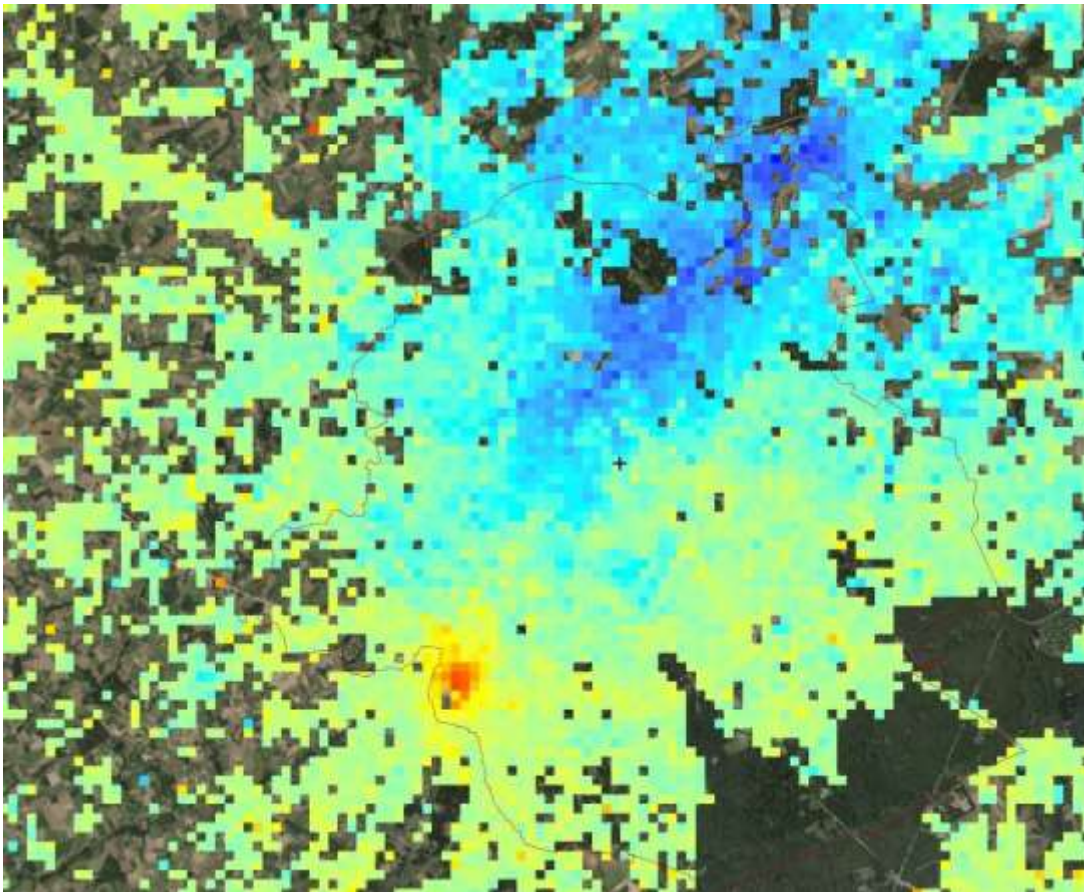


Overview of the ground movements highlighted by the Persistent Scatterer Technique (PSI) in Belgium



Pierre-Yves Declercq
& Jan Walstra



Geological Survey
of Belgium

museum



Contents

- The GEPATAR project
- PS-InSAR processing
- Ground movements in Belgium (3x)
- Outlook

GEPATAR

GEotechnical and Patrimonial Archives Toolbox for ARchitectural conservation in Belgium



Royal Belgian Institute of Natural Sciences,
Geological Survey of Belgium



Royal Military Academy, Signal and Image
Centre



University of Liège, Centre Spatial de Liège



Royal Institute for Cultural Heritage,
Laboratories



KU Leuven, Raymond Lemaire International
Centre for Conservation

GEPATAR

GEotechnical and Patrimonial Archives Toolbox for ARchitectural conservation in Belgium

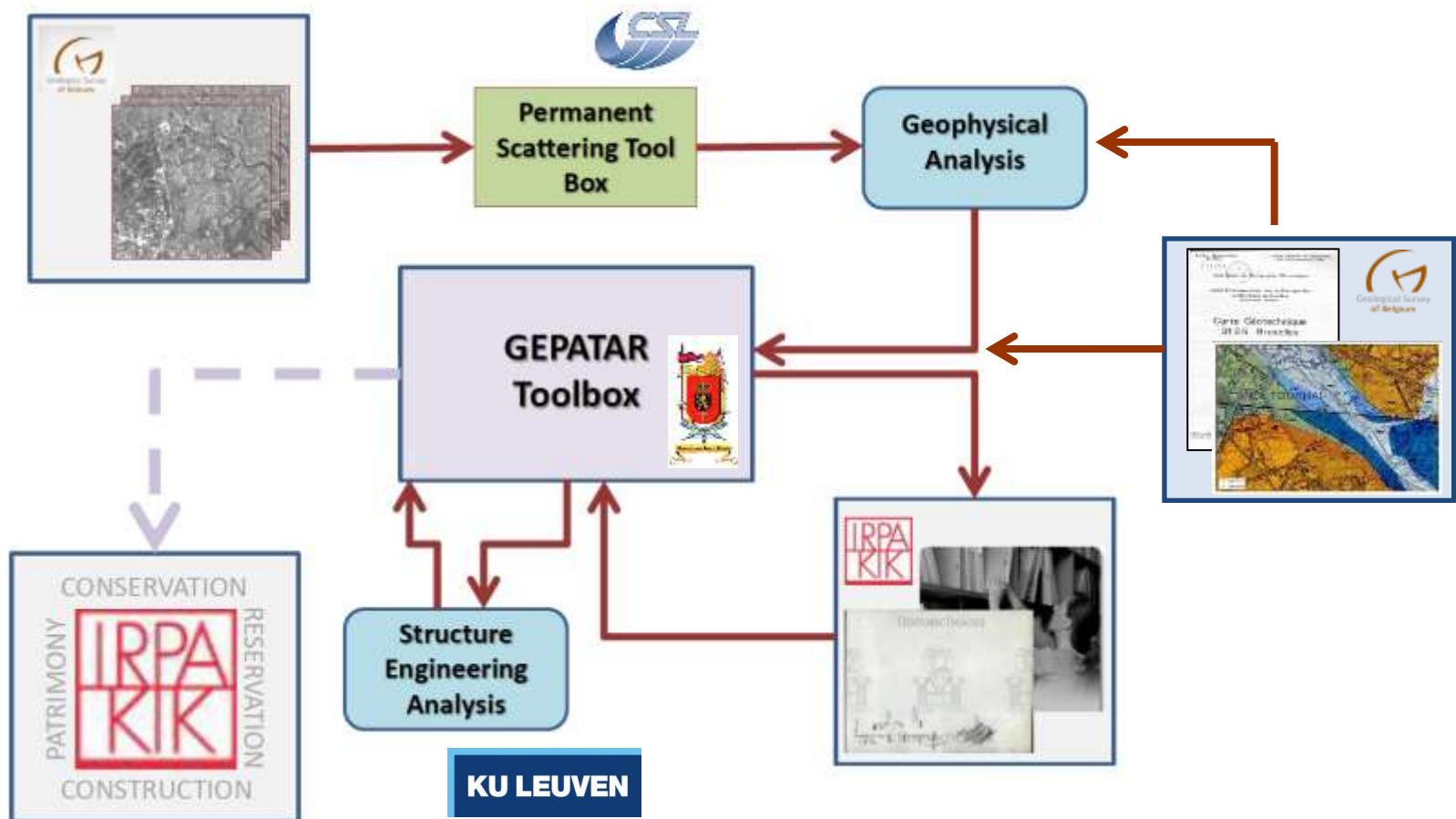


Funding: BRAIN-be, BELSPO

Objectives: development of a toolbox to help identifying built heritage at risk, using advanced image processing (PS-InSAR) and integral analysis of the GSB and RICH archives

GEPATAR

GEotechnical and Patrimonial Archives Toolbox for ARchitectural conservation in Belgium



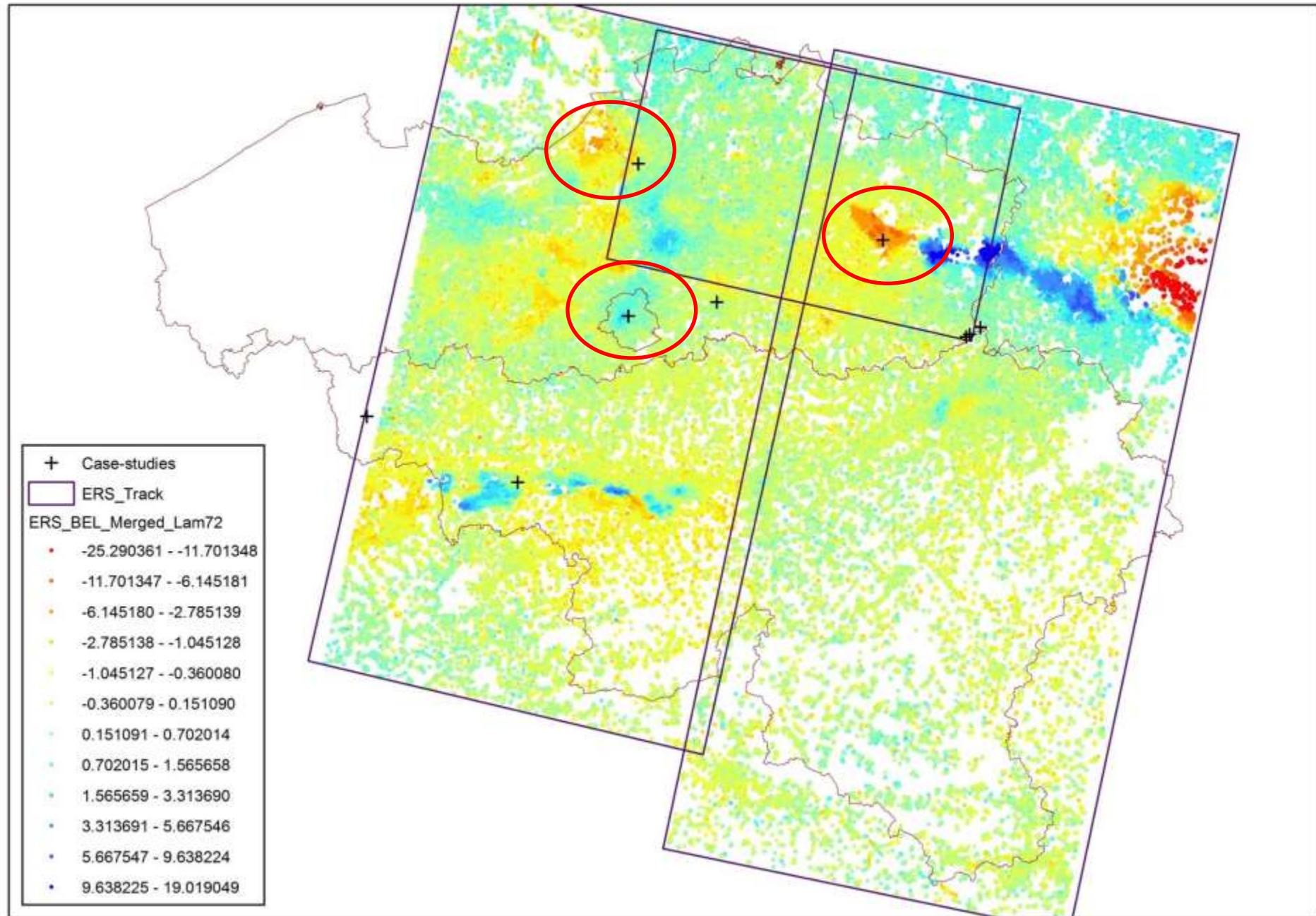
GEPATAR

GEotechnical and Patrimonial Archives Toolbox for ARchitectural conservation in Belgium

