the GW underflows from the limestone mountains to the plains.



2700 - Ducci et al.

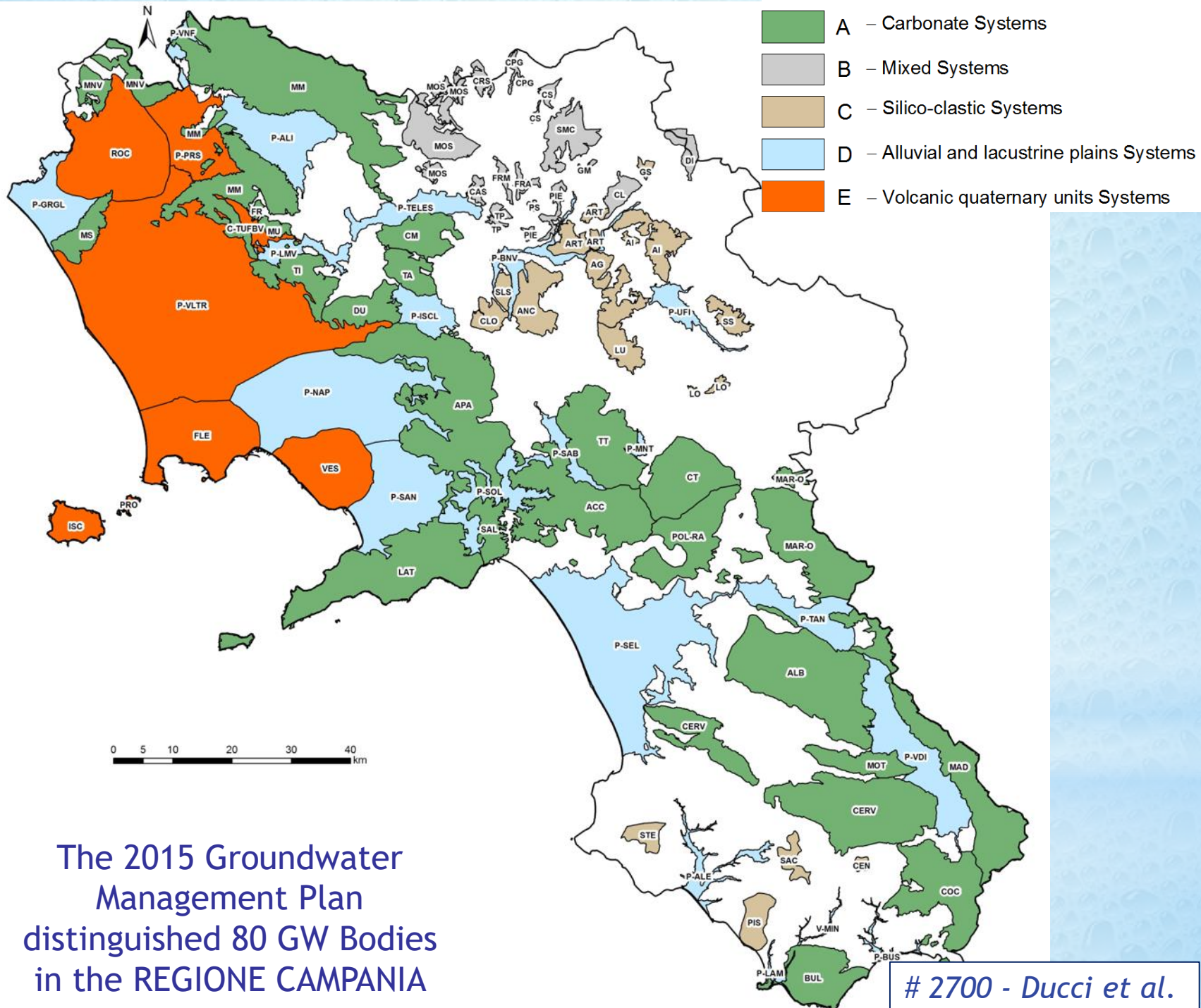
Corine Land Cover 2006



Corine land cover 2006 - Campania

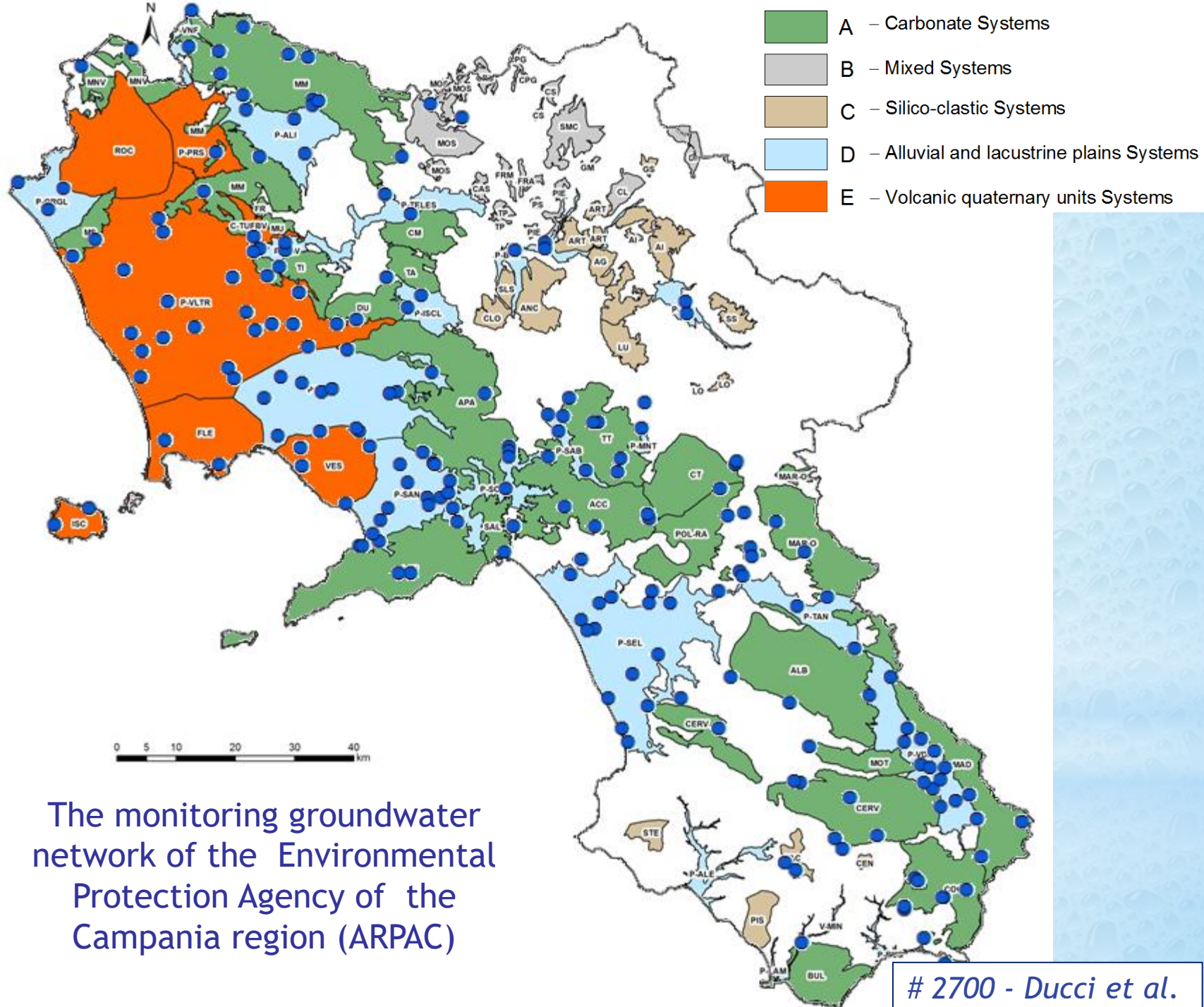
Legend

- Water bodies
- Agricultural areas
- Forest and semi natural areas
- Artificial surfaces
- Wetlands

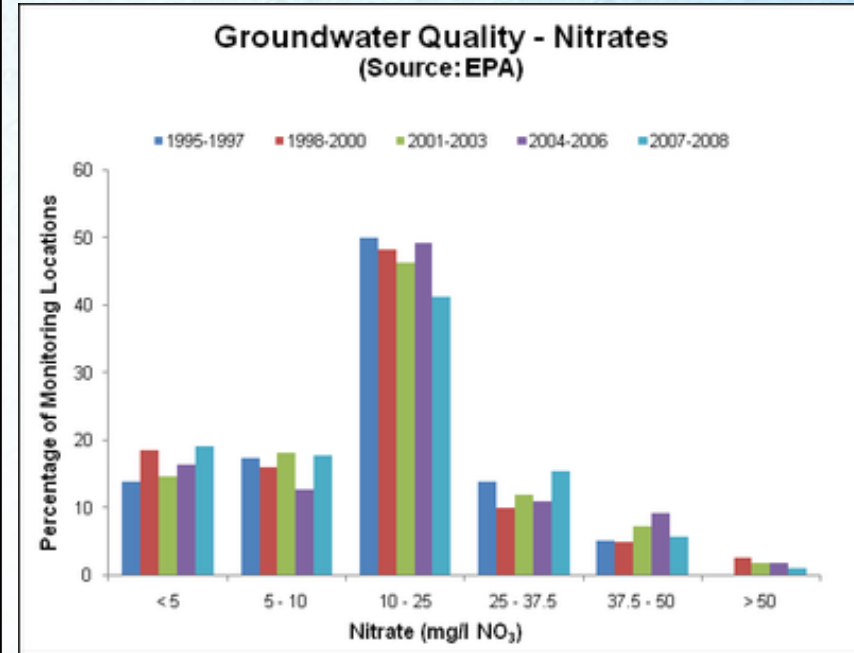
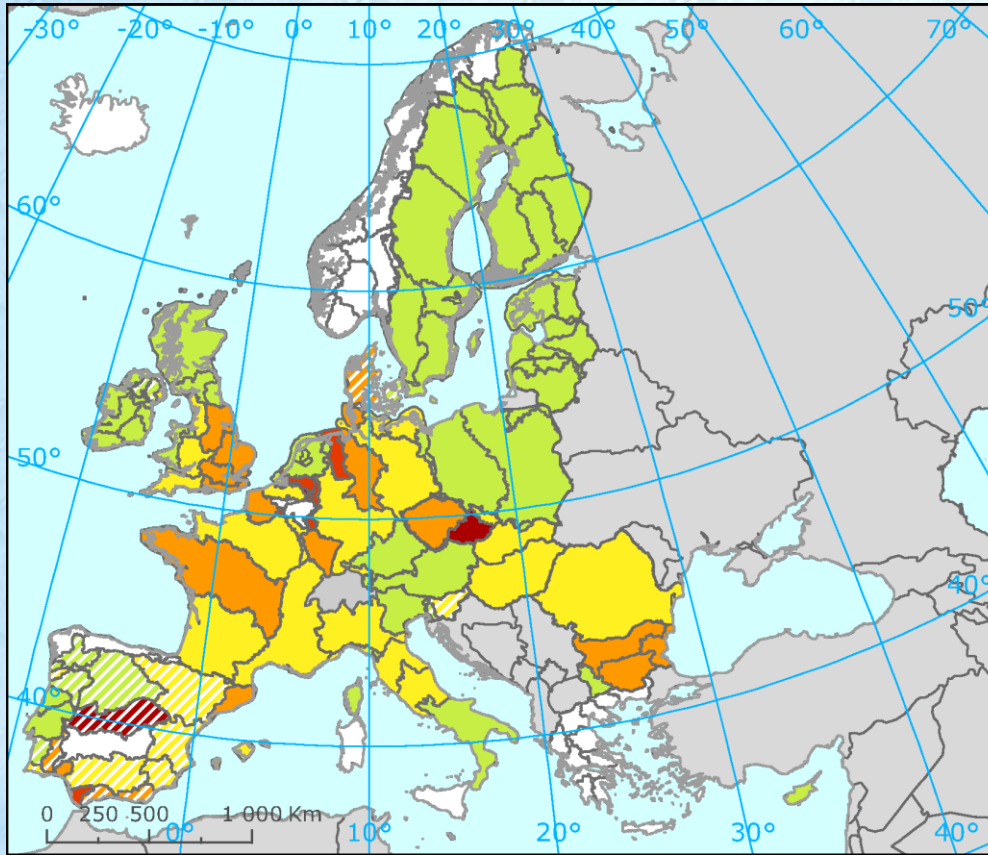


The 2015 Groundwater Management Plan distinguished 80 GW Bodies in the REGIONE CAMPANIA

2700 - Ducci et al.



Groundwater contamination by nitrates in the world



Percent of classified groundwater bodies with poor chemical status due to nitrates

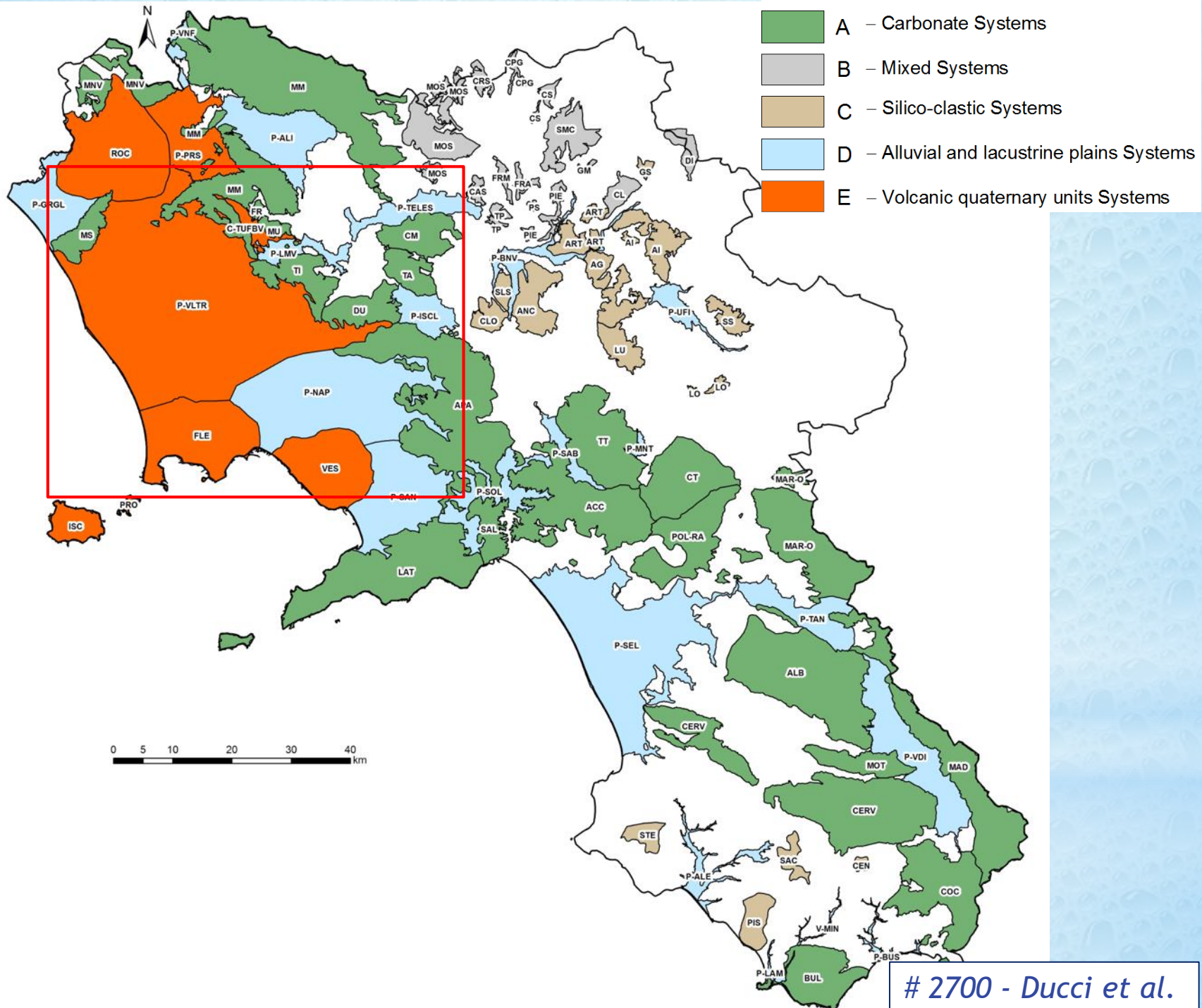


RBDs with unknown area of groundwater bodies (count instead of area used) are hatched

