Application of Multivariate Statistical Analysis and transport modeling to assess PCE diffuse pollution in Functional Urban Area of Milan, Italy

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THE AIM OF THE WORK

The Italian law 152/2006 adopted the WFD principles and entrusts to the Regions the task of identifying areas affected by to groundwater diffuse pollution and to assess the contamination level.

We present the case tetrachloroethylene (PCE) diffuse pollution in Milano Functional Urban Area (FUA)
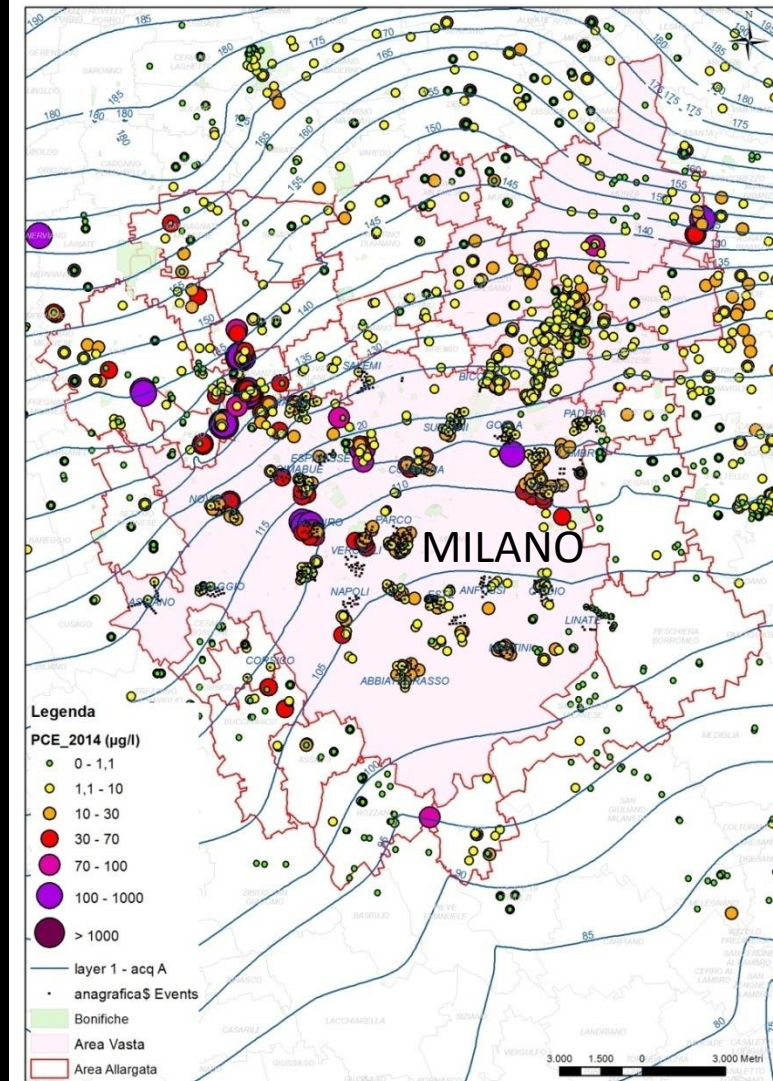
Dealing with diffuse contamination we need to define 2 kind of groundwa

1) **point** high/ver

2) **multi** unident able to

HOW TO SEPARATE DIFFUSE CONTAMINATION FROM PLUMES

Starting from a wide dataset (45.000 data) cluster analysis and a transport model have been combined to distinguish point and multiple-point sources contribution to the diffuse concentration in Milano FUA