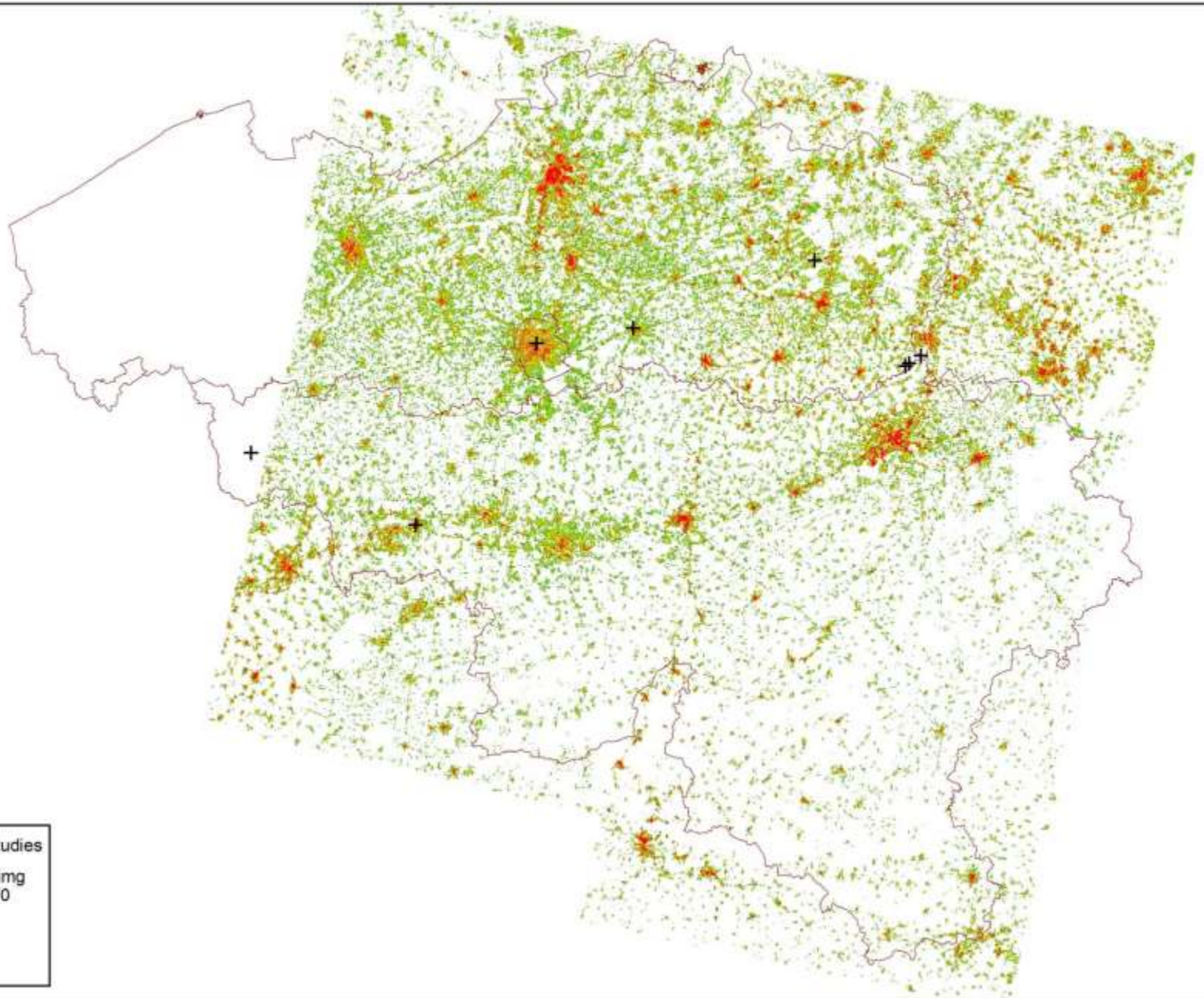
Ground movement hazards in Belgium:

- Compaction of soft sediments
- (Past) mining activities
- Groundwater extraction & recharge
- Landslides