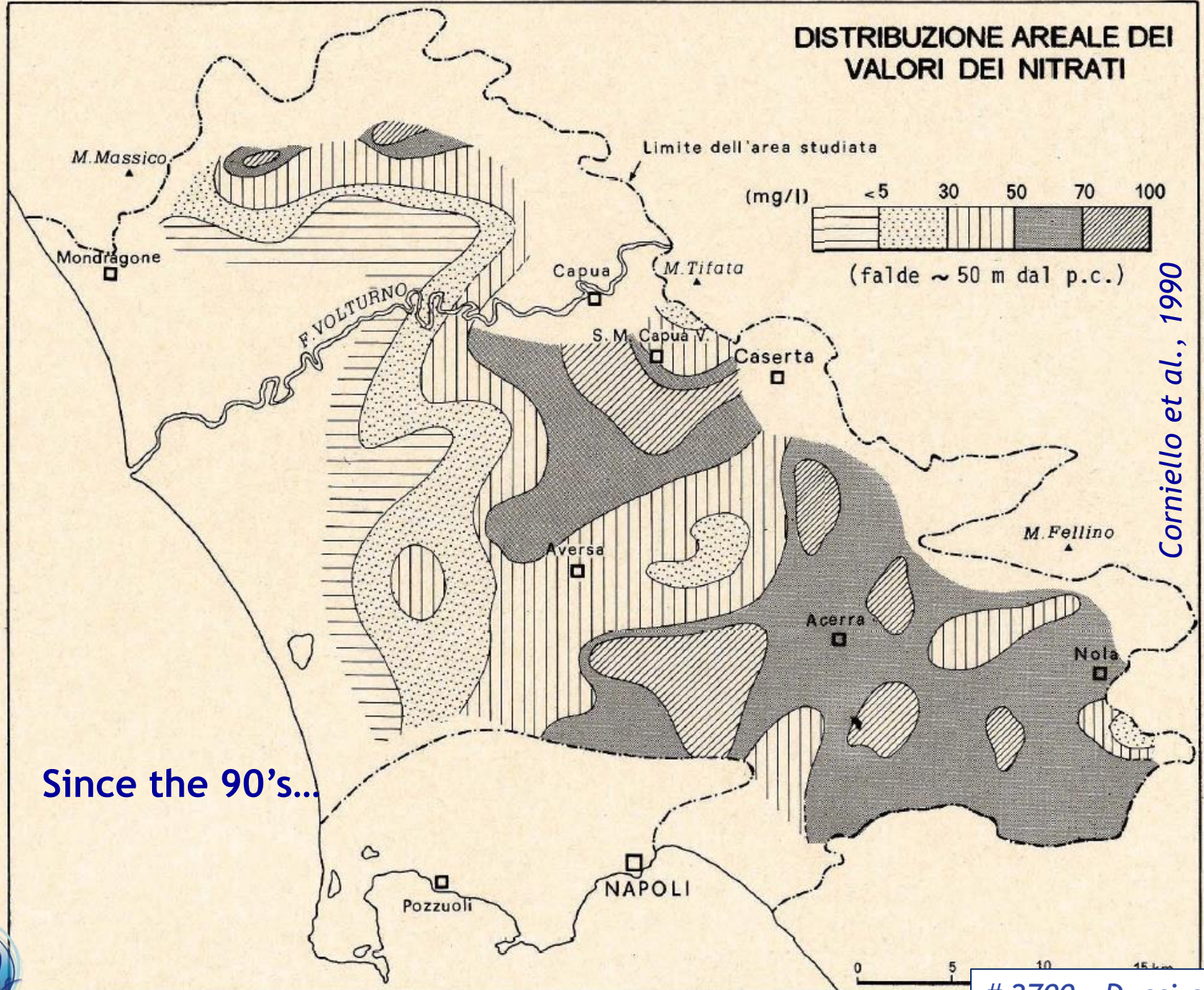


what knowledge we have in Campania Region about Nitrates in groundwater?

2700 - Ducci et al.



DISTRIBUZIONE AREALE DEI VALORI DEI NITRATI



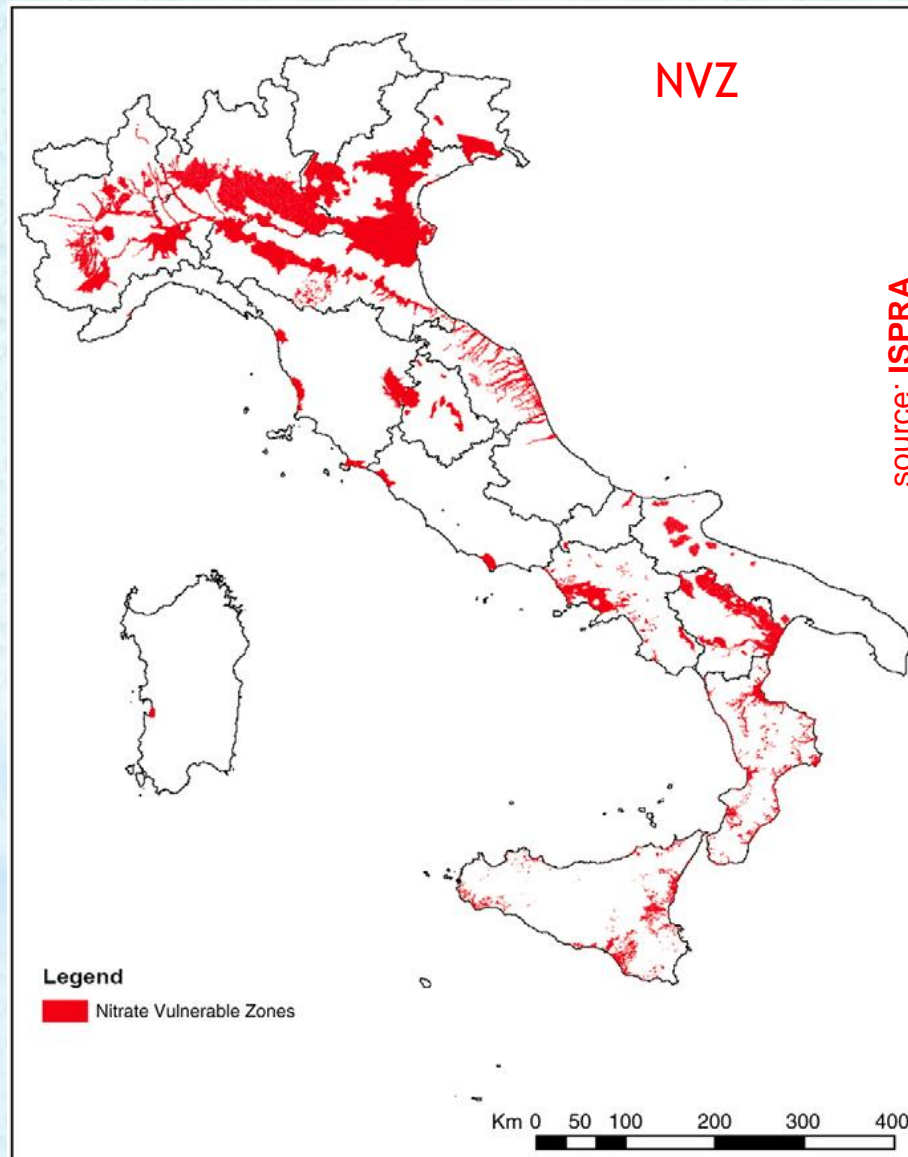
Corniello et al., 1990

Since the 90's...

2700 - Ducci et al.