HYDROCHEMICAL DATA SET (2003-2014) AVAILABLE IN MILANO FUA (TCE,PCE,CLF)
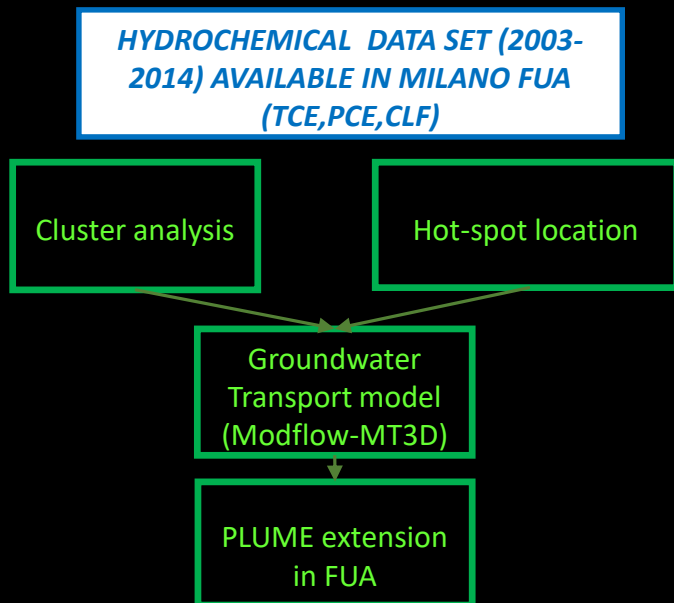
Cluster analysis

Hot-spot location

Numero cluster dei caso
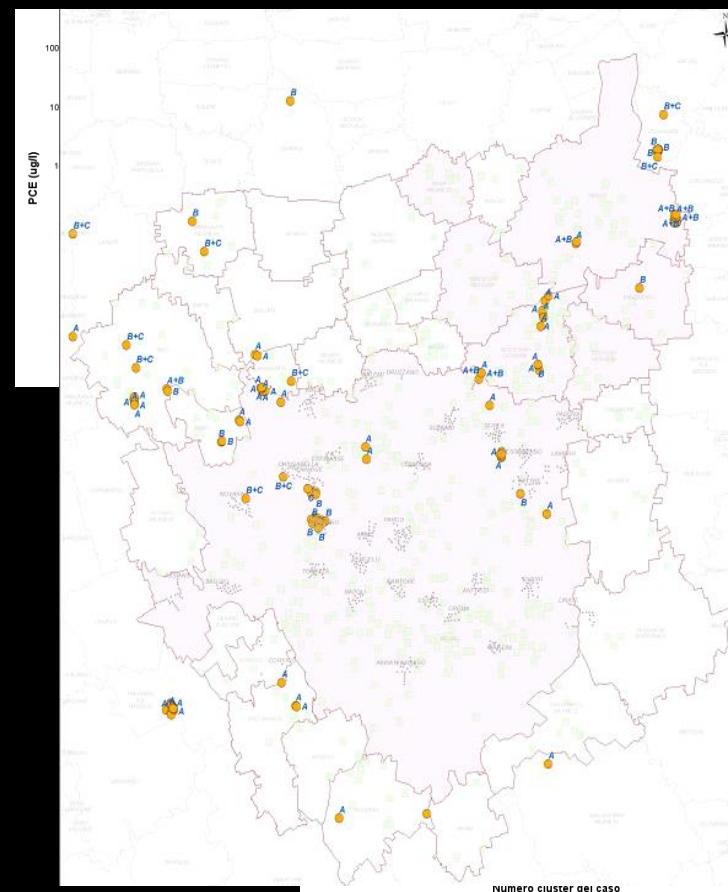
HOW TO SEPARATE DIFFUSE CONTAMINATION FROM PLUMES

Once hot spots have been identified a groundwater transport model has been applied to assess the PCE plume extension

HYDROCHEMICAL DATA SET (2003-2014) AVAILABLE IN MILANO FUA (TCE,PCE,CLF)

Cluster analysis

Hot-spot location

Groundwater Transport model (Modflow-MT3D)