ERS (1992-2001): tracks 423/151/380, 71/66/68 scenes, 990.877 PSI points

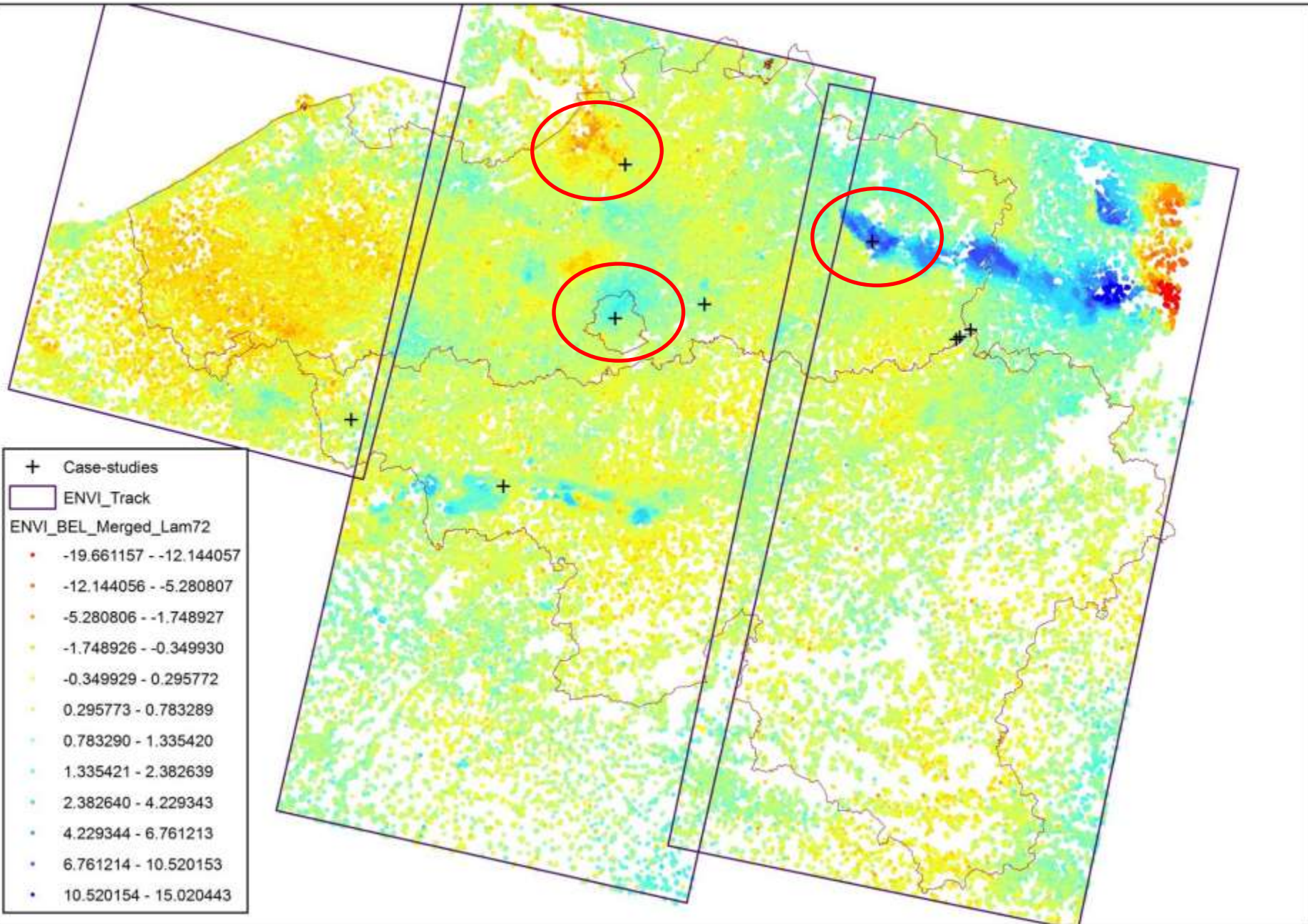


ERS (1992-2001): PSI point density, 200 x 200 m grid

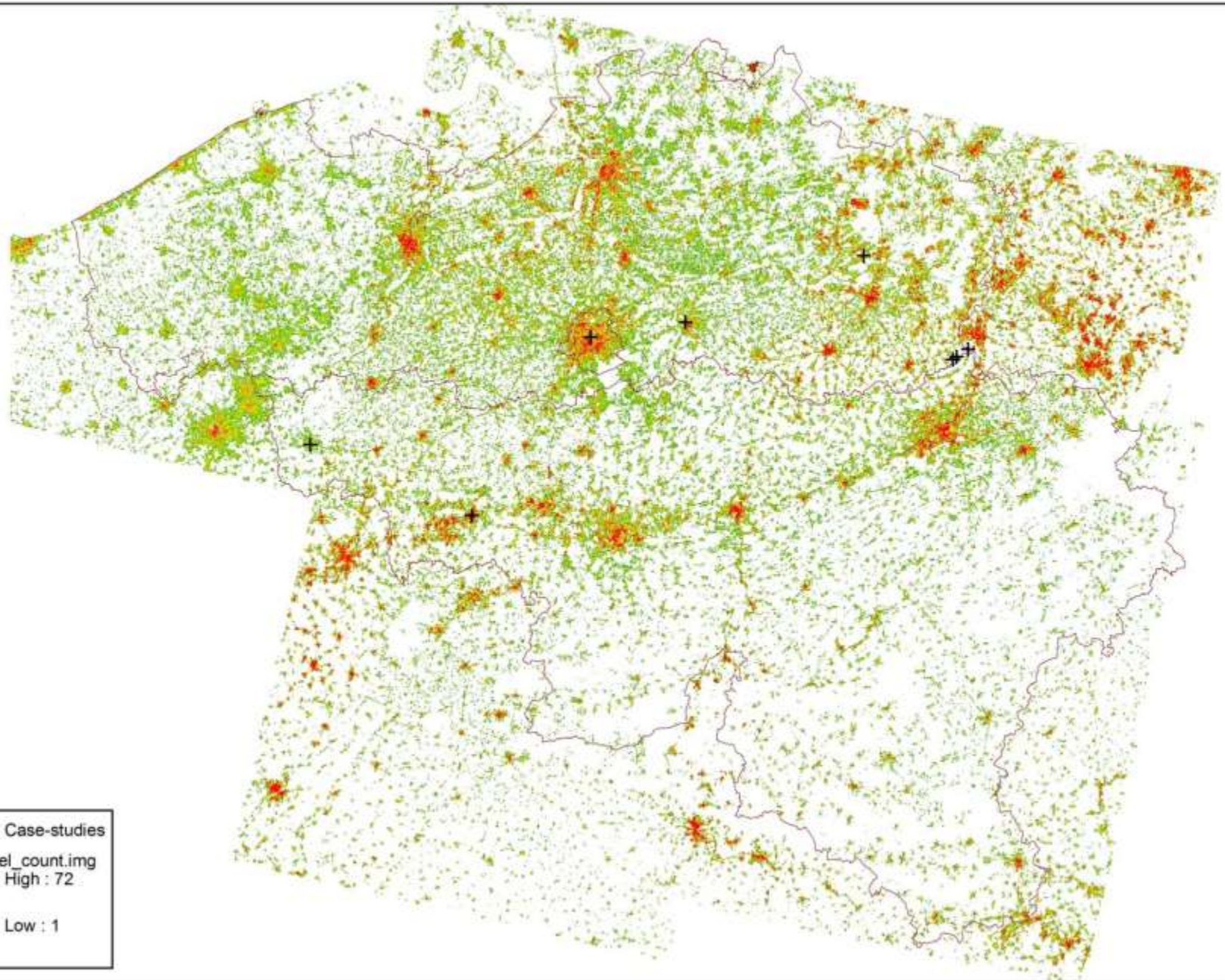


+ Case-studies
ers_bel_count.img
High : 70
Low : 1

ENVISAT (2003-2010): tracks 466/423/380, 48/75/67 scenes, 1.653.202 PSI points



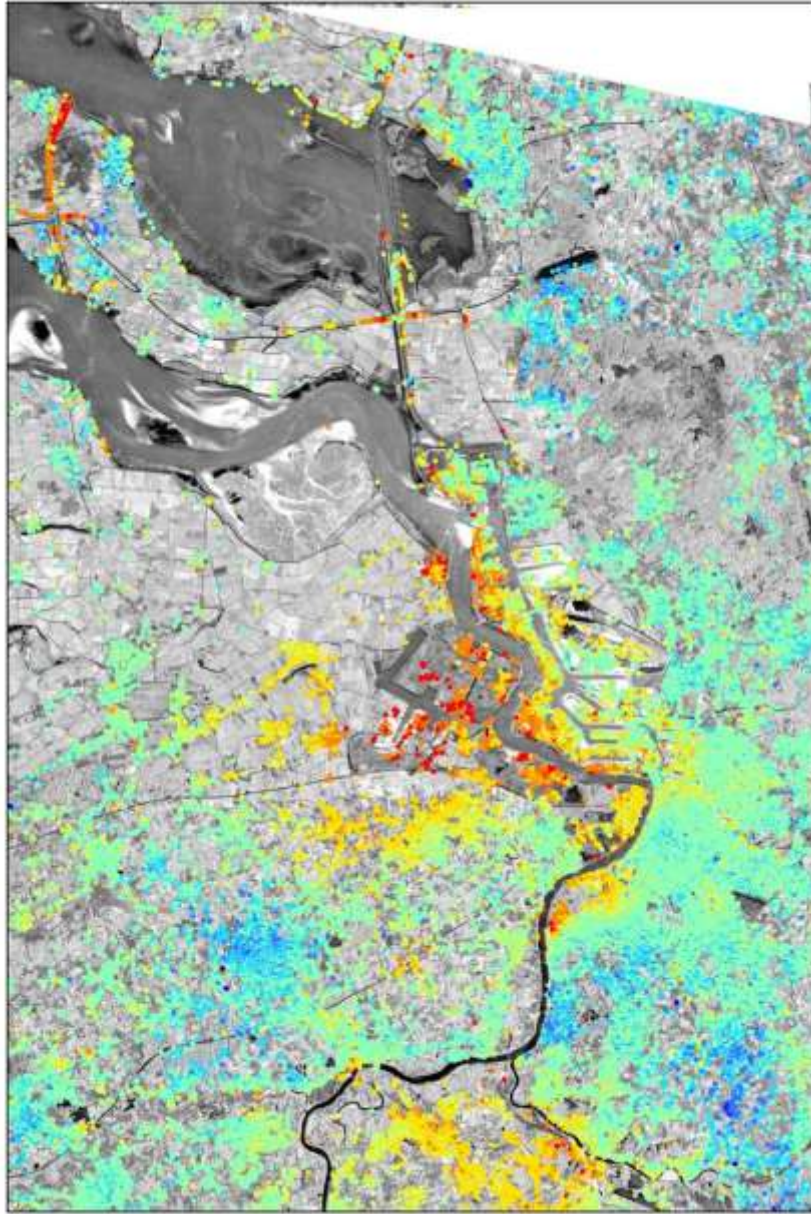
ENVISAT (2003-2010): PSI point density, 200 x 200 m grid