Nitrates vulnerable zones NVZ in Campania Region

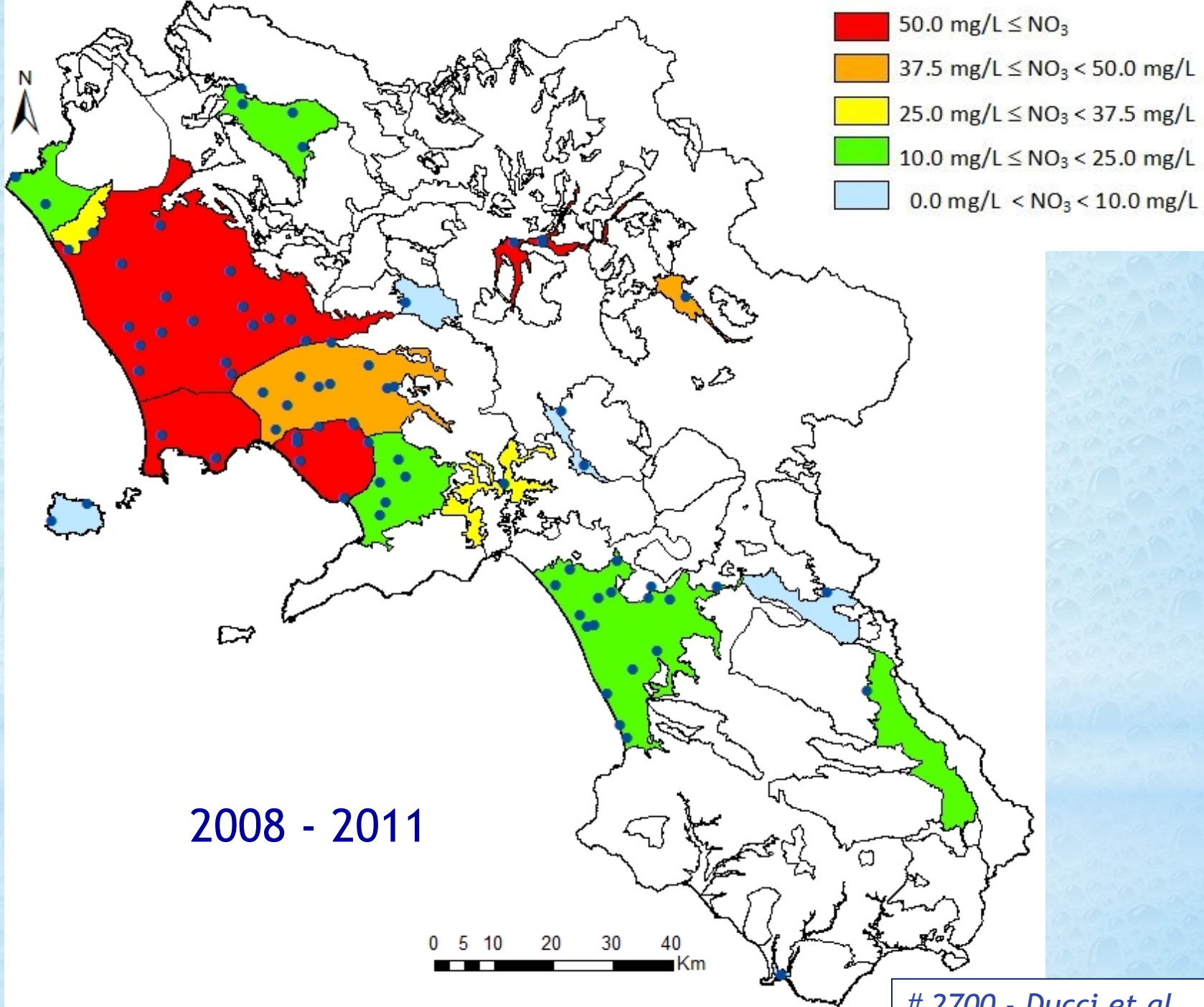


february 2003

Present knowledge in Campania Region about nitrates in groundwater

- At regional scale
- At GW body scale
- At GW well scale

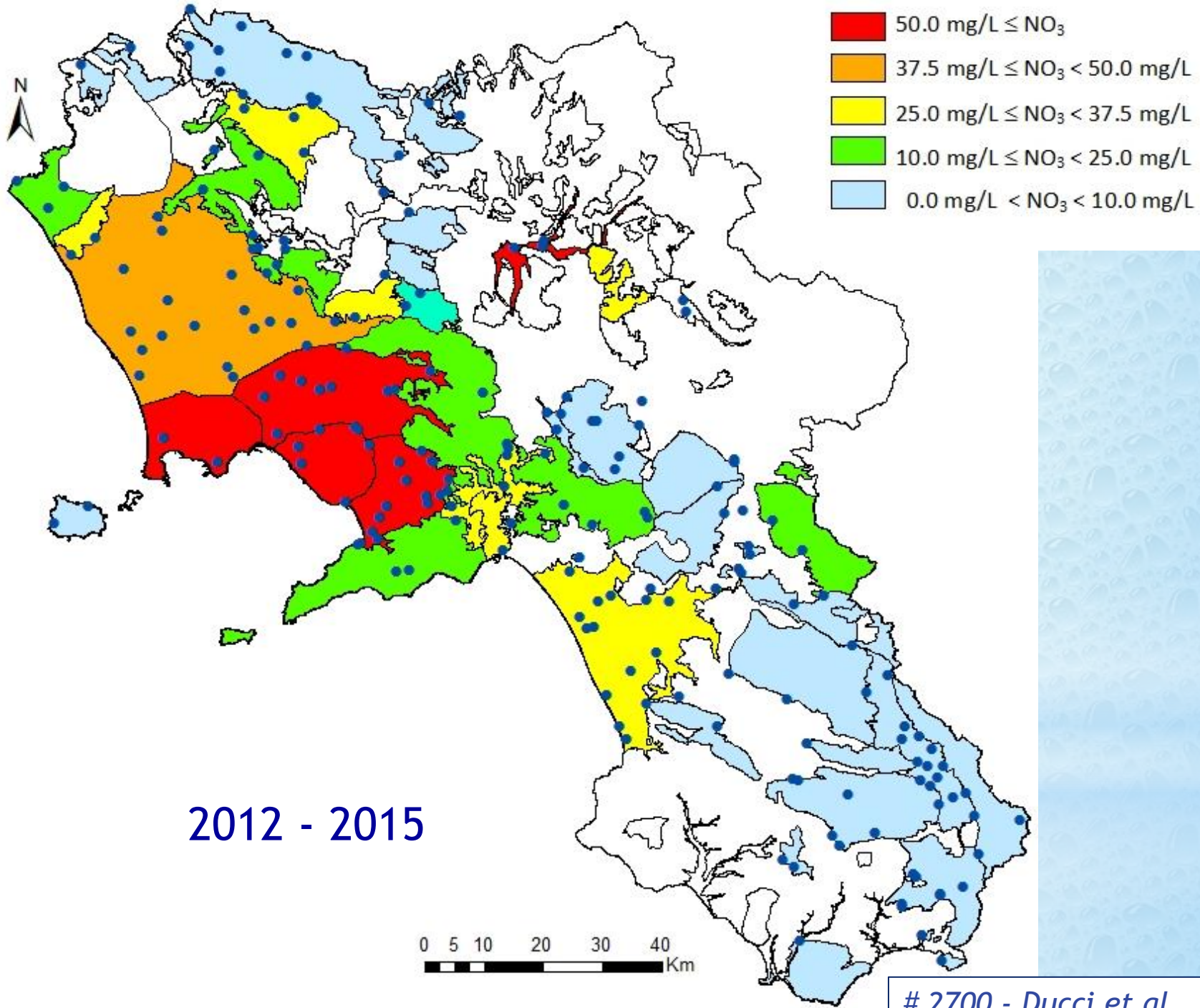
regional scale



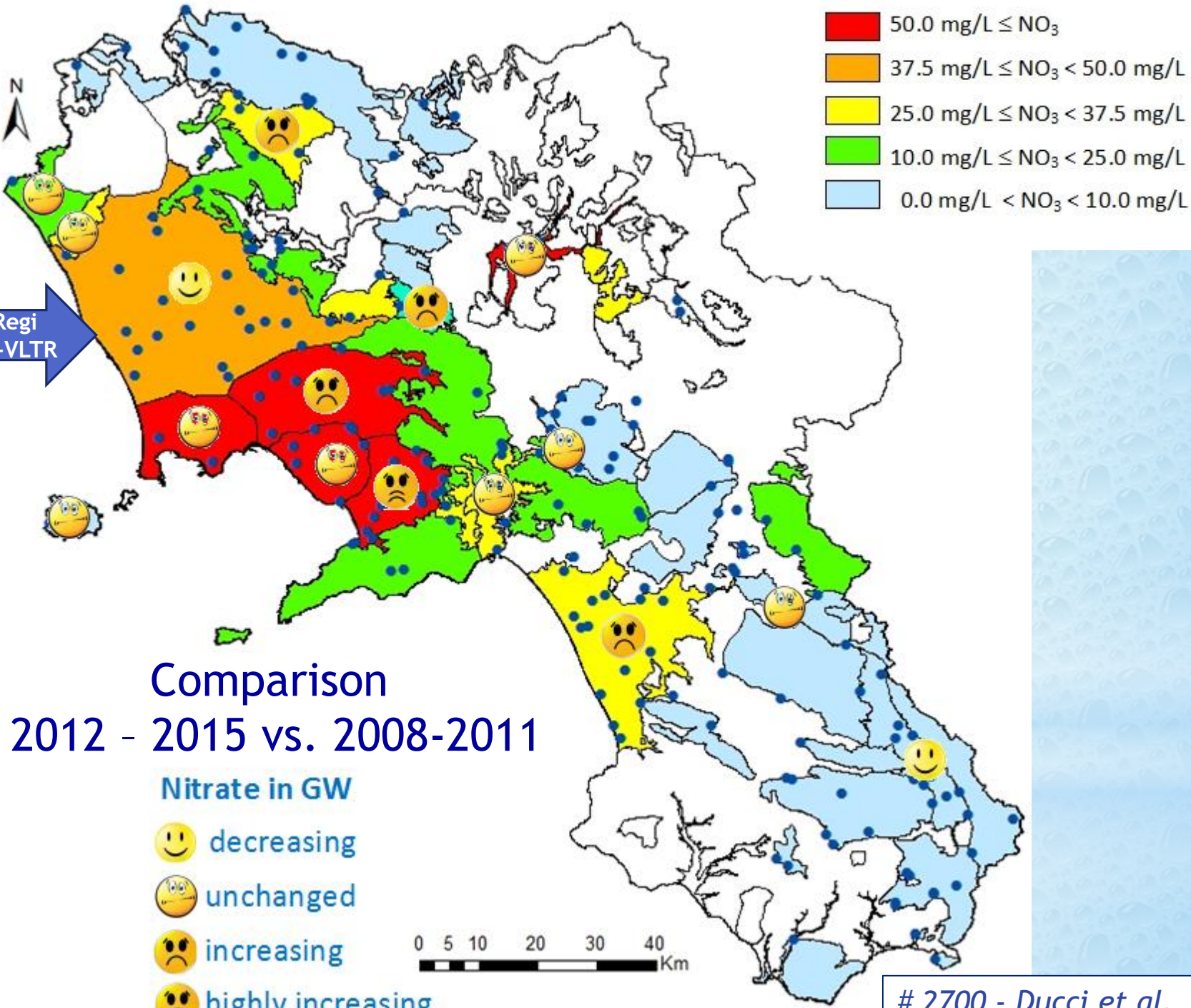
2700 - Ducci et al.



regional scale



regional scale

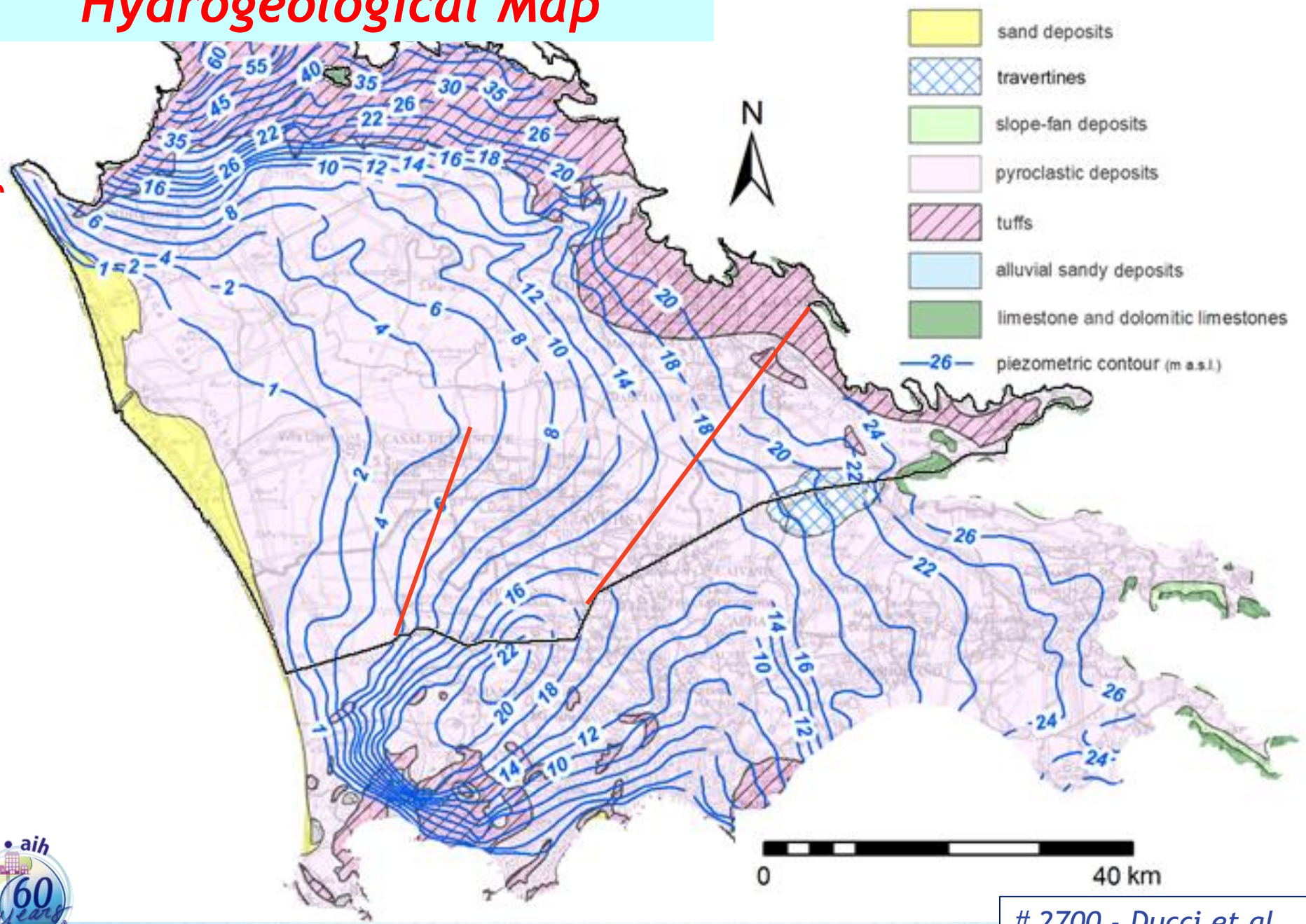


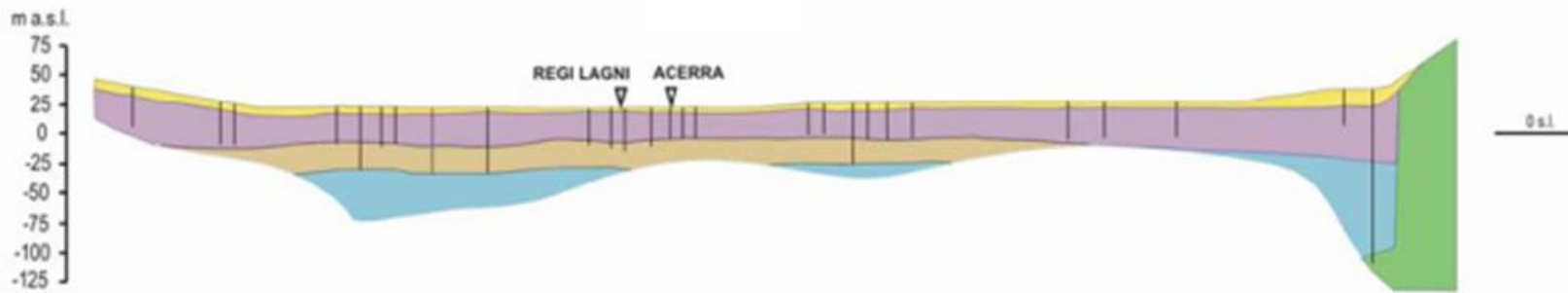
2700 - Ducci et al.



Hydrogeological Map

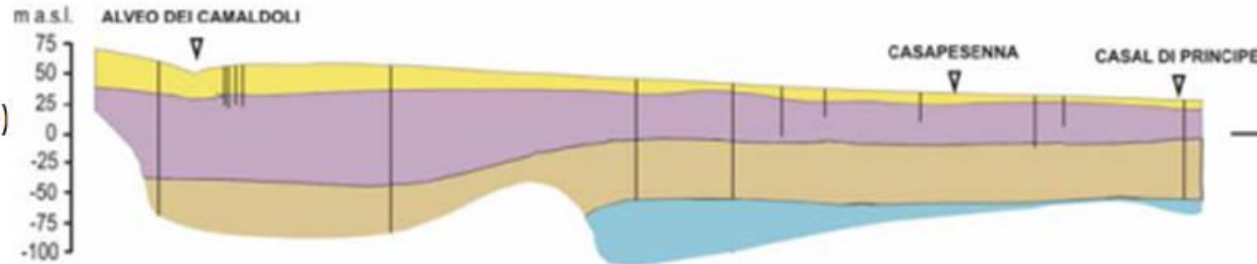
GW body scale





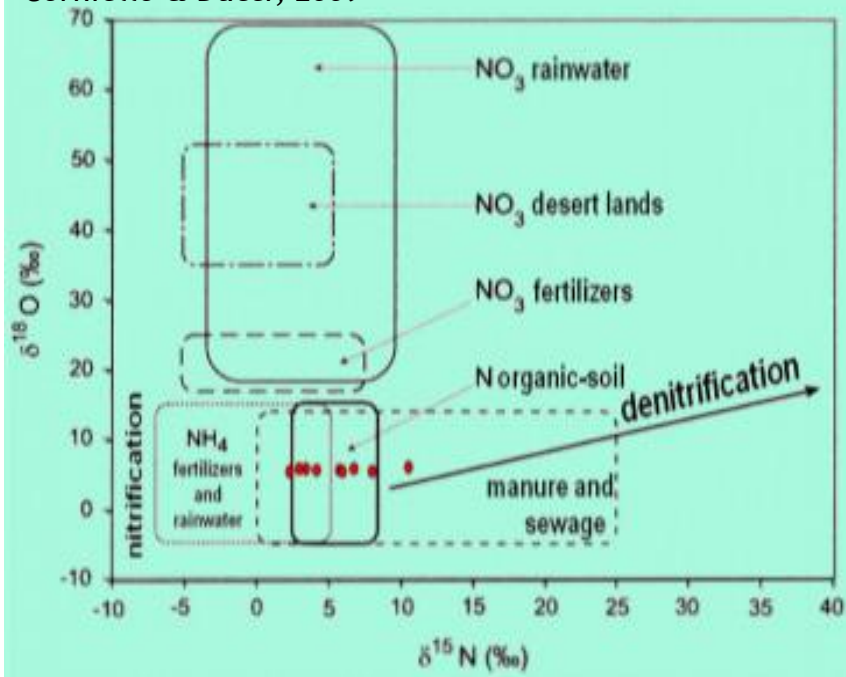
boreholes

- pyroclastics (a) and alluvial deposits (b) with peat levels (in black) — (Quaternary)
- Campanian Ignimbrite (39 ky B.P.)
- pyroclastics (Quaternary)
- old alluvial deposits (Plio-Pleistocene)
- arenaceous-clayey flysch (Miocene)
- limestone (Cretaceous)