PLUME extension in FUA

M E T H O D O L O G Y
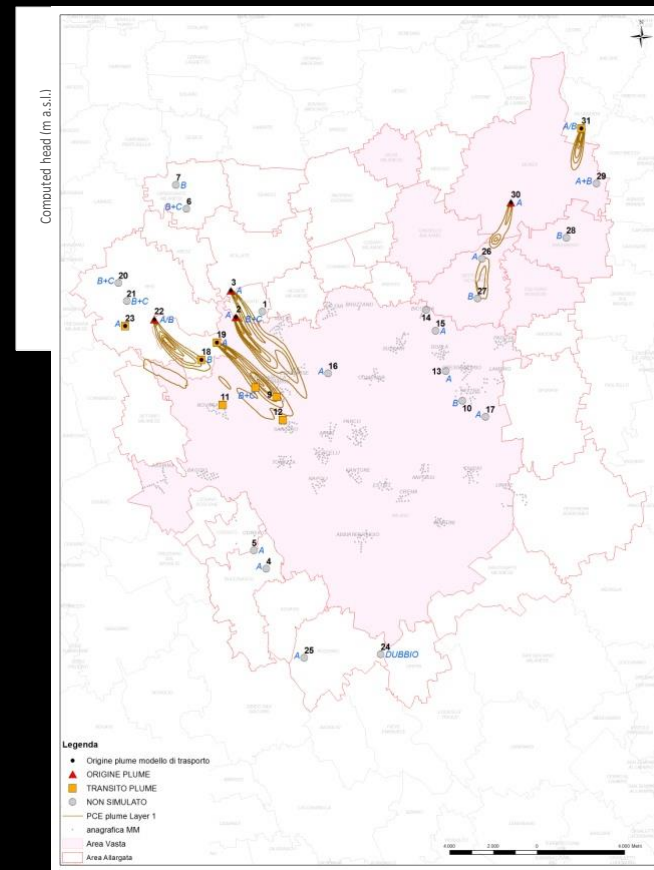
HOW TO SEPARATE DIFFUSE CONTAMINATION FROM PLUMES

Once the plumes extension is simulated the monitoring points hit by them can be canceled from the dataset

HYDROCHEMICAL DATA SET (2003-2014) AVAILABLE IN MILANO FUA (TCE,PCE,CLF)

Cluster analysis

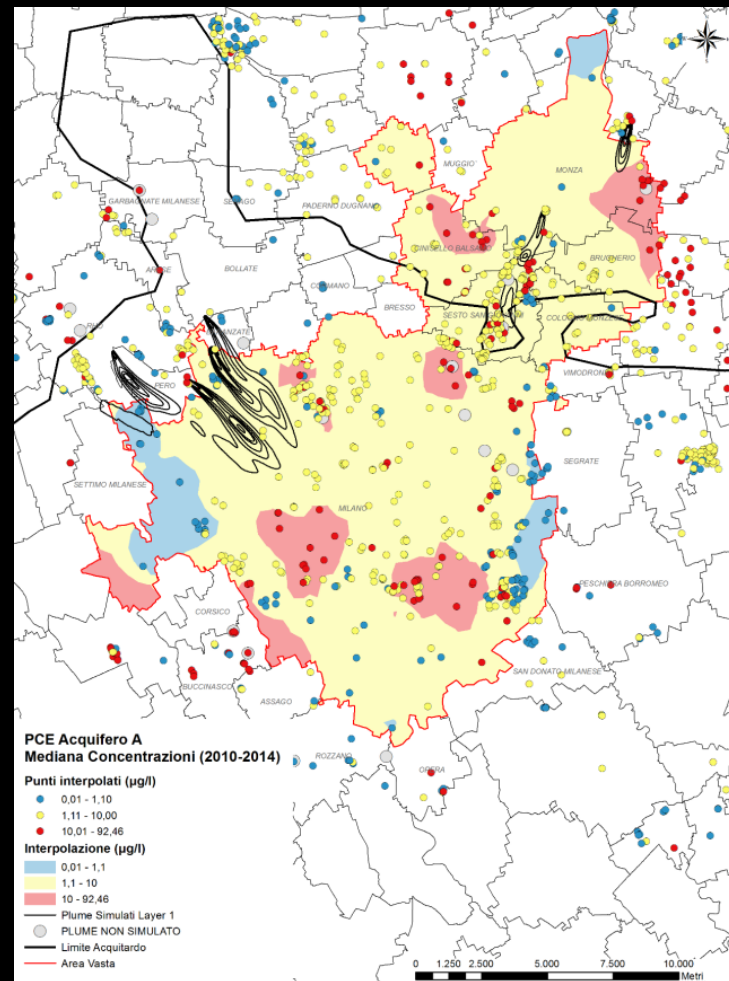Hot-spot location

Groundwater Transport model (Modflow-MT3D)