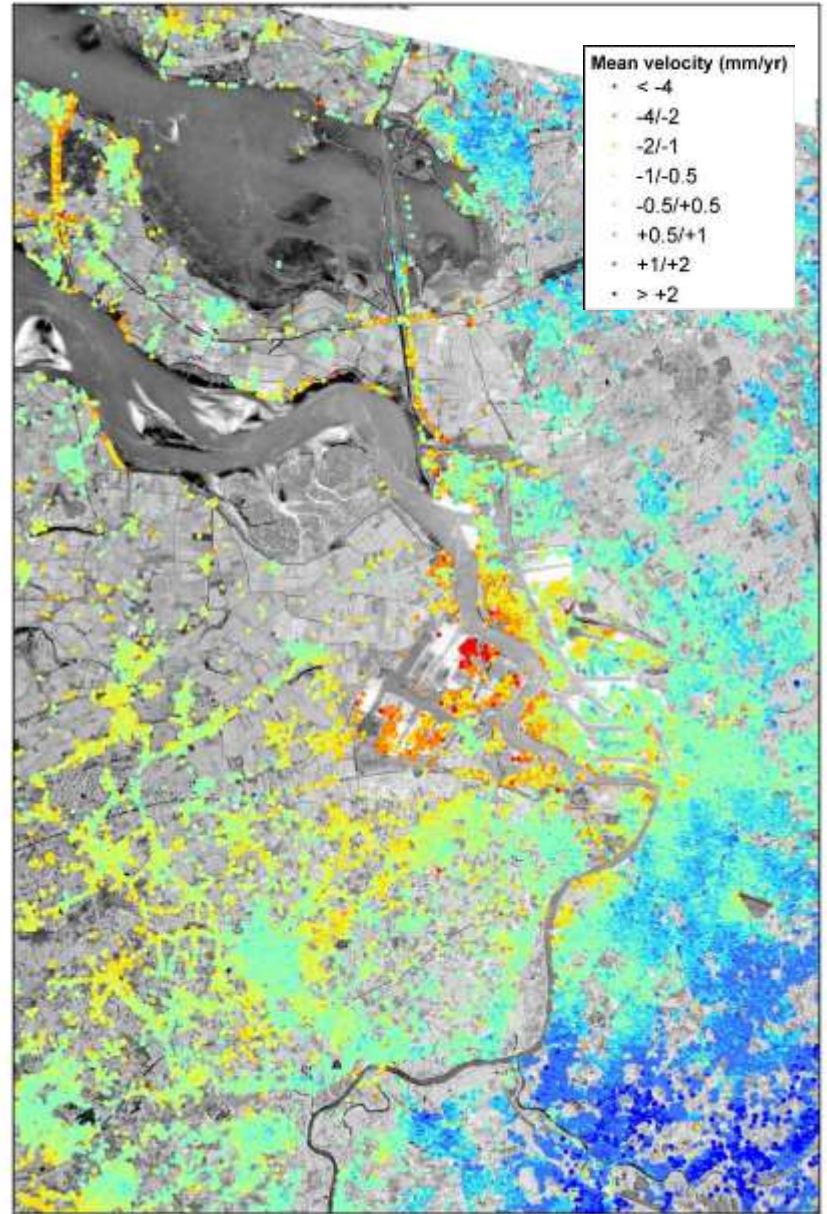


Ground subsidence in the Scheldt estuary

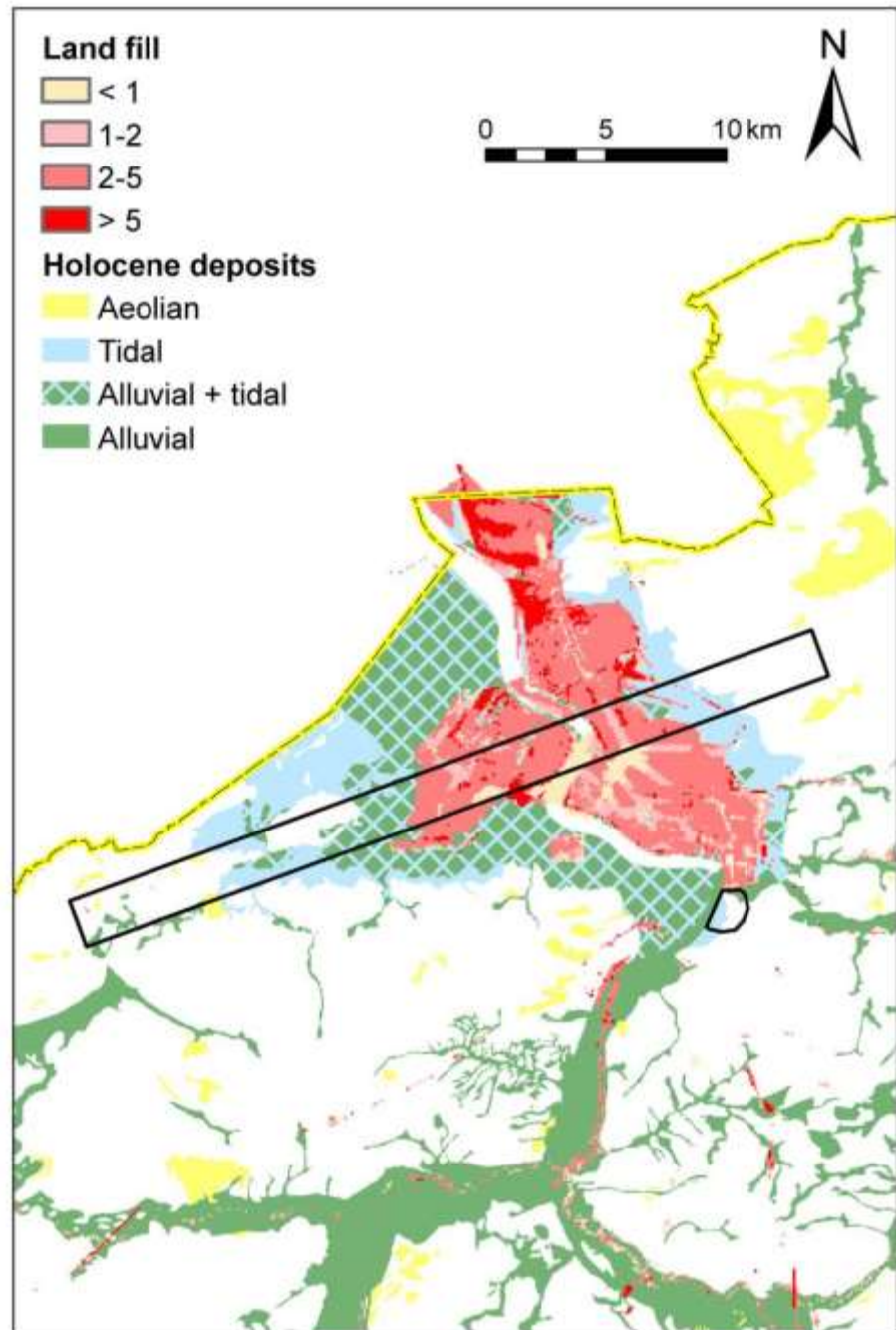
ERS1/2: 1992-2001

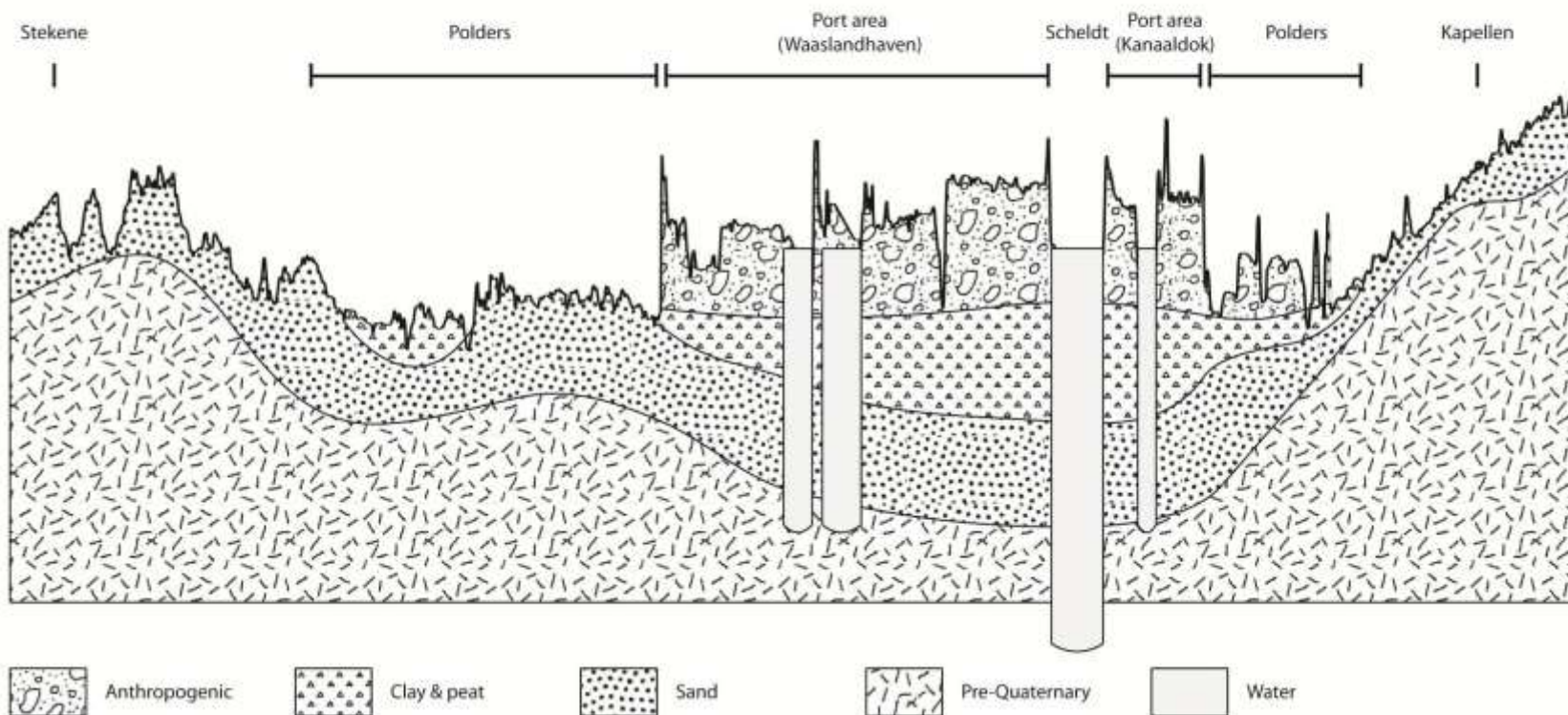
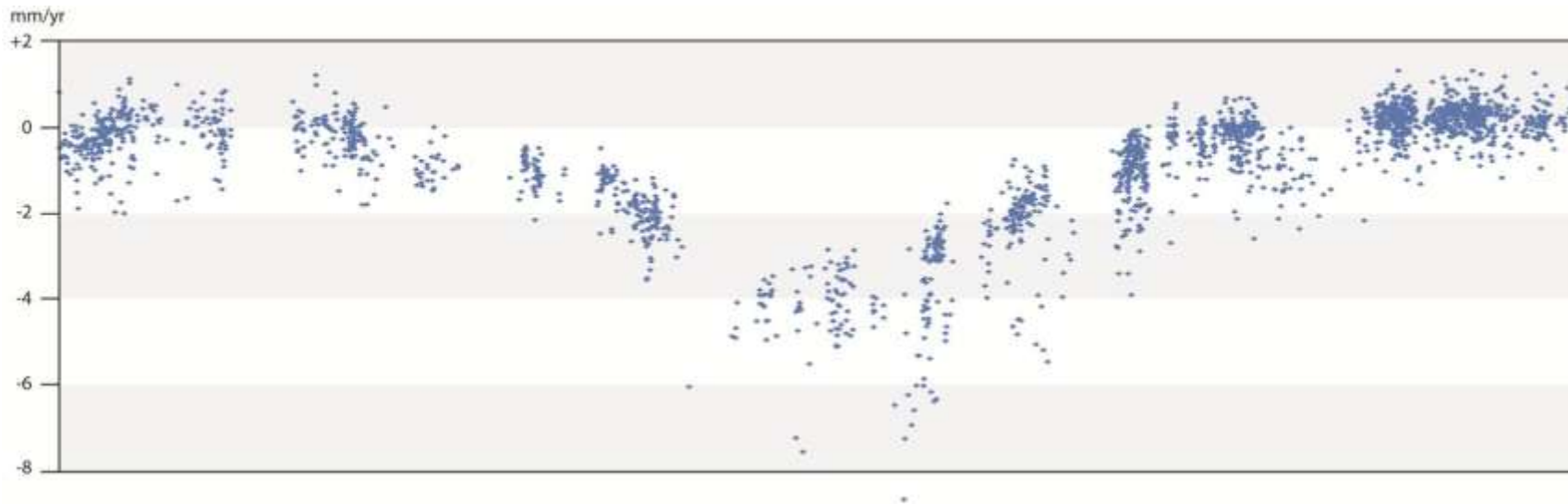