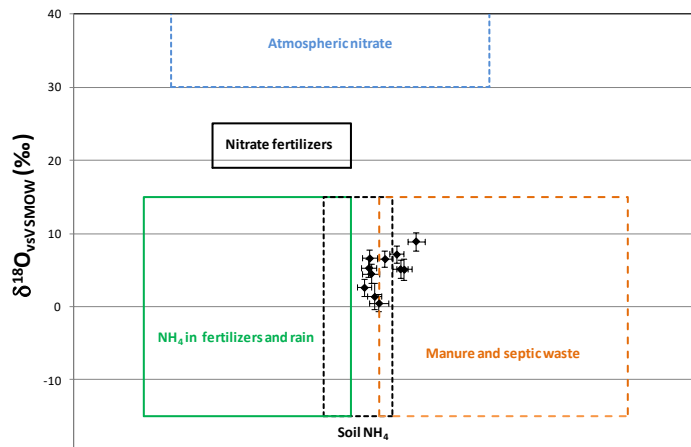


isotopic studies

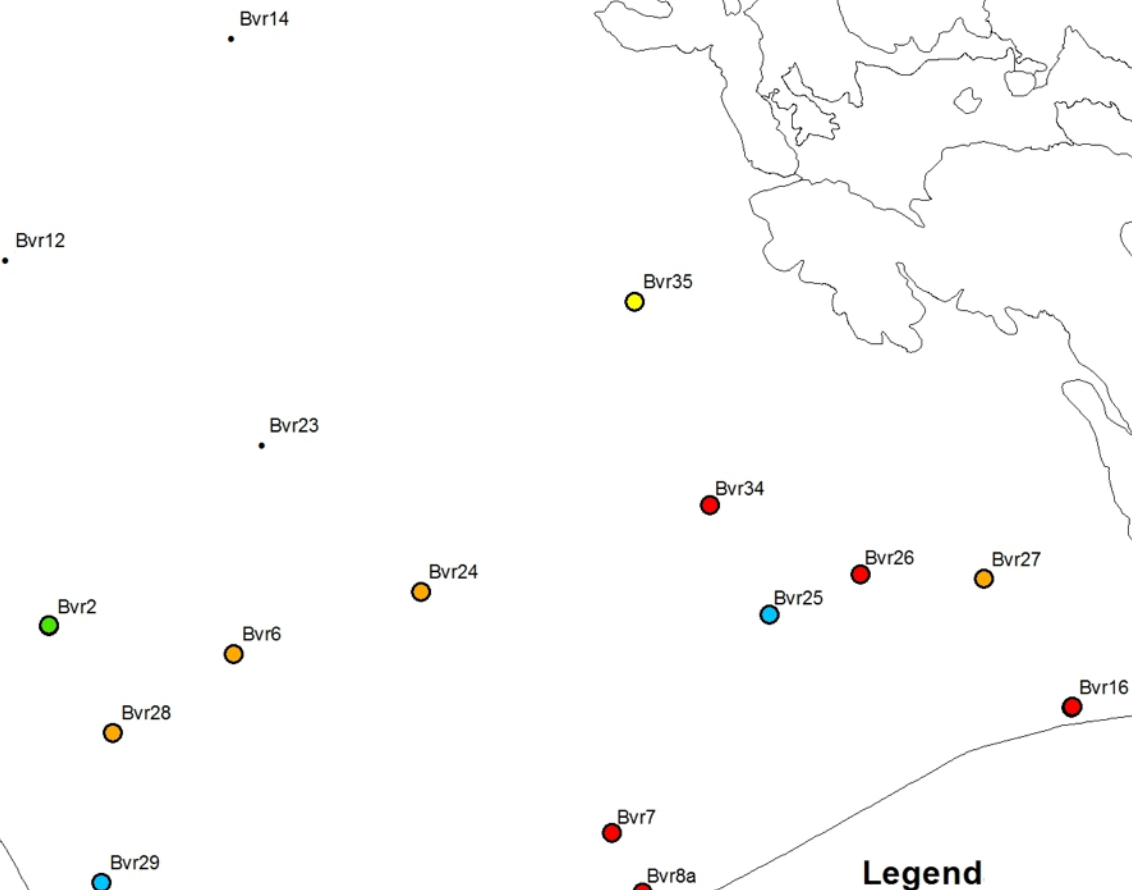
Corniello & Ducci, 2009



isotopic studies



2004 - 2007

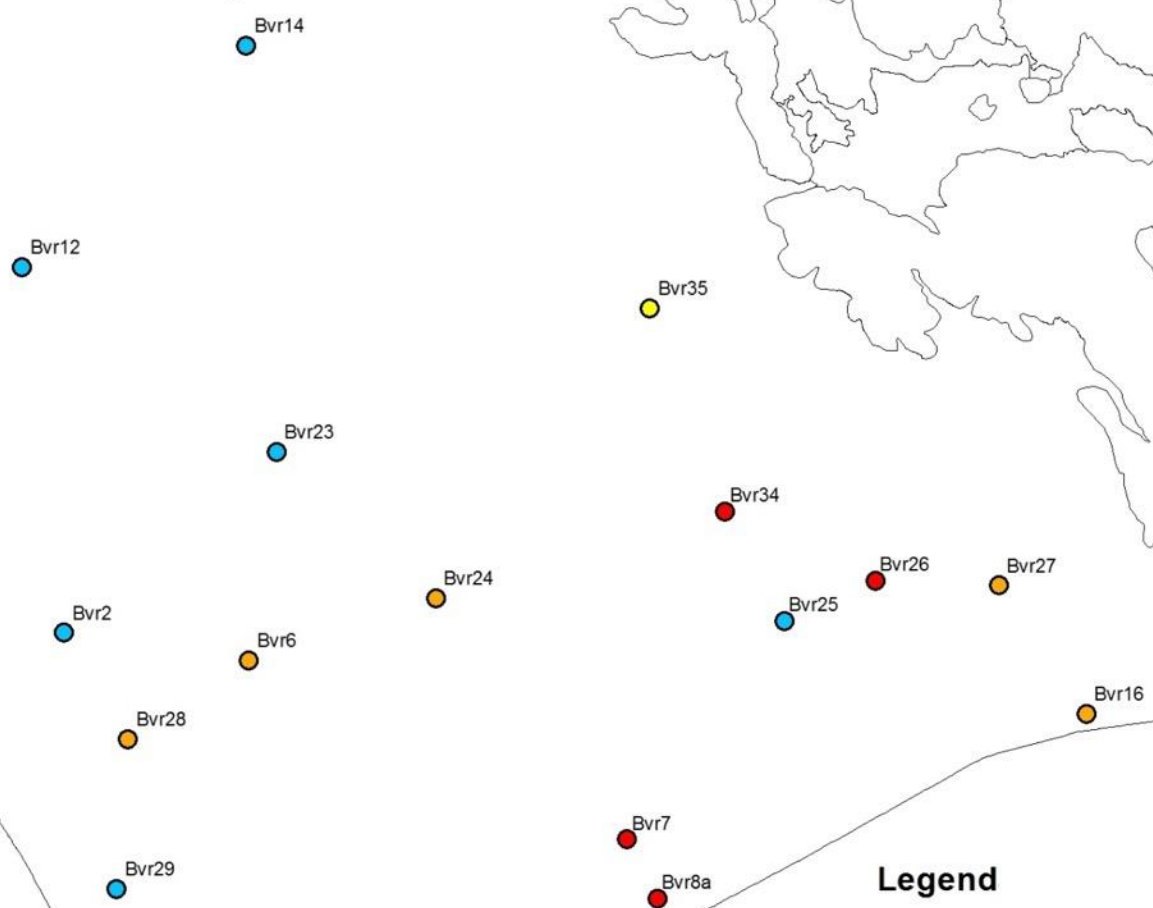


Legend

- 50.0 mg/L ≤ NO₃
- 37.5 mg/L ≤ NO₃ < 50.0 mg/L
- 25.0 mg/L ≤ NO₃ < 37.5 mg/L
- 10.0 mg/L ≤ NO₃ < 25.0 mg/L
- 0.0 mg/L < NO₃ < 10.0 mg/L

2700 - Ducci et al.

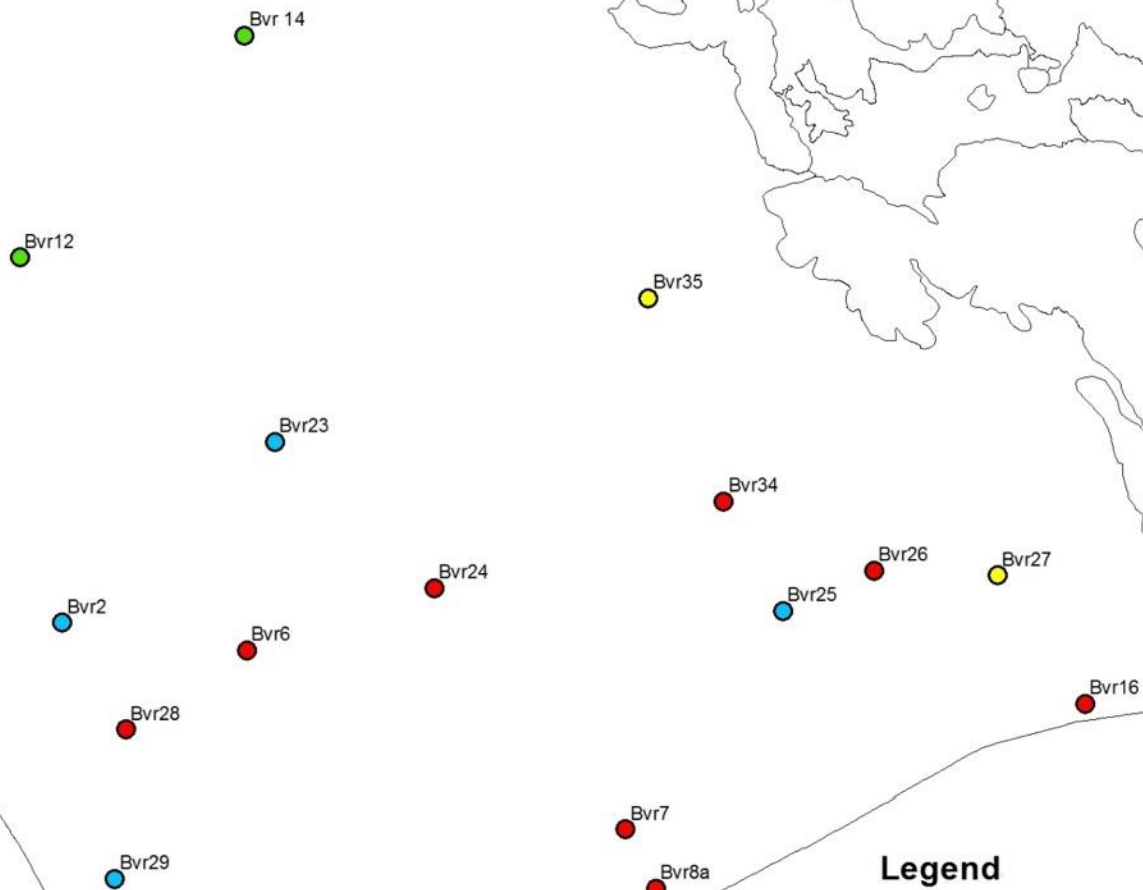
2008 - 2011



Legend

- 50.0 mg/L ≤ NO₃
- 37.5 mg/L ≤ NO₃ < 50.0 mg/L
- 25.0 mg/L ≤ NO₃ < 37.5 mg/L
- 10.0 mg/L ≤ NO₃ < 25.0 mg/L
- 0.0 mg/L < NO₃ < 10.0 mg/L

2012 - 2015

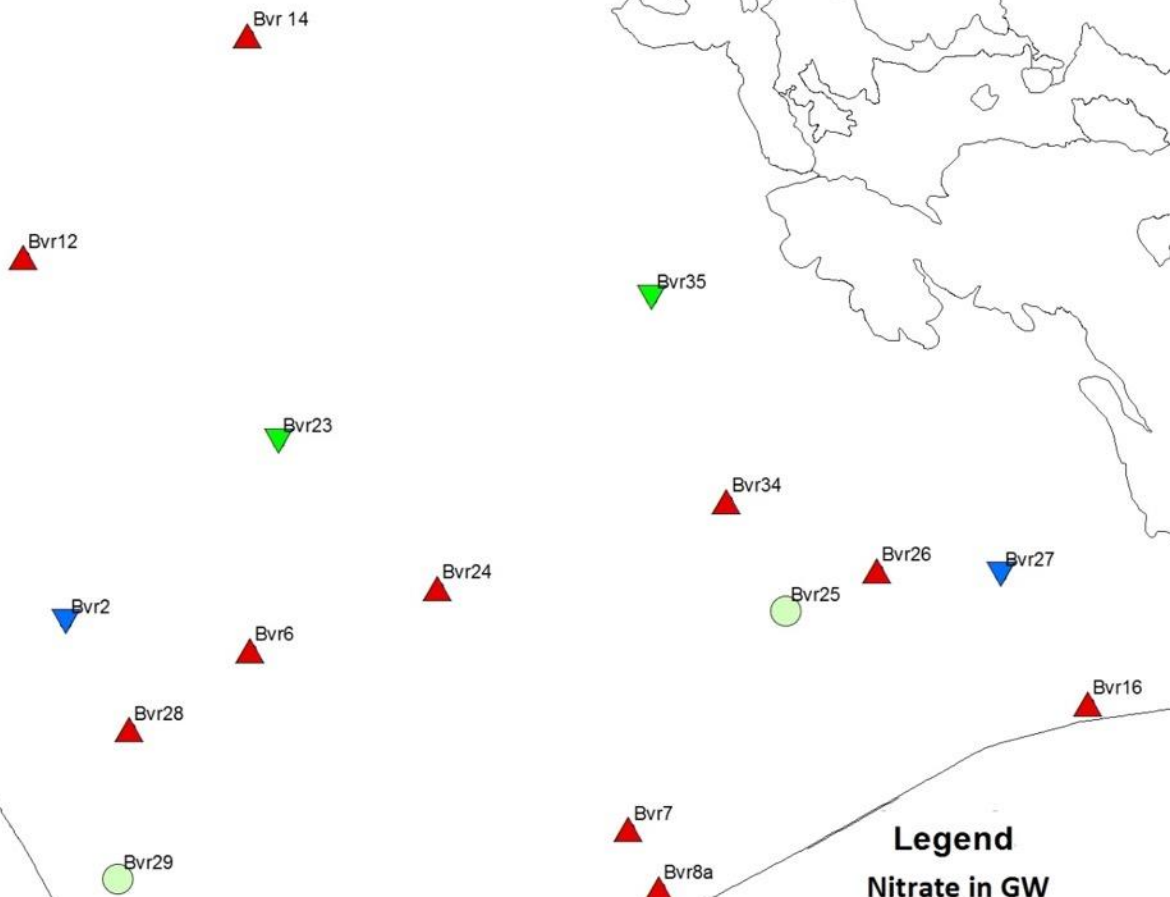


Legend

- 50.0 mg/L ≤ NO₃
- 37.5 mg/L ≤ NO₃ < 50.0 mg/L
- 25.0 mg/L ≤ NO₃ < 37.5 mg/L
- 10.0 mg/L ≤ NO₃ < 25.0 mg/L
- 0.0 mg/L < NO₃ < 10.0 mg/L

2700 - Ducci et al.