PLUME extension in FUA

GEOSTATISTICAL analysis (cleaned dataset)

Diffuse contamination MAP

M E T H O D O L O G Y

RESULTS

PCE Acquifero A
Mediana Concentrazioni (2010-2014)
Punti interpolati (µg/l)
- 0,01 - 1,10
- 1,11 - 10,00
- 10,01 - 92,46
Interpolazione (µg/l)
- 0,01 - 1,1
- 1,1 - 10
- 10 - 92,46
— Plume Simulati Layer 1
○ PLUME NON SIMULATO
— Limite Acquitardo
— Area Vasta

0   1.250 2.500   5.000   7.500   10.000
                                                    Metri

HOW TO SEPARATE DIFFUSE CONTAMINATION FROM PLUMES

Diffuse contamination map showed that is incorrect to define a single PCE diffuse value for the entire study area. Then Factor and Multivariate analysis have been applied to define the proper value in each of the areas (yellow and read) where concentrations are higher than the

Italian threshold limit (1,1 ug/l)

HYDROCHEMICAL DATA SET (2003-2014) AVAILABLE IN MILANO FUA (TCE,PCE,CLF)

Cluster analysis

Hot-spot location

Groundwater Transport model (Modflow-MT3D)

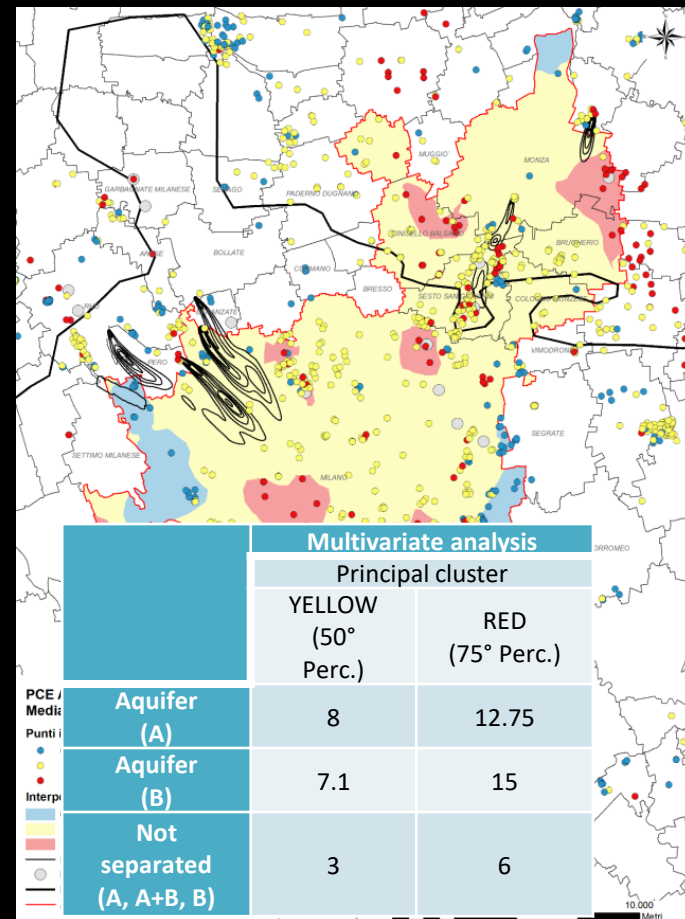PLUME extension in FUA

GEOSTATISTICAL analysis (cleaned dataset)

Factor and Multivariate analysis

Diffuse contamination MAP

Assessment of diffuse contamination

METHODOLOGY

RESULTS

	Multivariate analysis	
	Principal cluster	
	YELLOW (50° Perc.)	RED (75° Perc.)
Aquifer (A)	8	12.75
Aquifer (B)	7.1	15
Not separated (A, A+B, B)	3	6

THANK YOU

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