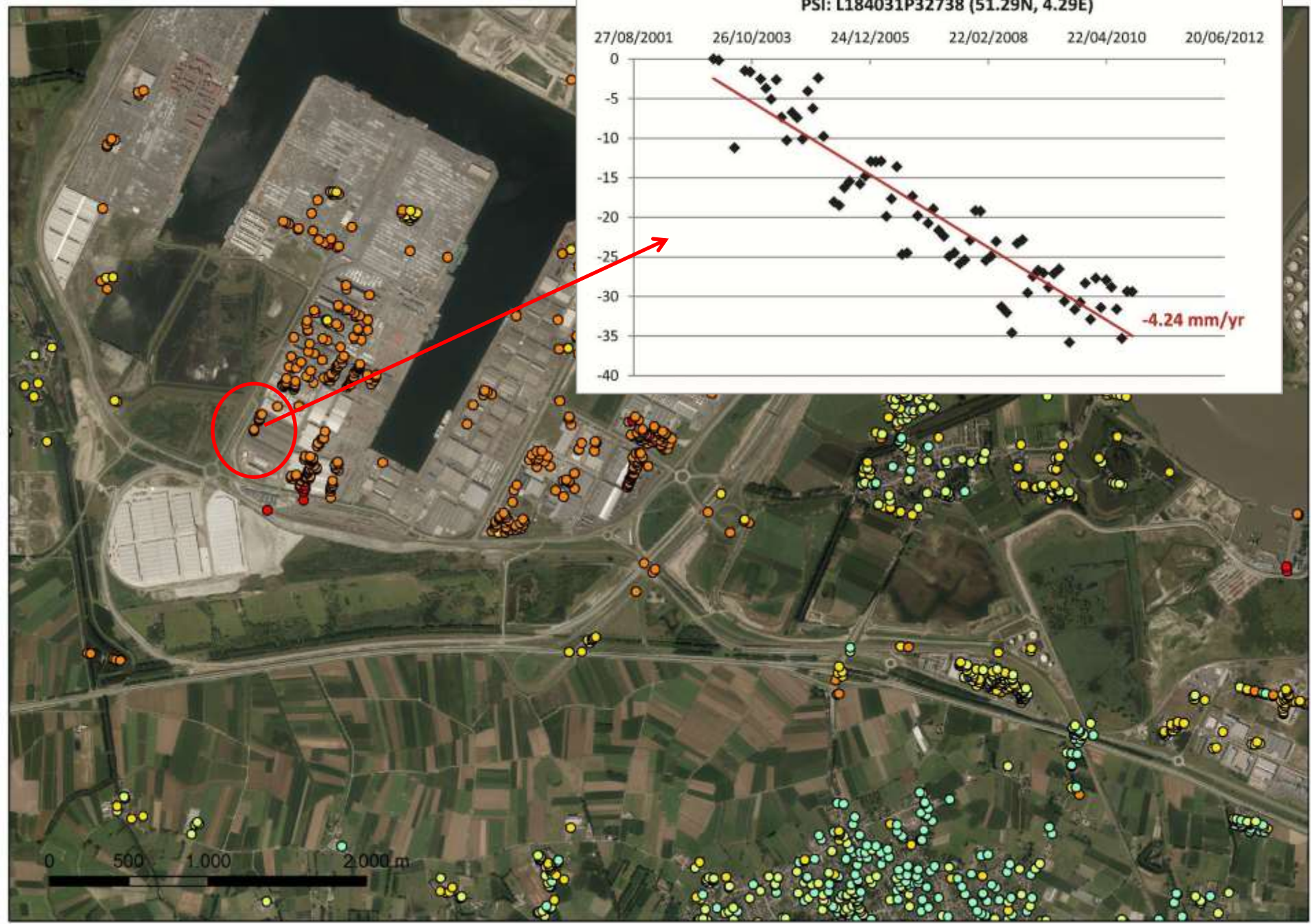
ENVISAT: 2003-2010



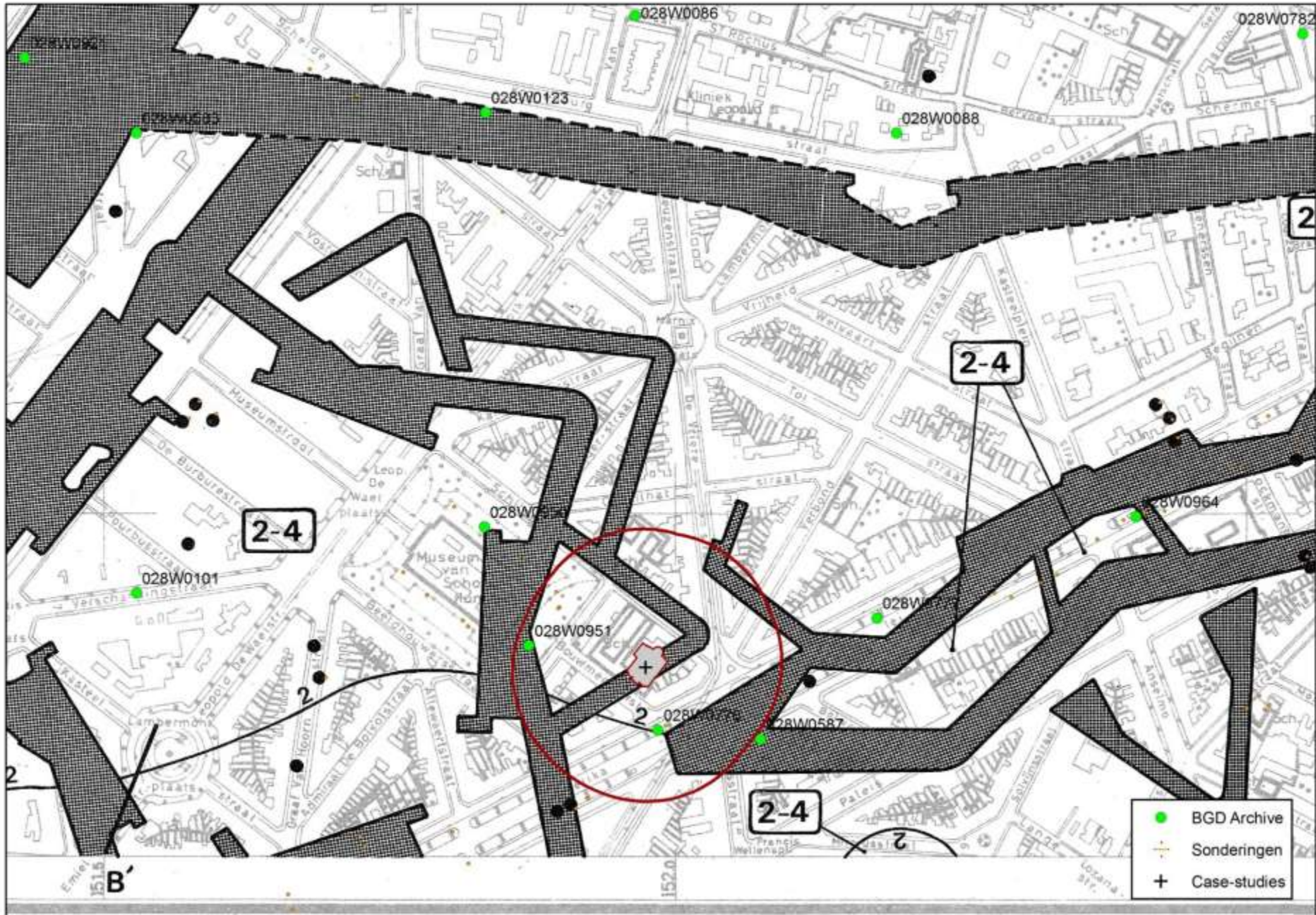
Spatial extent of soft Holocene deposits



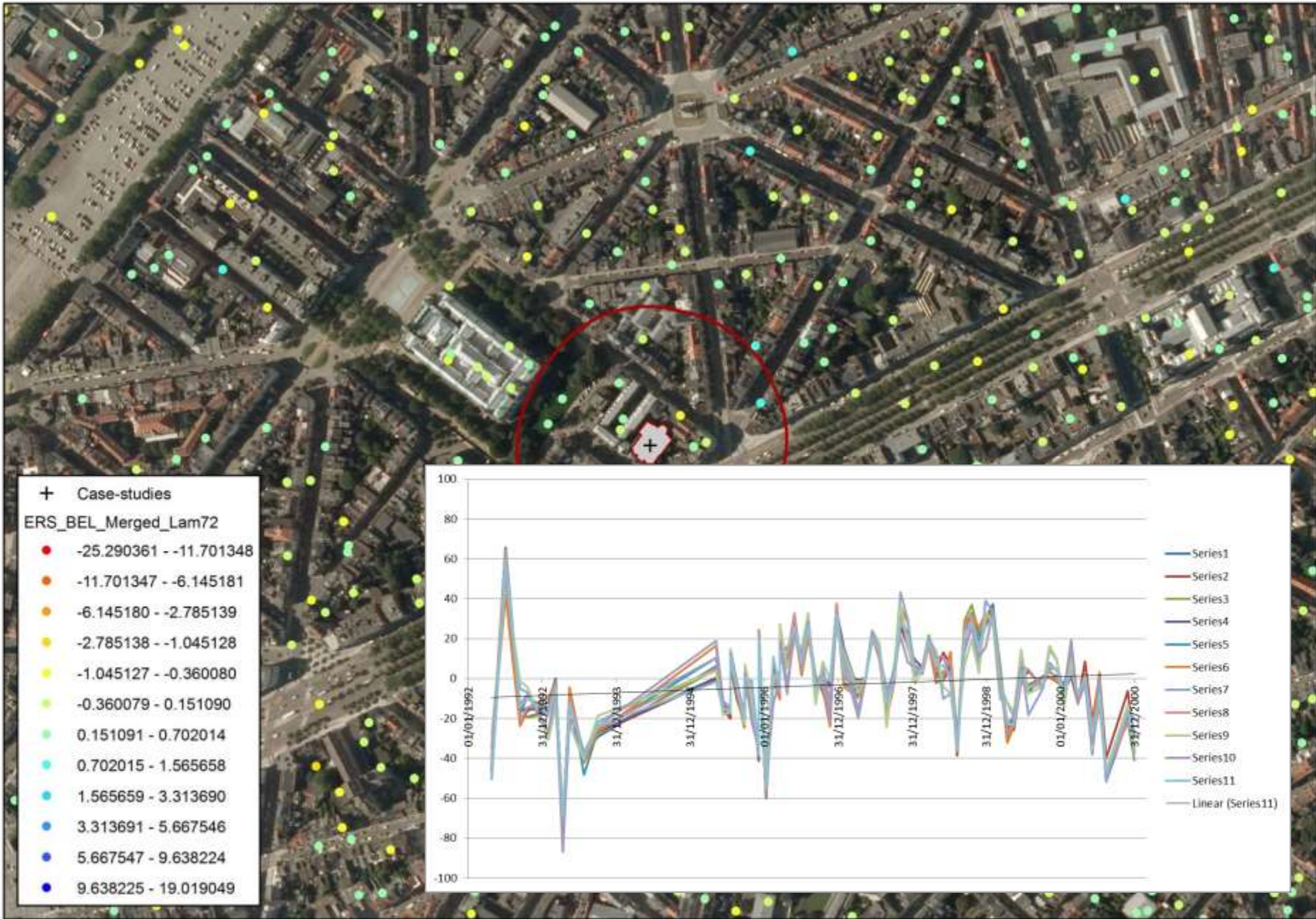




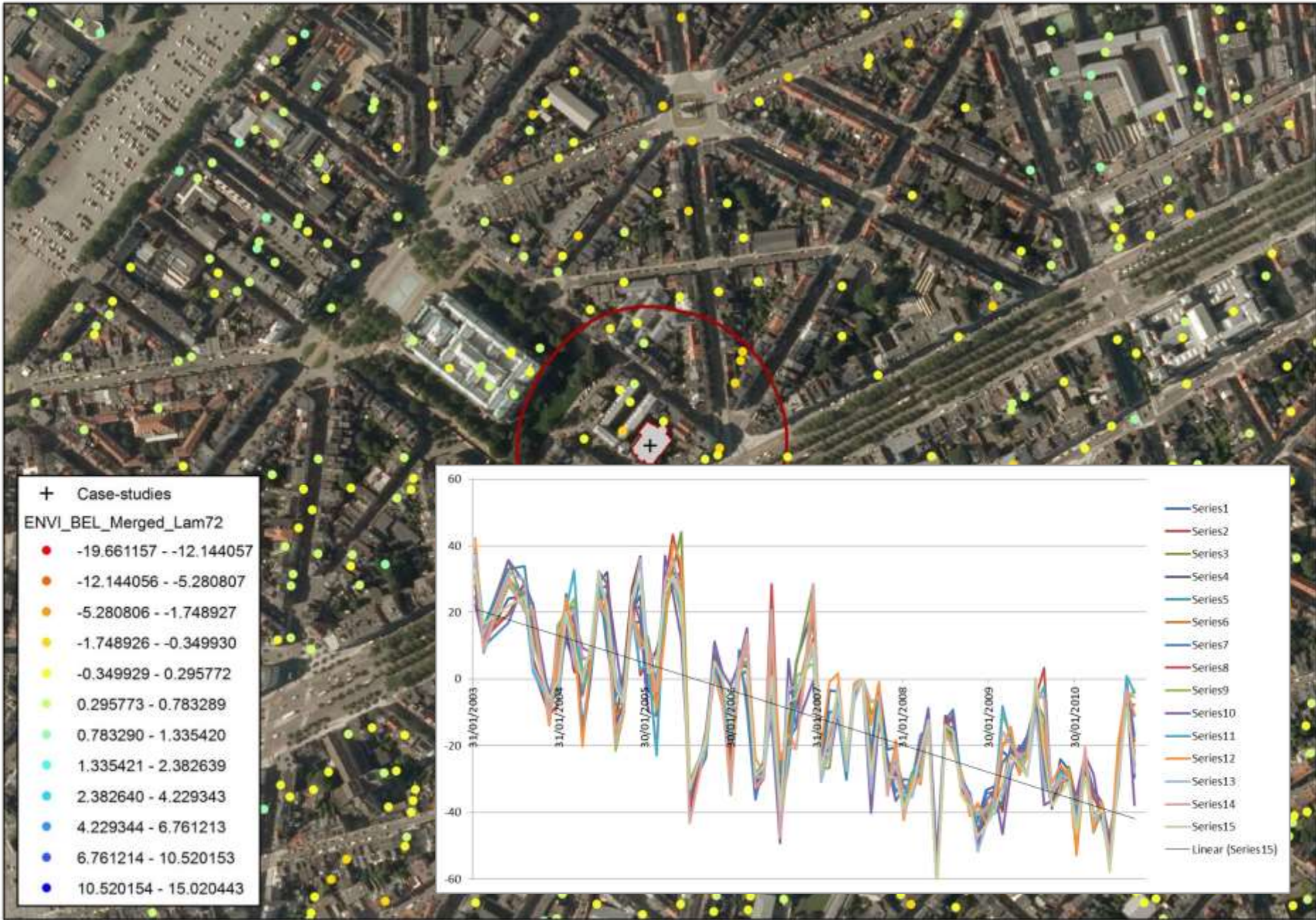
Antwerp (Dutch synagogue): Geotechnical map