Comparison
2012 - 2015
vs.
2008-2011



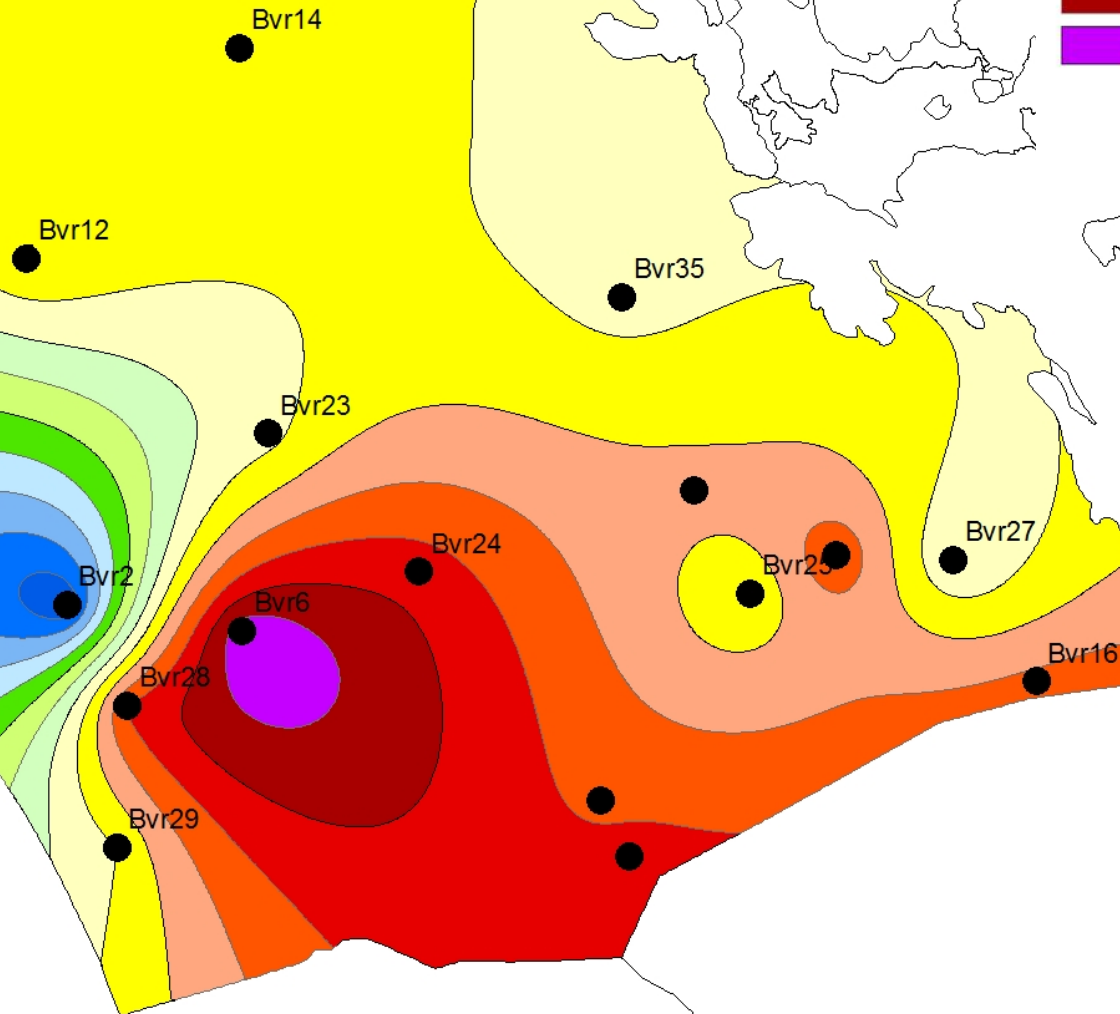
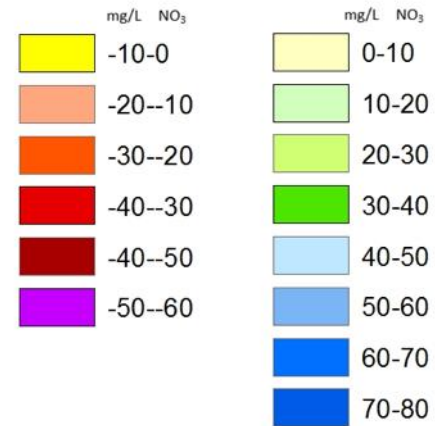
Legend

Nitrate in GW

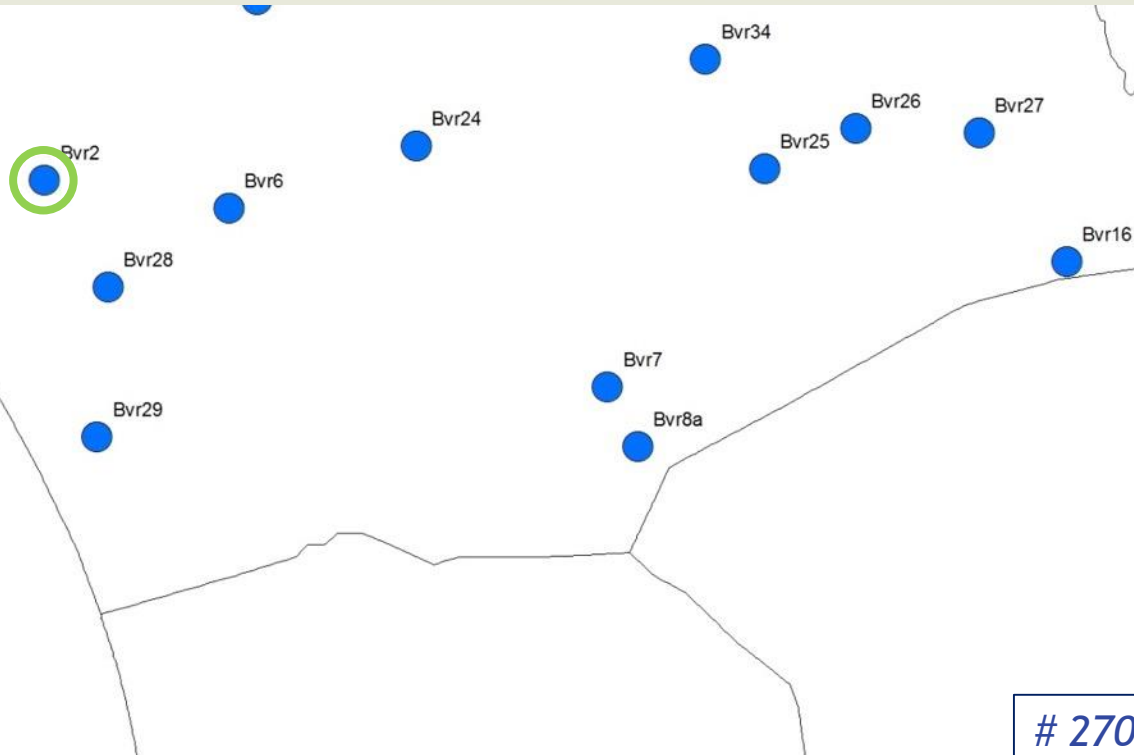
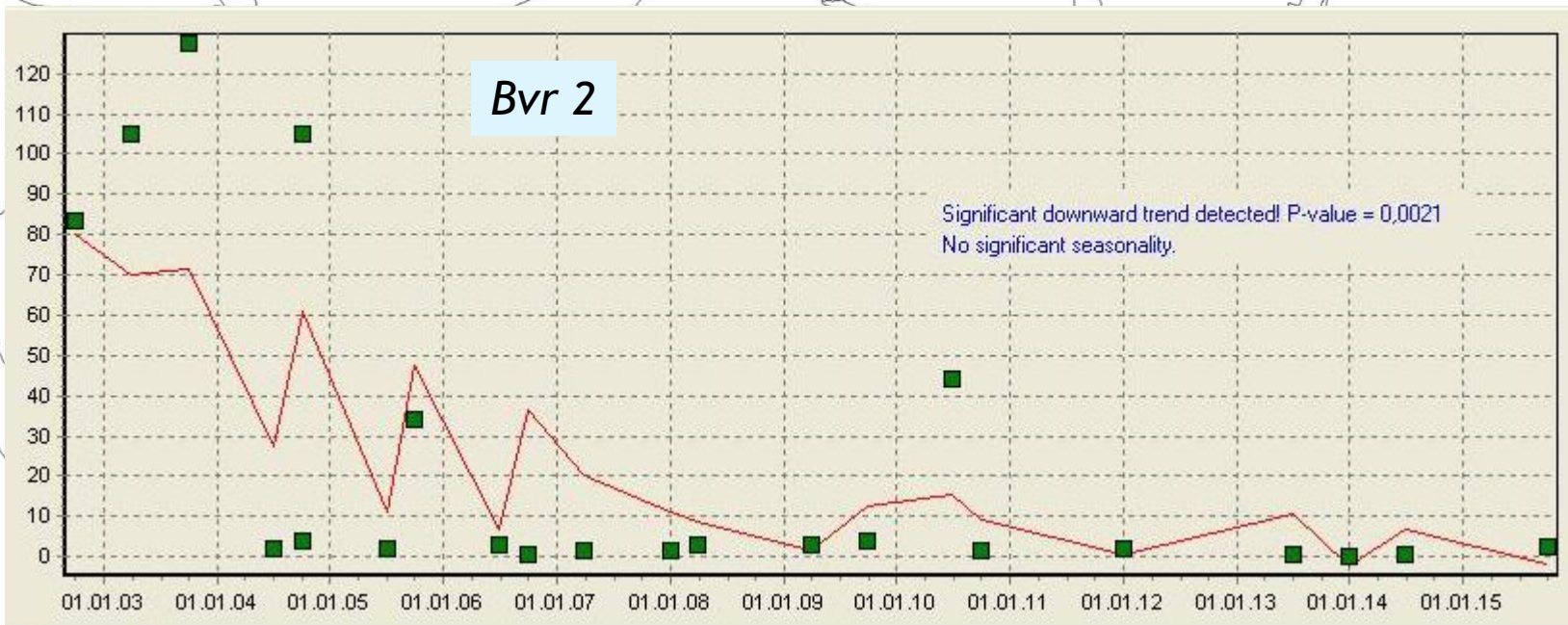
- ▲ increasing
- ▼ decreasing
- ▼ highly decreasing
- unchanged

GW body scale

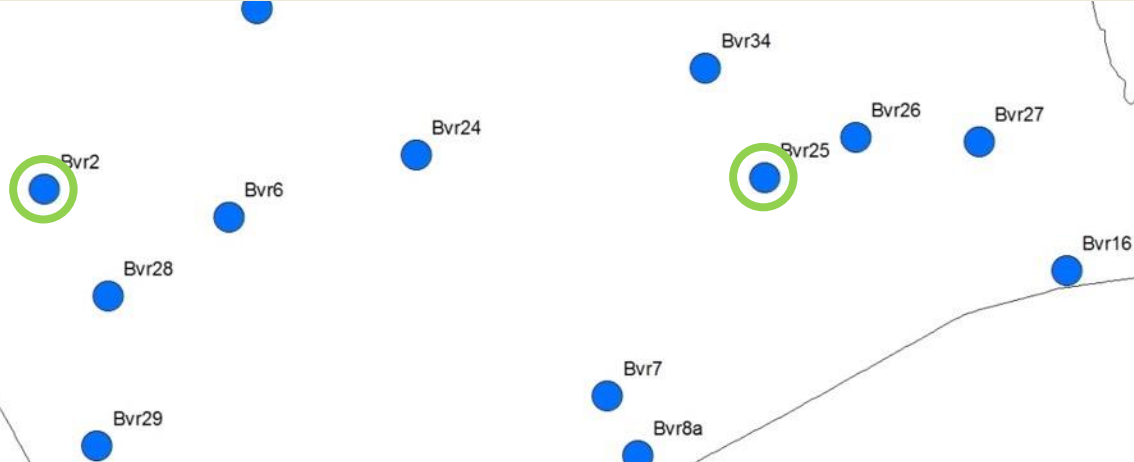
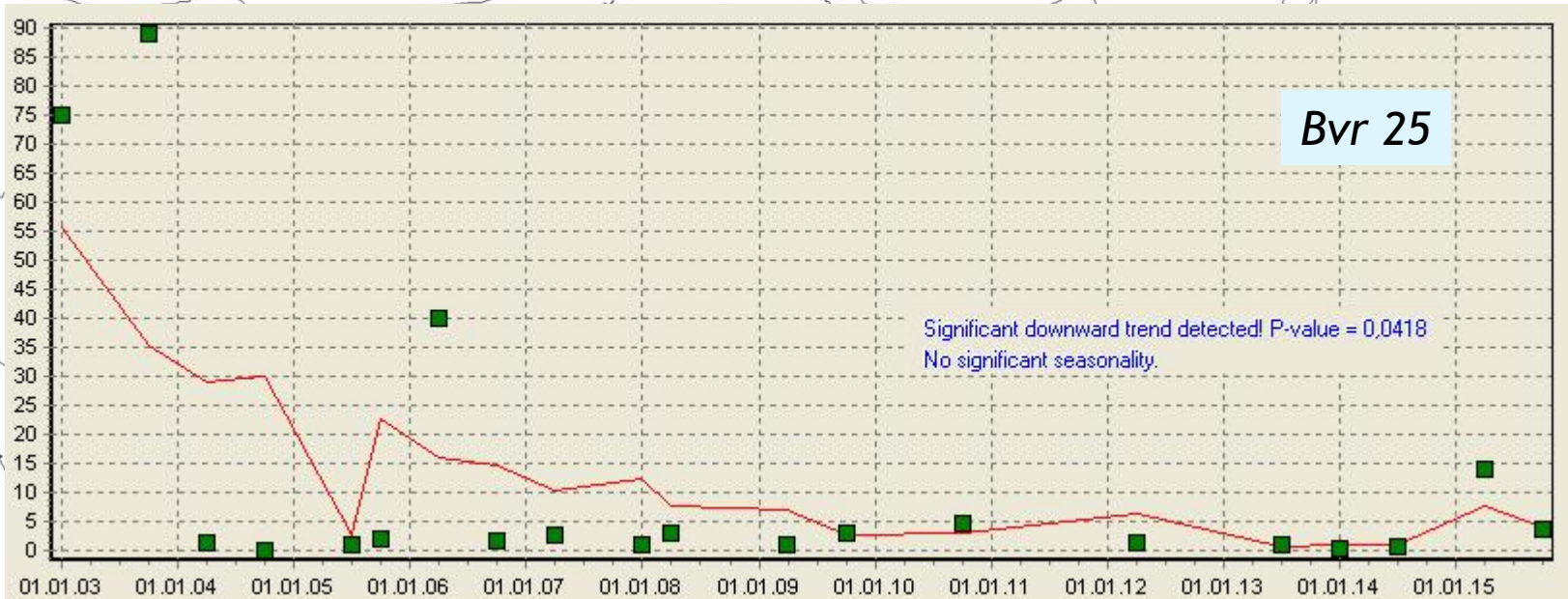
Comparison
2012 - 2015
vs.
2008-2011

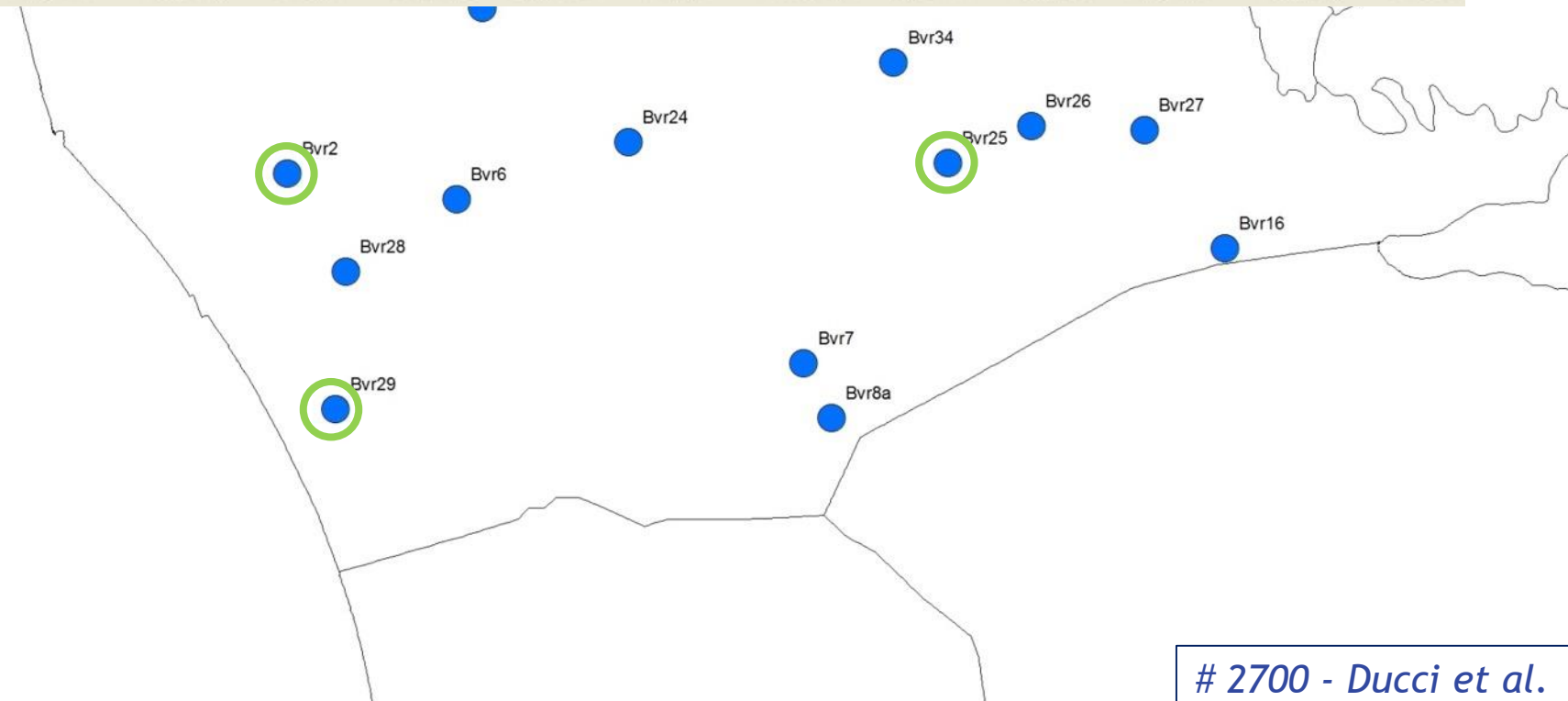
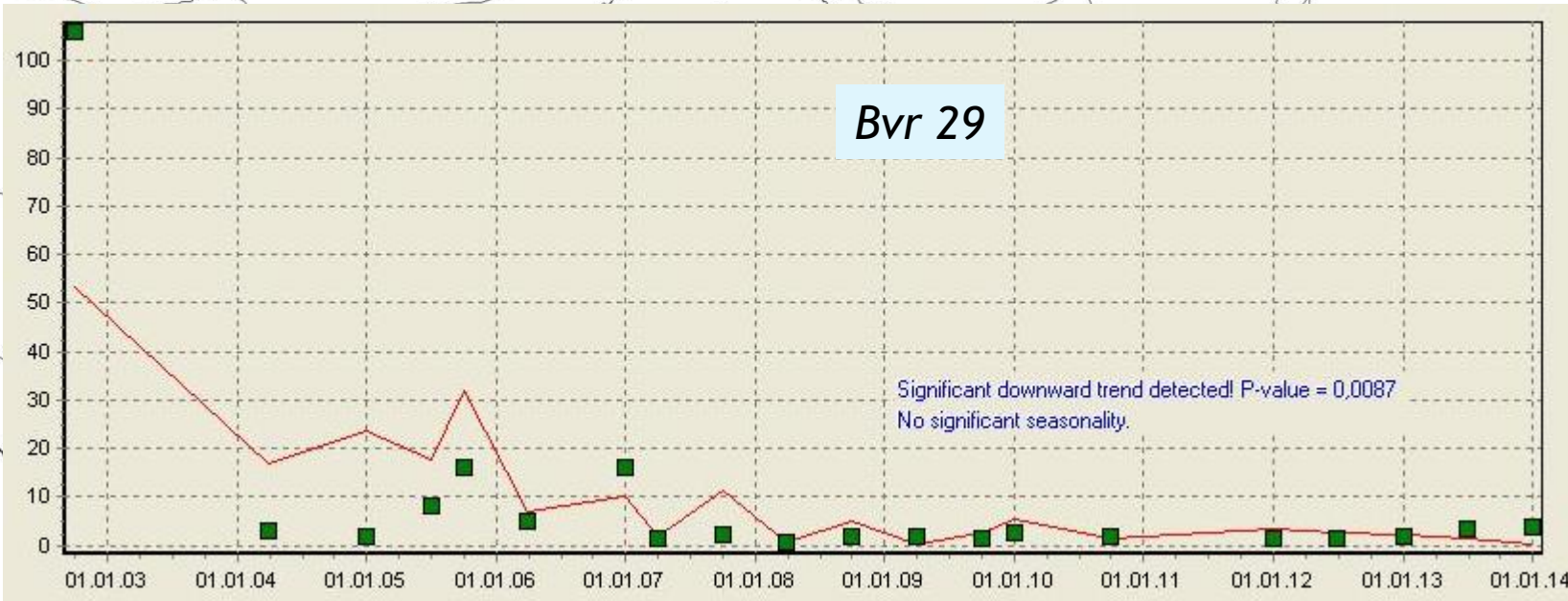


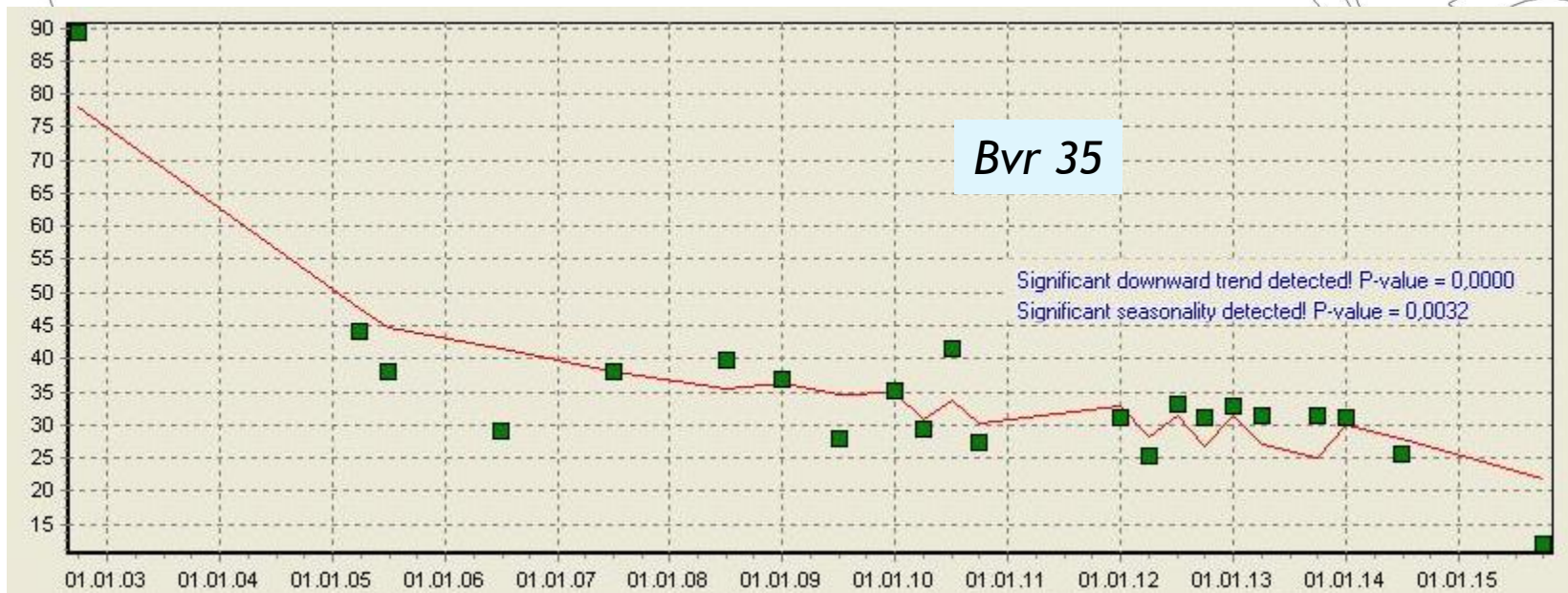
2700 - Ducci et al.

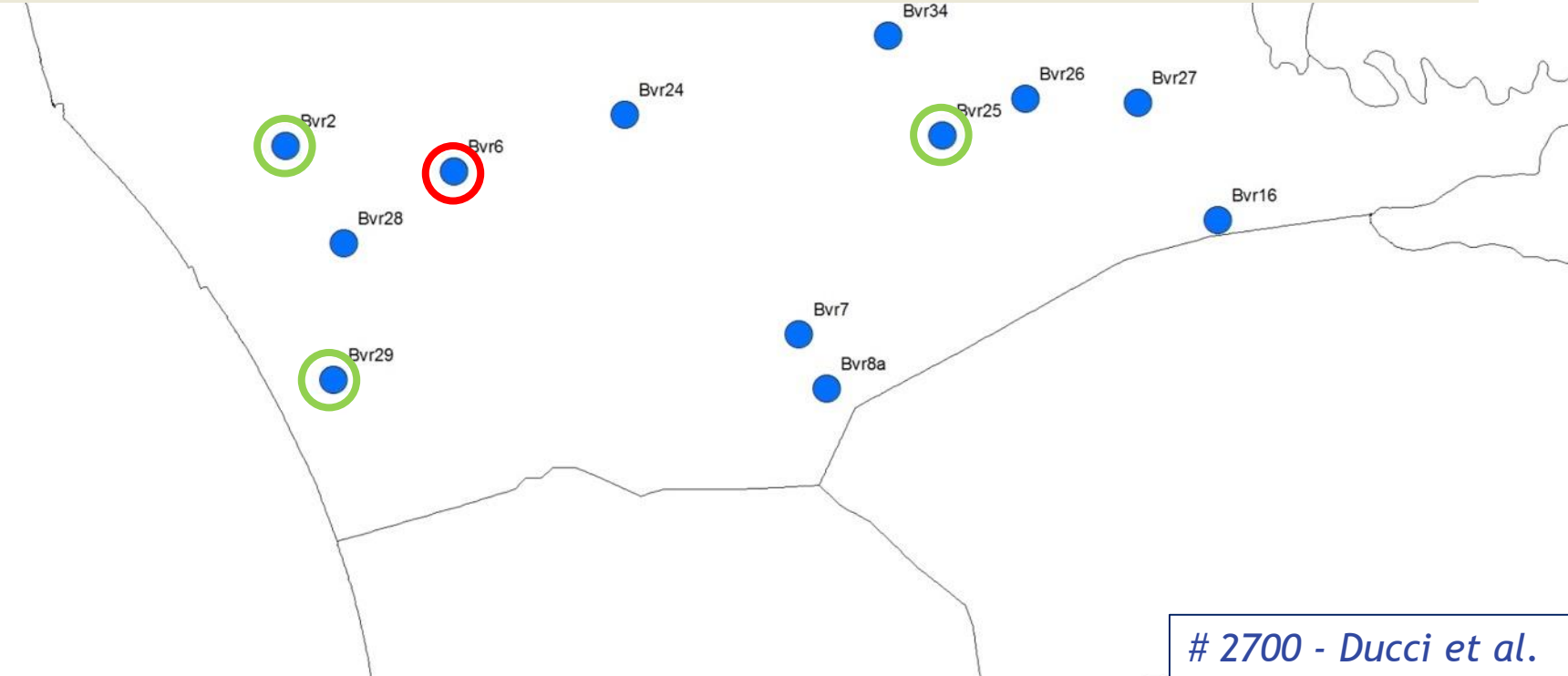
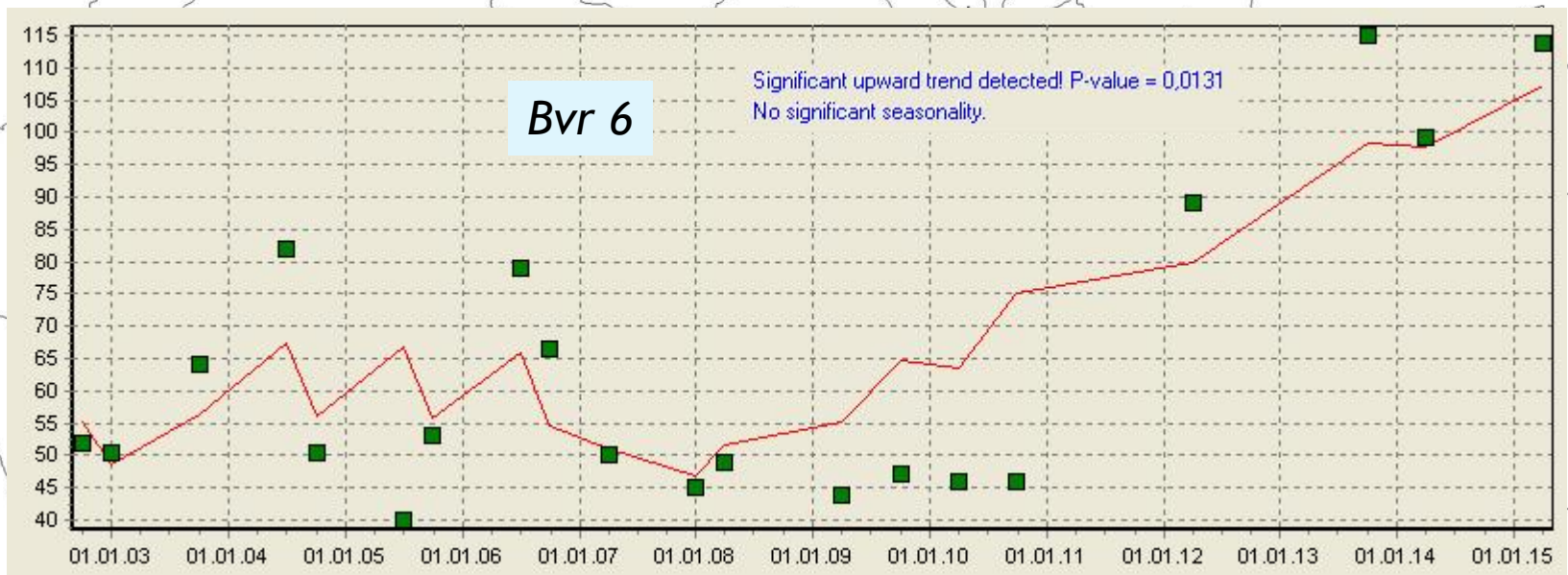