Antwerp (Dutch synagogue): ERS PSI points



Antwerp (Dutch synagogue): ENVISAT PSI points

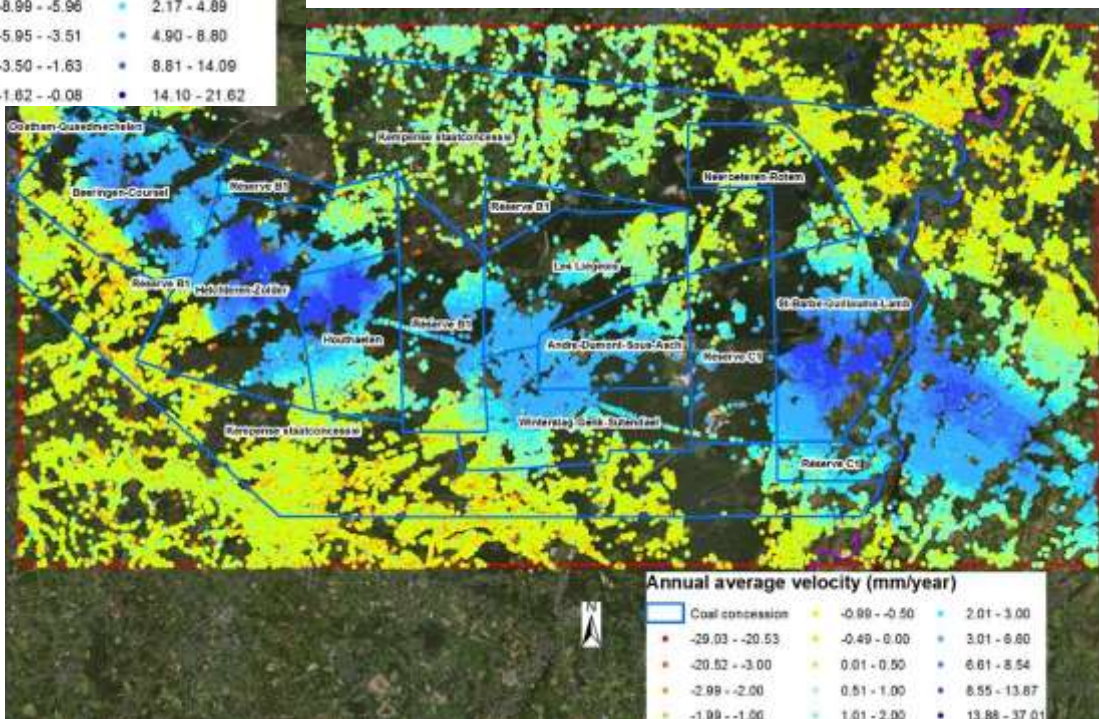
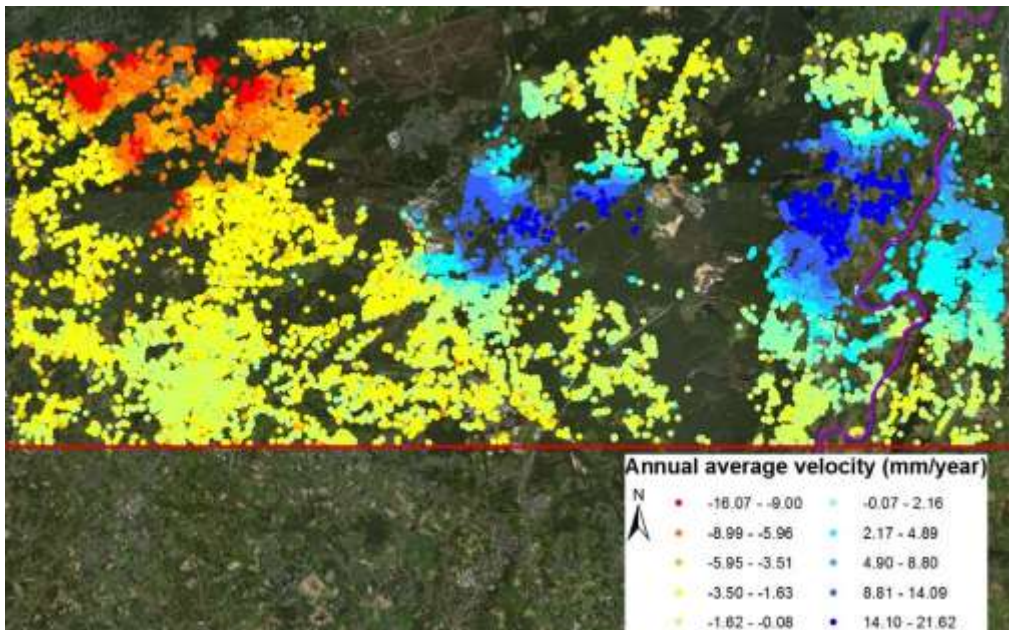




**Mining activities
in the Campine coal basin**

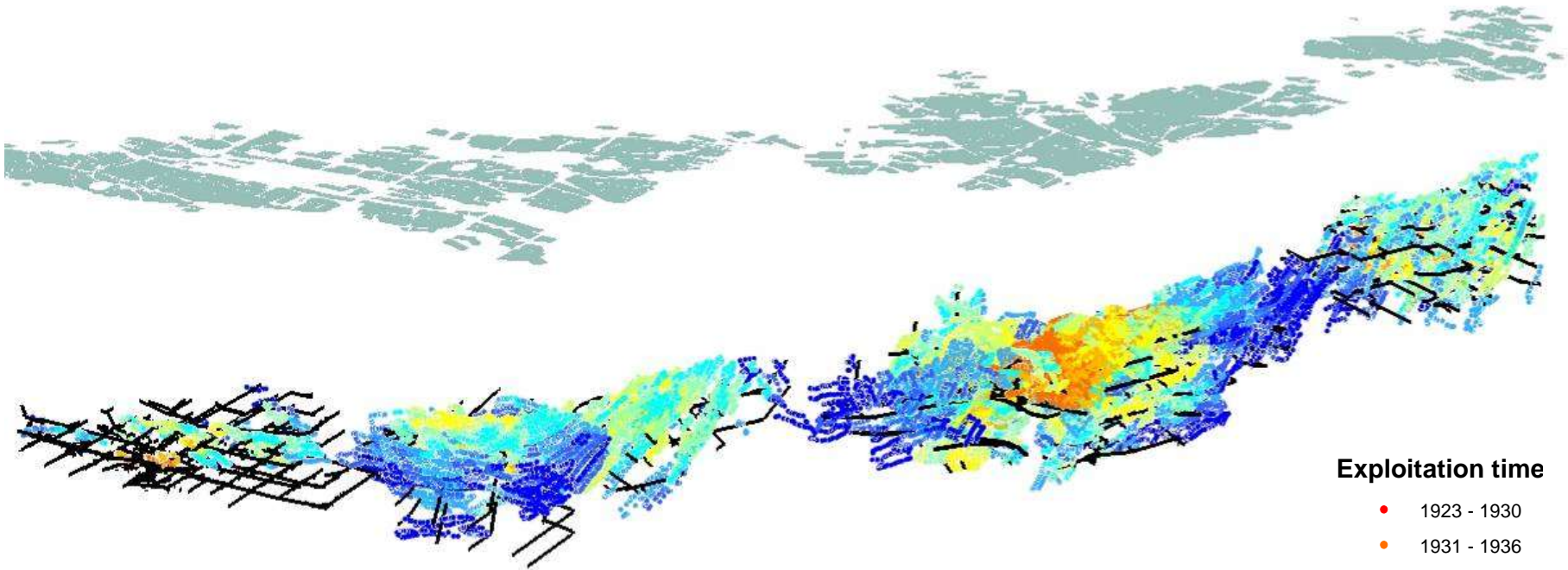
Mining activities in the Campine coal basin, Limburg:

< ERS PSI points (1992-2000)



ENVISAT PSI points (2003-2010) >
Concession areas are indicated

Mining activities in the Campine coal basin, Limburg:

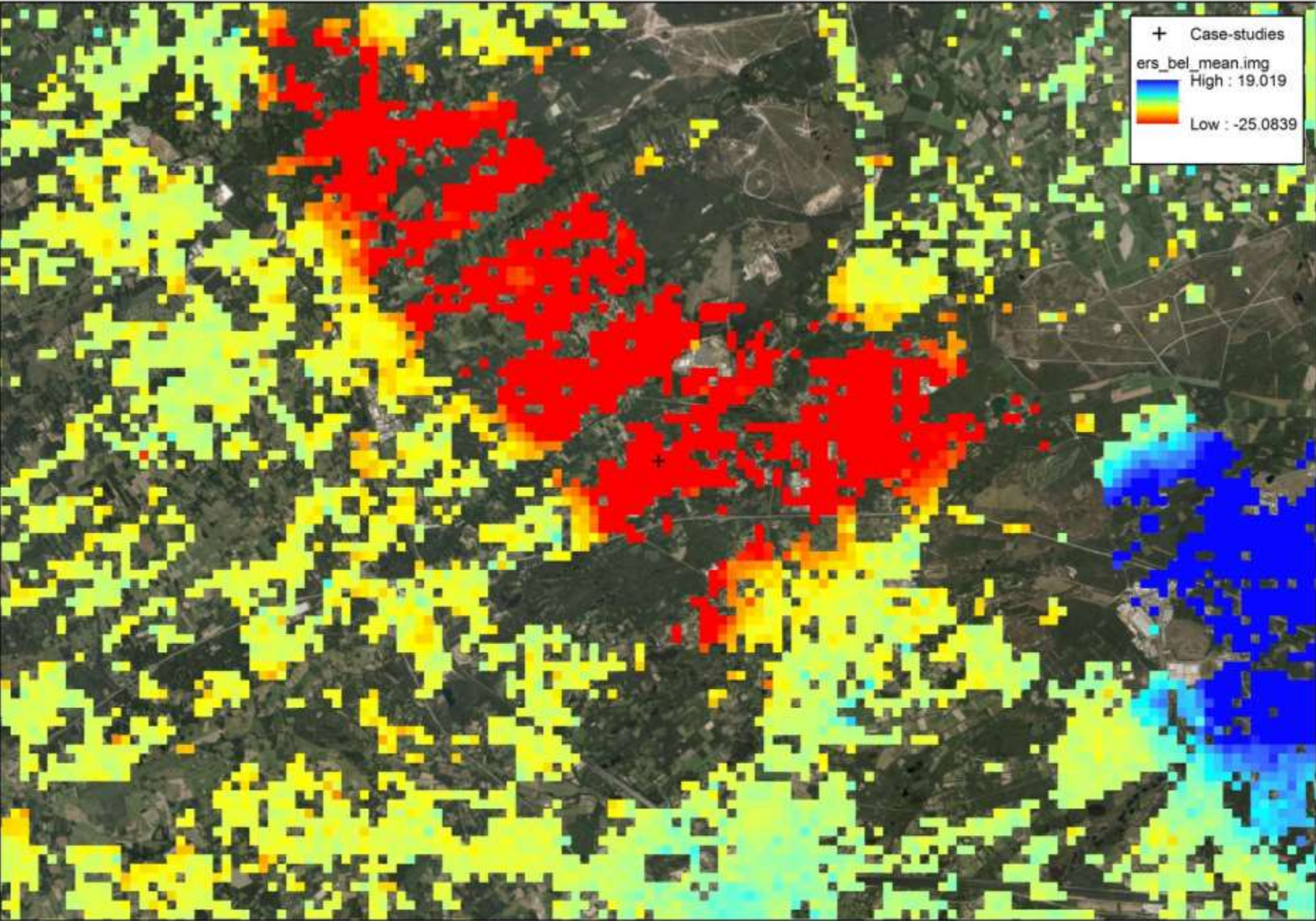


Exploitation time

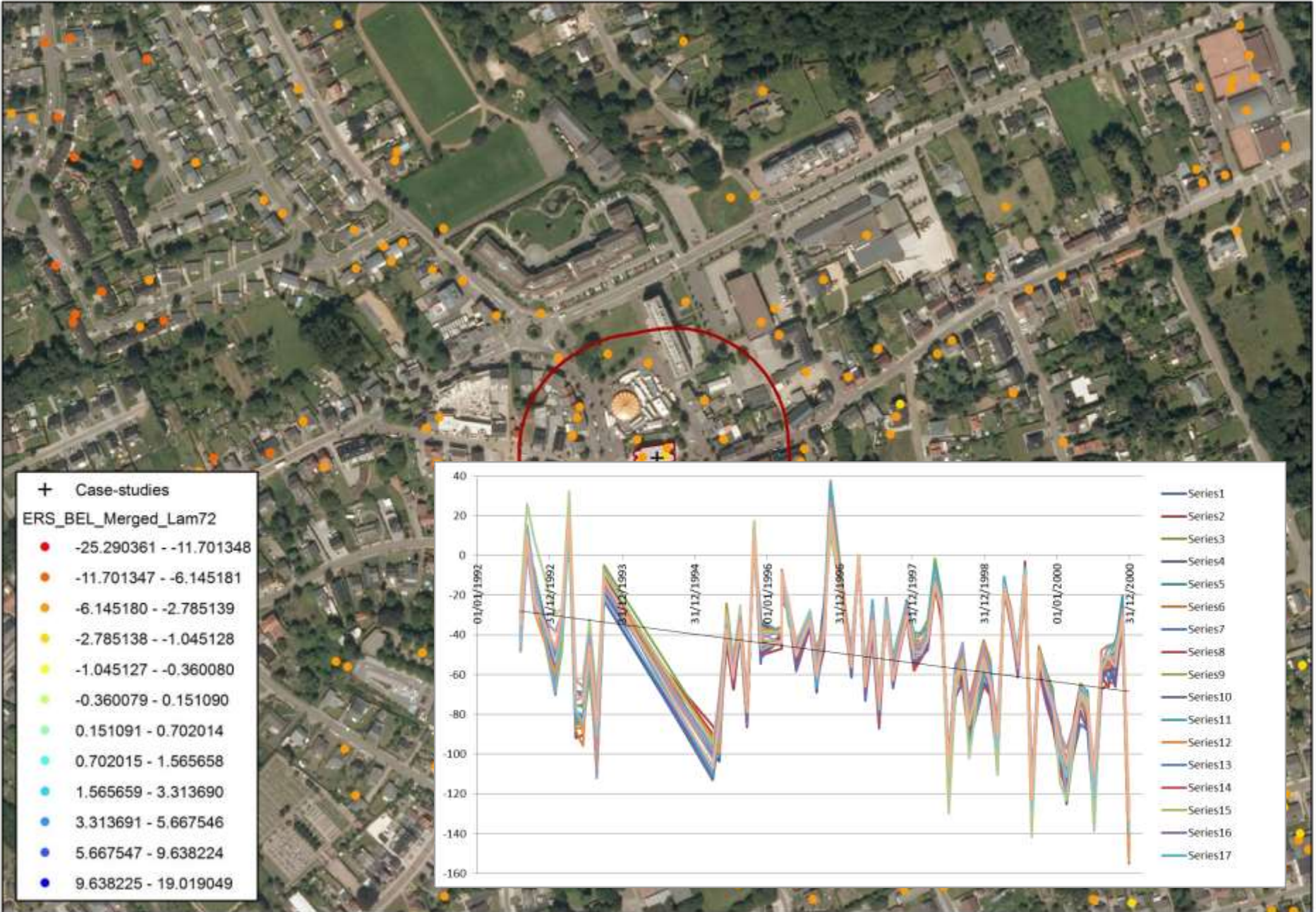
- 1923 - 1930
- 1931 - 1936
- 1937 - 1943
- 1944 - 1950
- 1951 - 1955
- 1956 - 1960
- 1961 - 1965
- 1966 - 1972
- 1973 - 1980
- 1981 - 1987

After closure groundwater pumping activities were abandoned, recharge of aquifers leads to hydrostatic overpressure and elastic rebound (uplift). West and east are at different stages of recharge. (pumping stopped in 1986-1988 vs. 1991-1992)