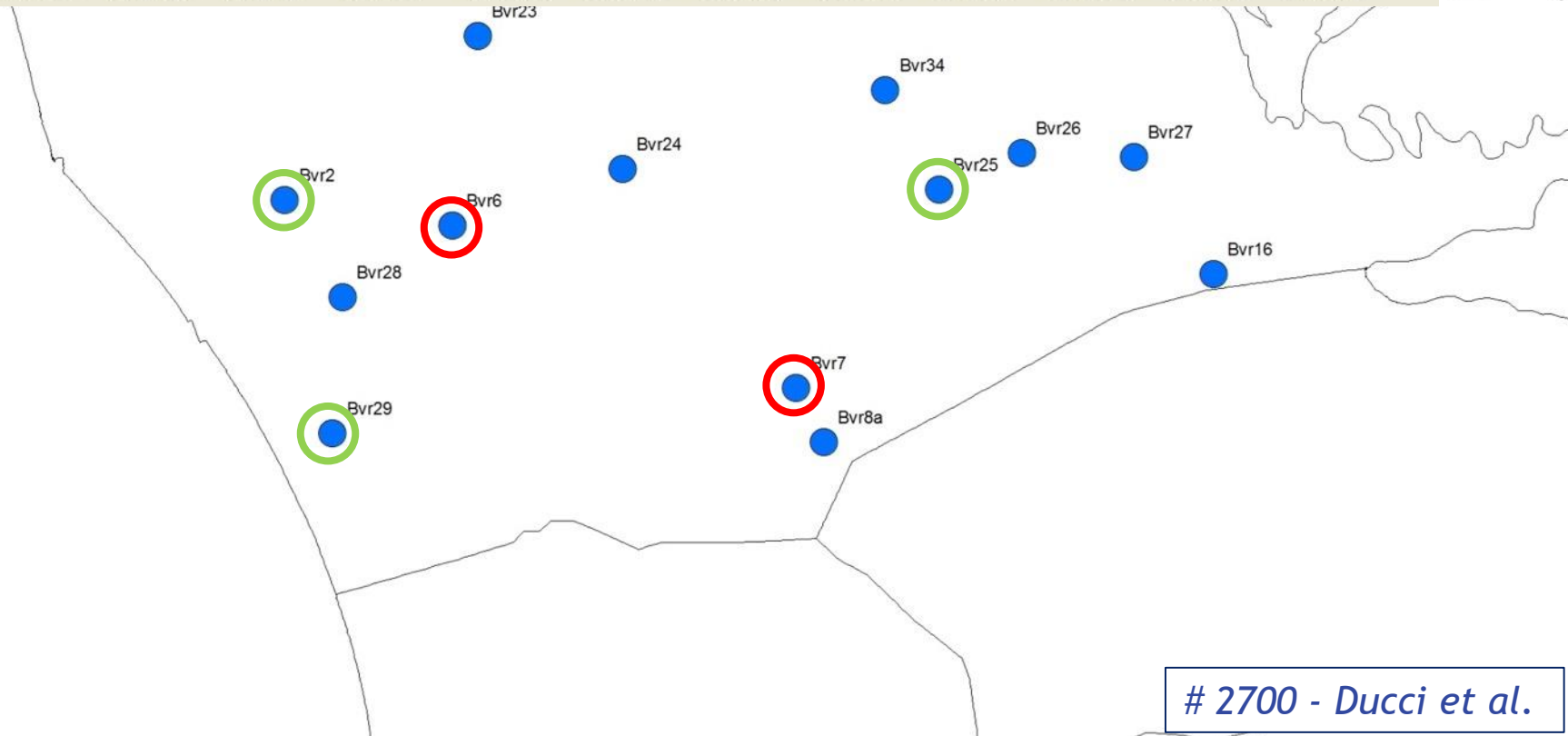
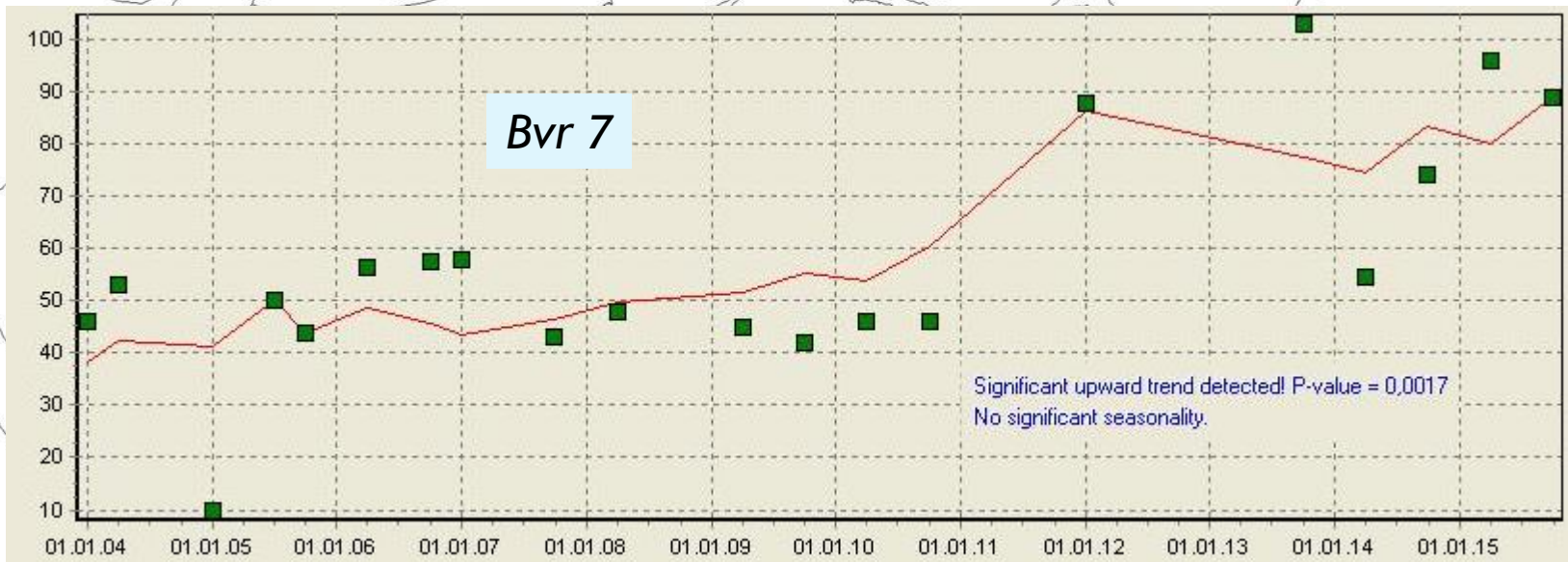
GW well scale



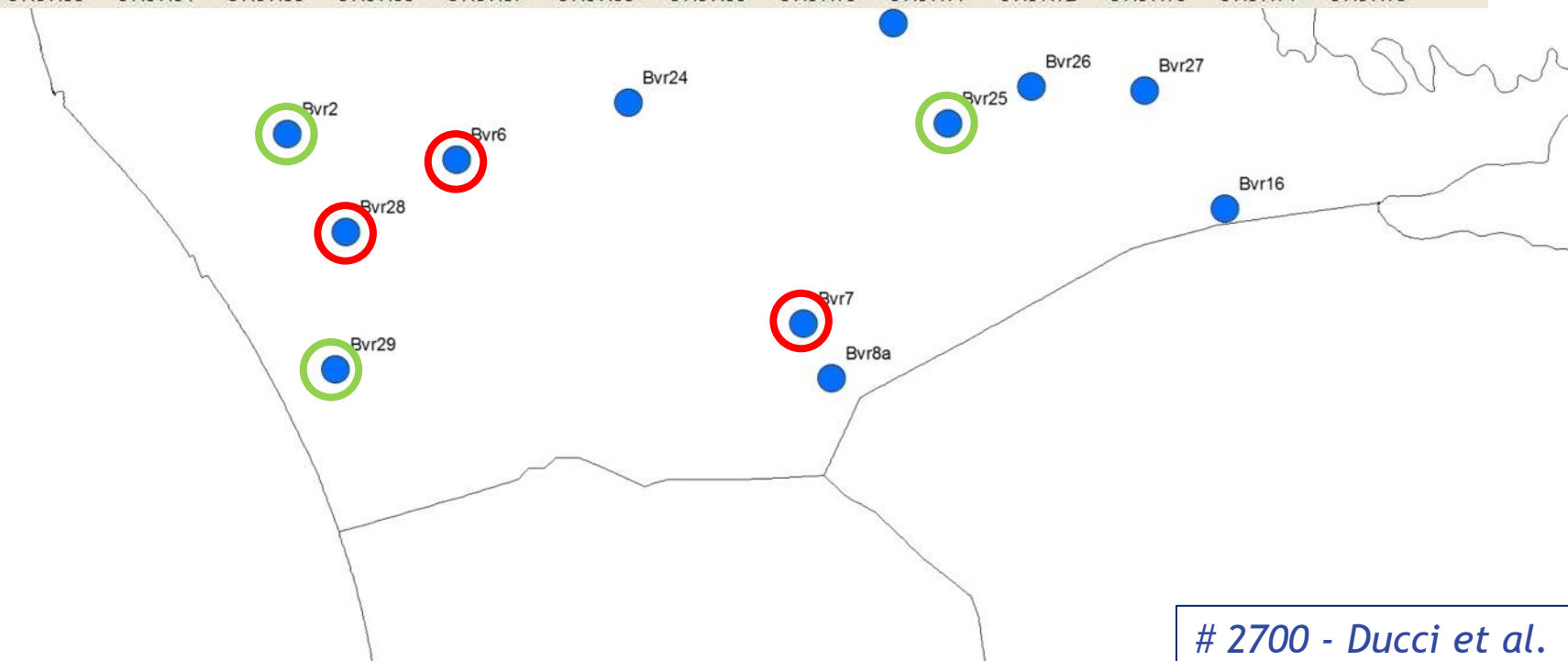
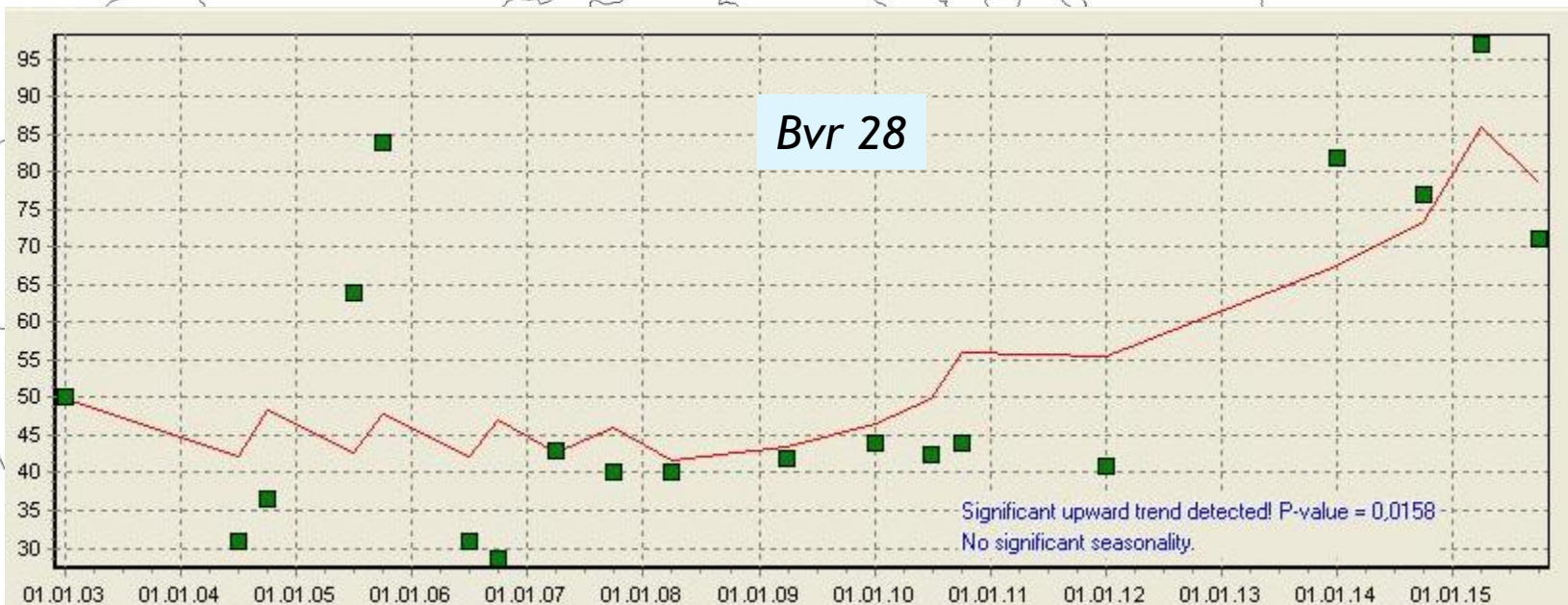




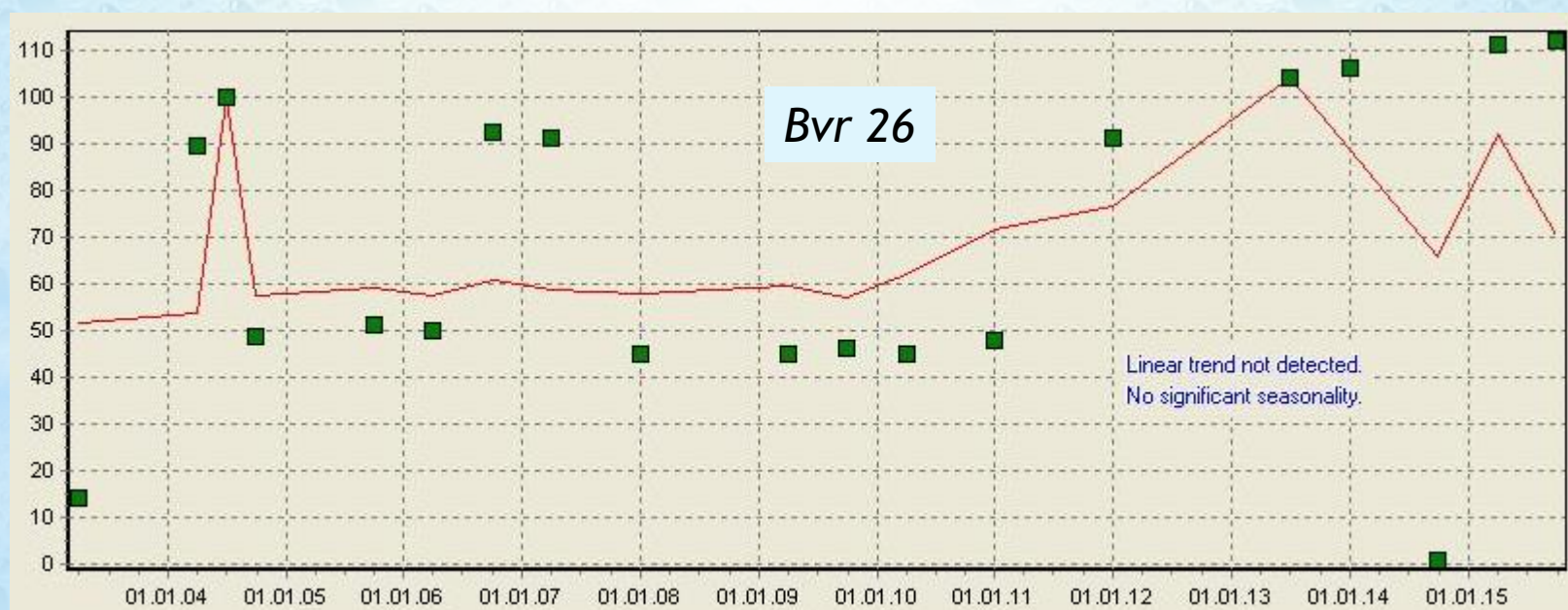
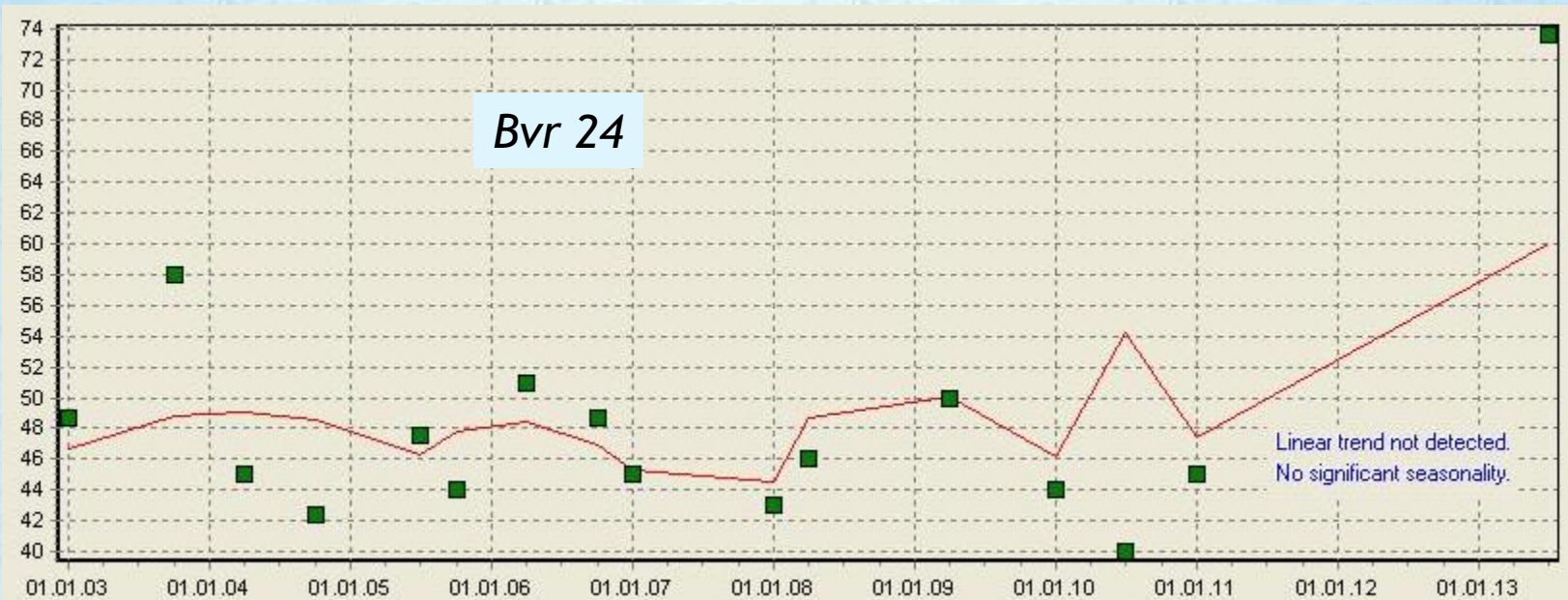


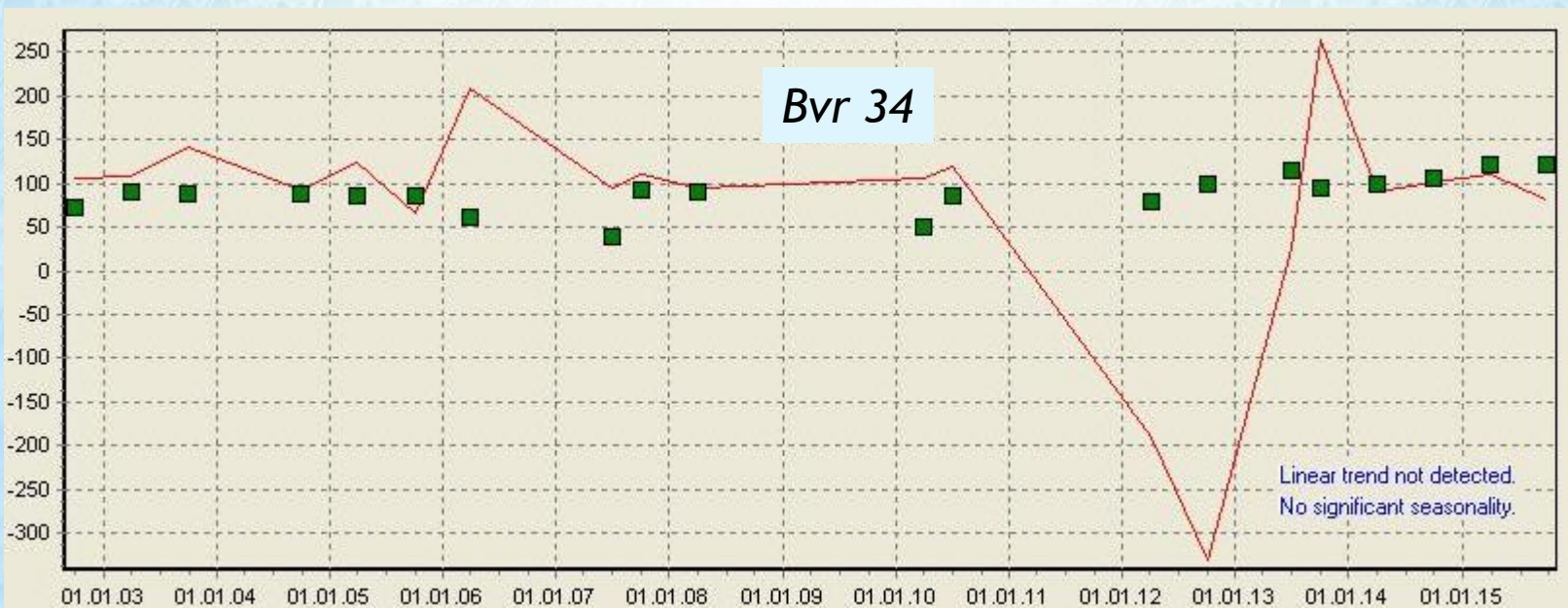
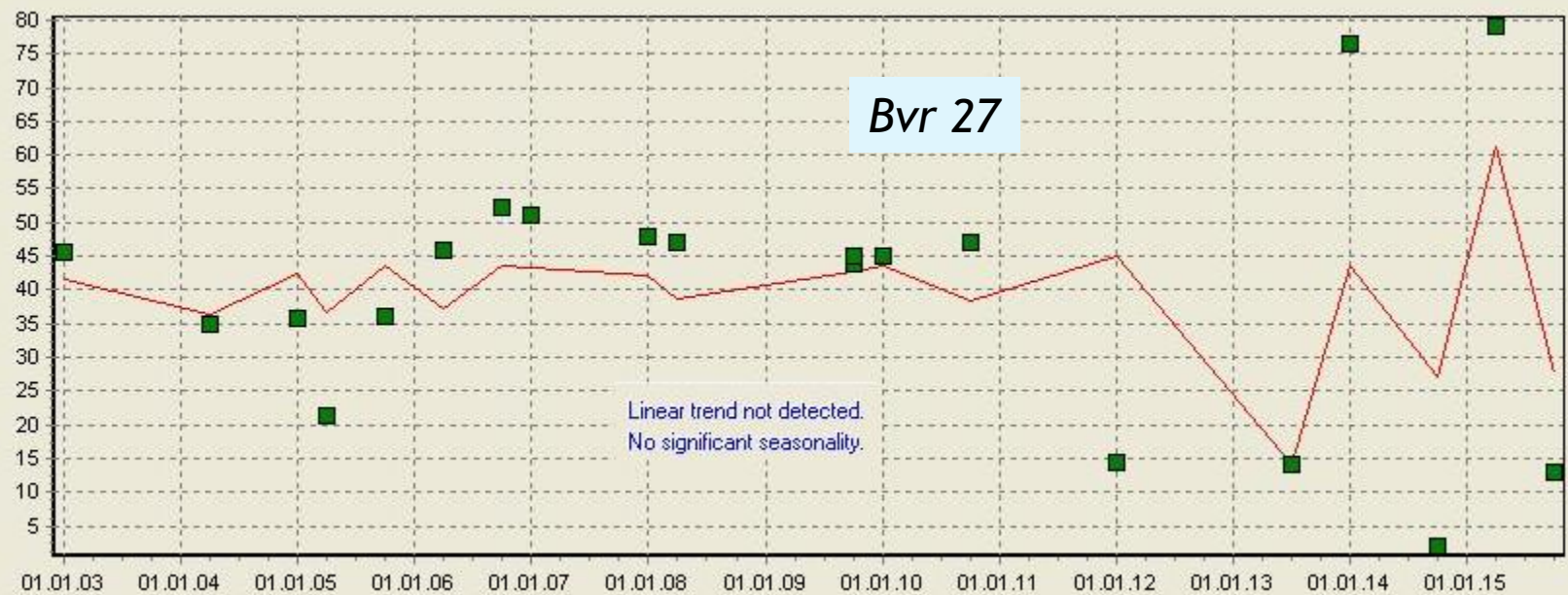


GW well scale

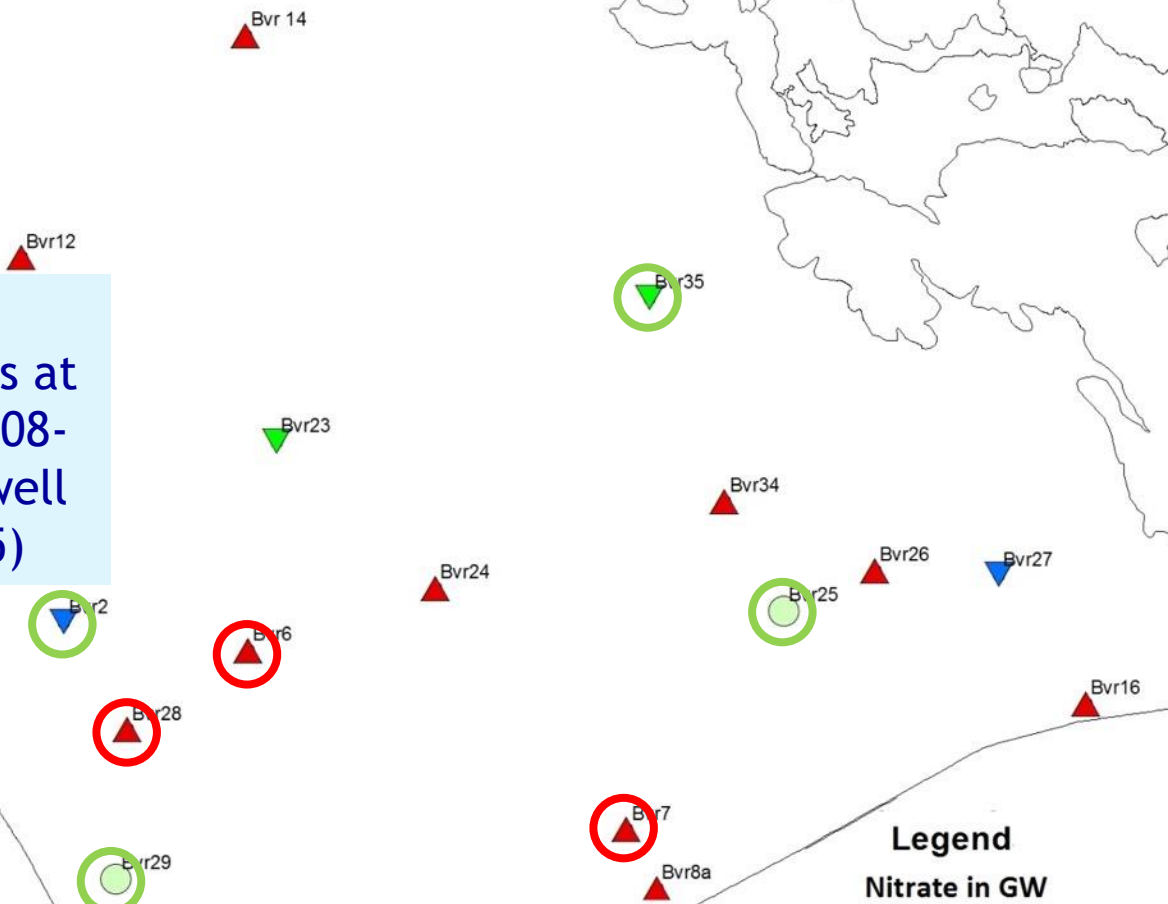








Comparison
between the trends at
GW body scale (2008-
2015) and at GW well
scale (2002-2015)



Legend
Nitrate in GW
▲ increasing
▼ decreasing
▼ highly decreasing
○ unchanged



Conclusions

- The groundwater monitoring of the Campania region (southern Italy) carried out by the Environmental Protection Agency allowed the identification of the nitrate pollution as the major threat for the alluvial-pyroclastic GWBs.
- The nitrate trends were calculated by adopting different approaches at different scales: at regional scale (graphic analysis), at GW body scale (geostatistic spatial analysis) and at GW well scale (statistical linear trend analysis).
- In the period 2004-2015 nitrate trends are different in each well of the same GWB.
- At GWB scale the location of upward and downward trends and the zonation of areas with similar trend seem to be related to differences in land use and environmental pressures. Longer time series have to be required for confirmation.
- The comparison of two trend evaluation methods show similar but not identical patterns

Hackert, 1784



Thanks!



2700 - Ducci et al.