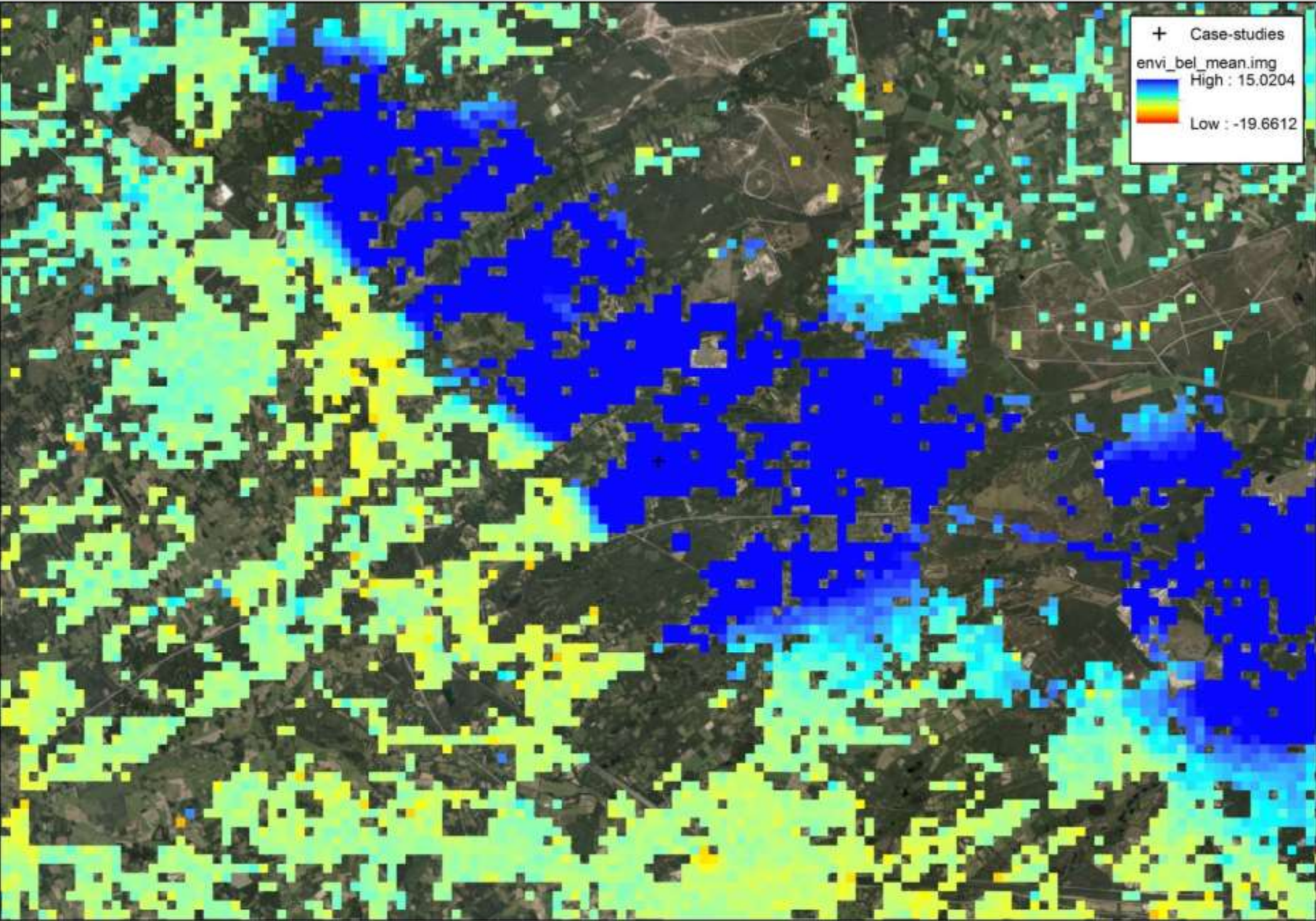
Zolder: ERS mean velocity



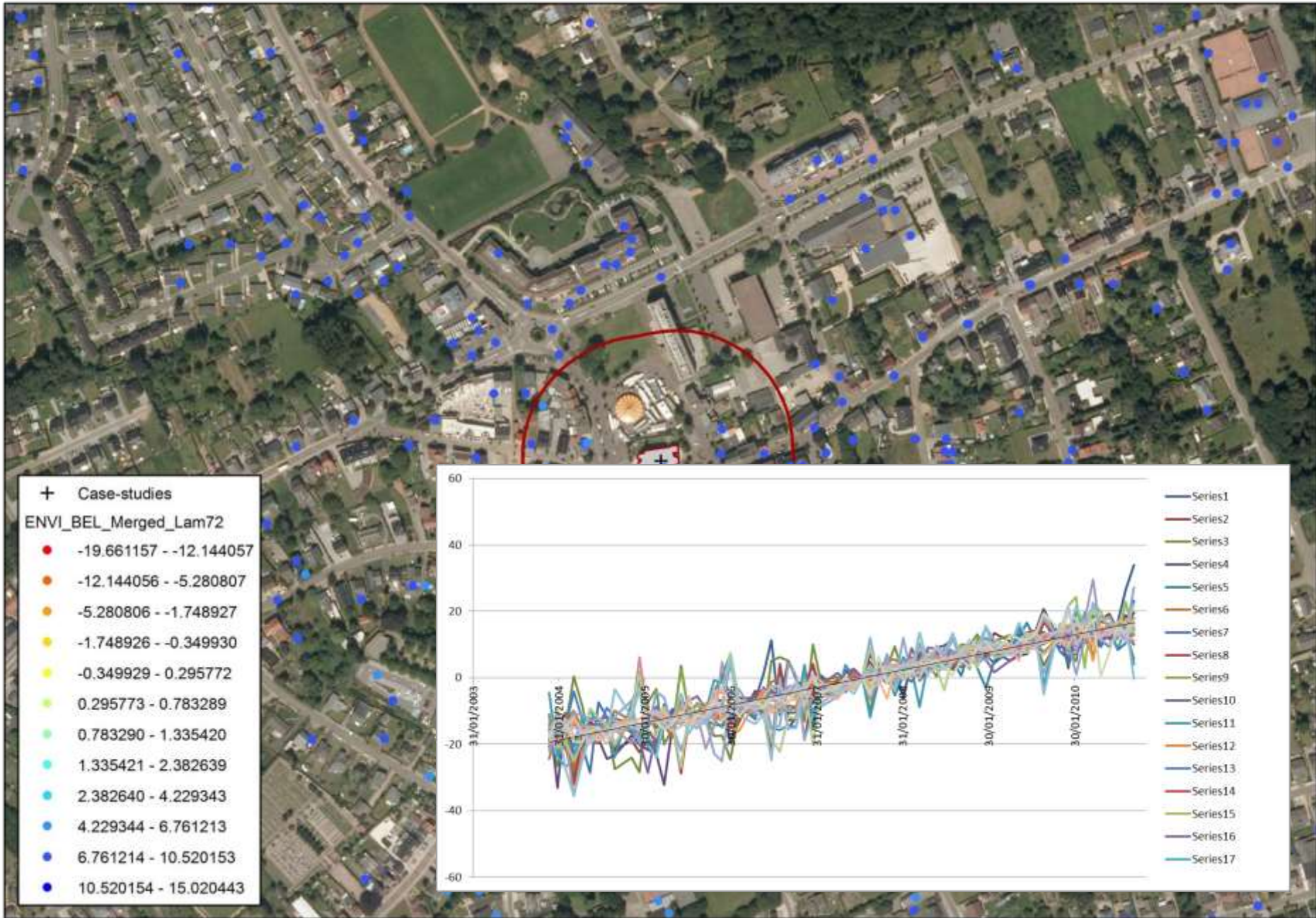
Zolder (St-Vincentius' Church): ERS PSI points



Zolder: ENVISAT mean velocity



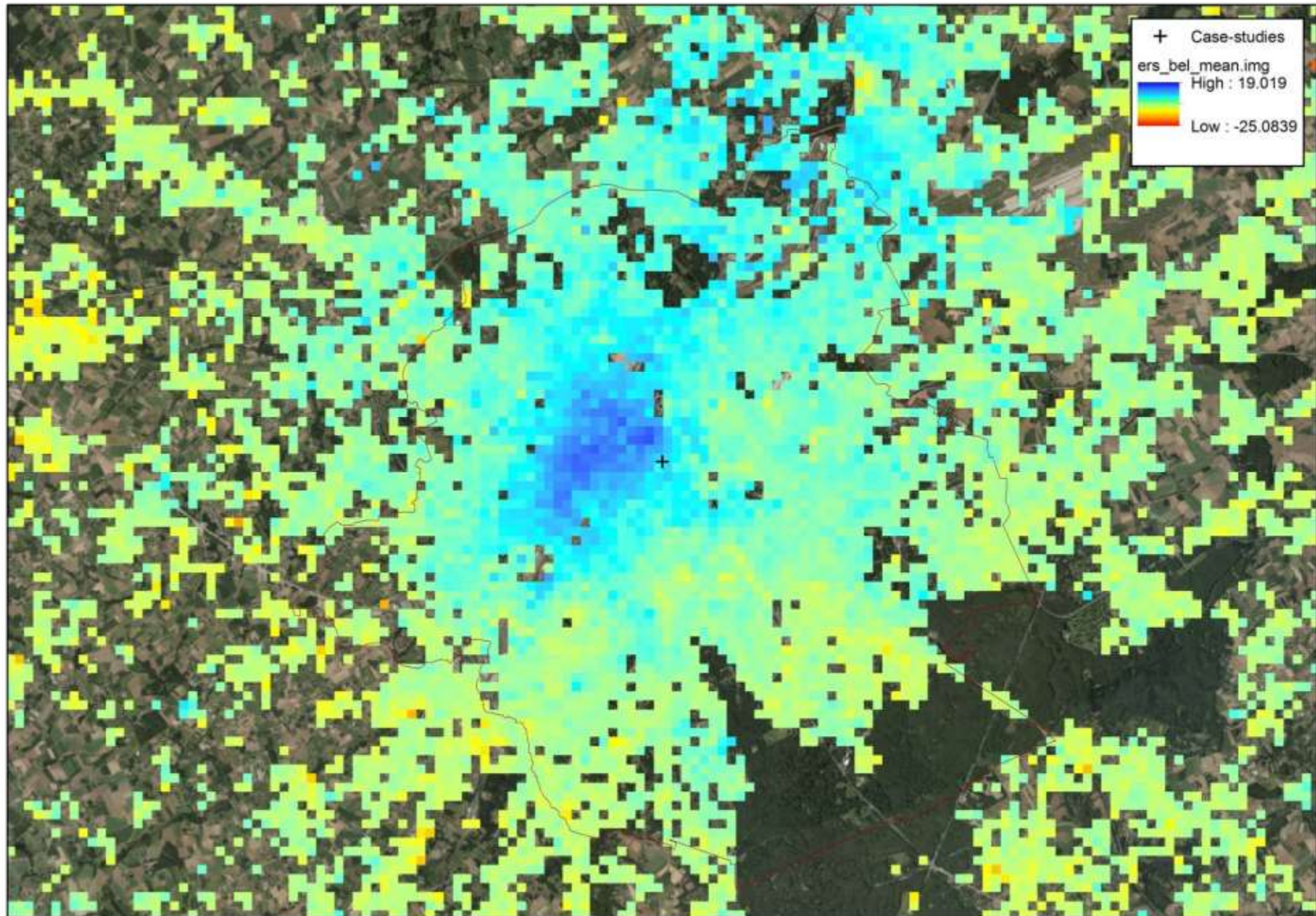
Zolder (St-Vincentius' Church): ENVISAT PSI points



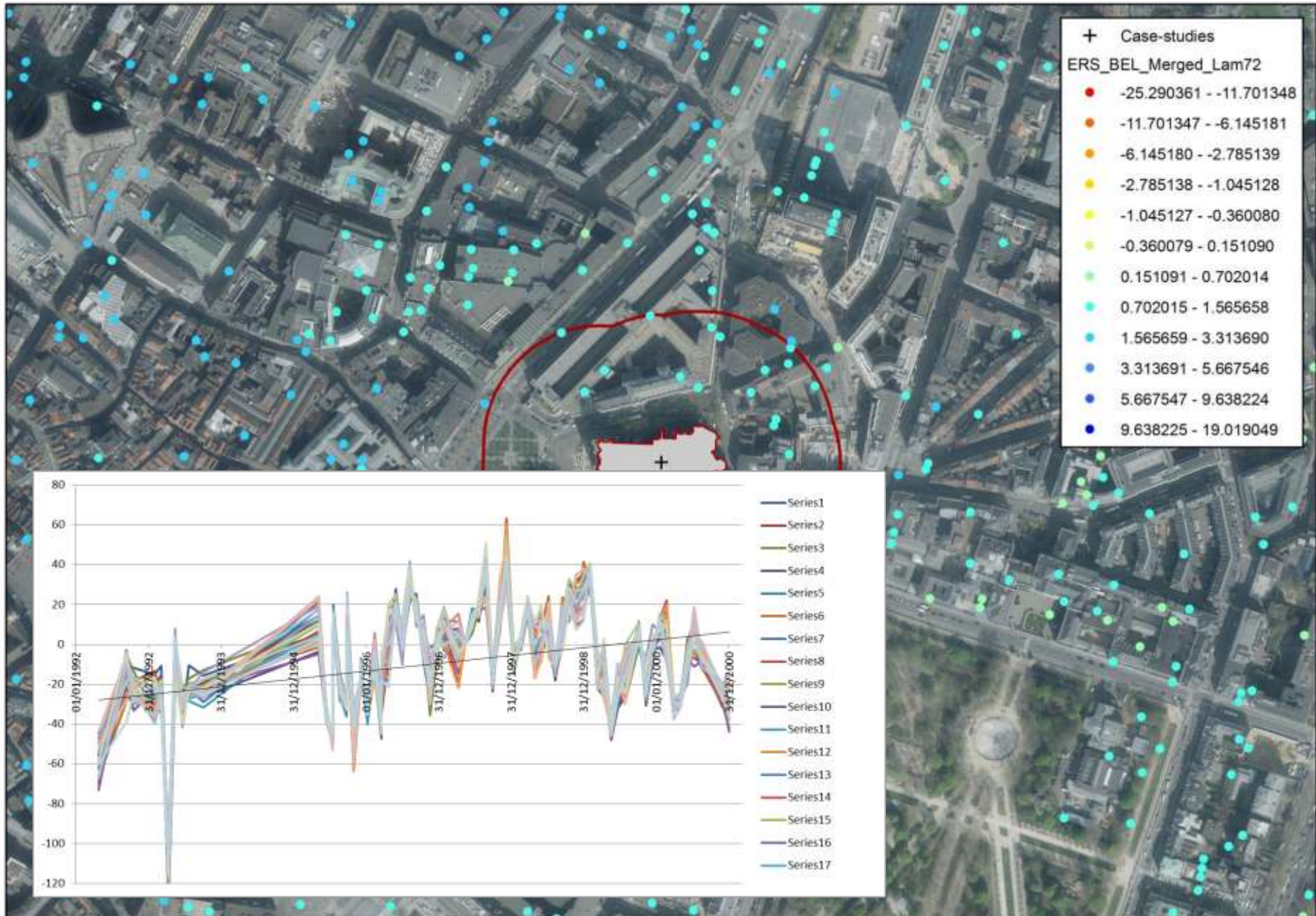
Brussels on the rise



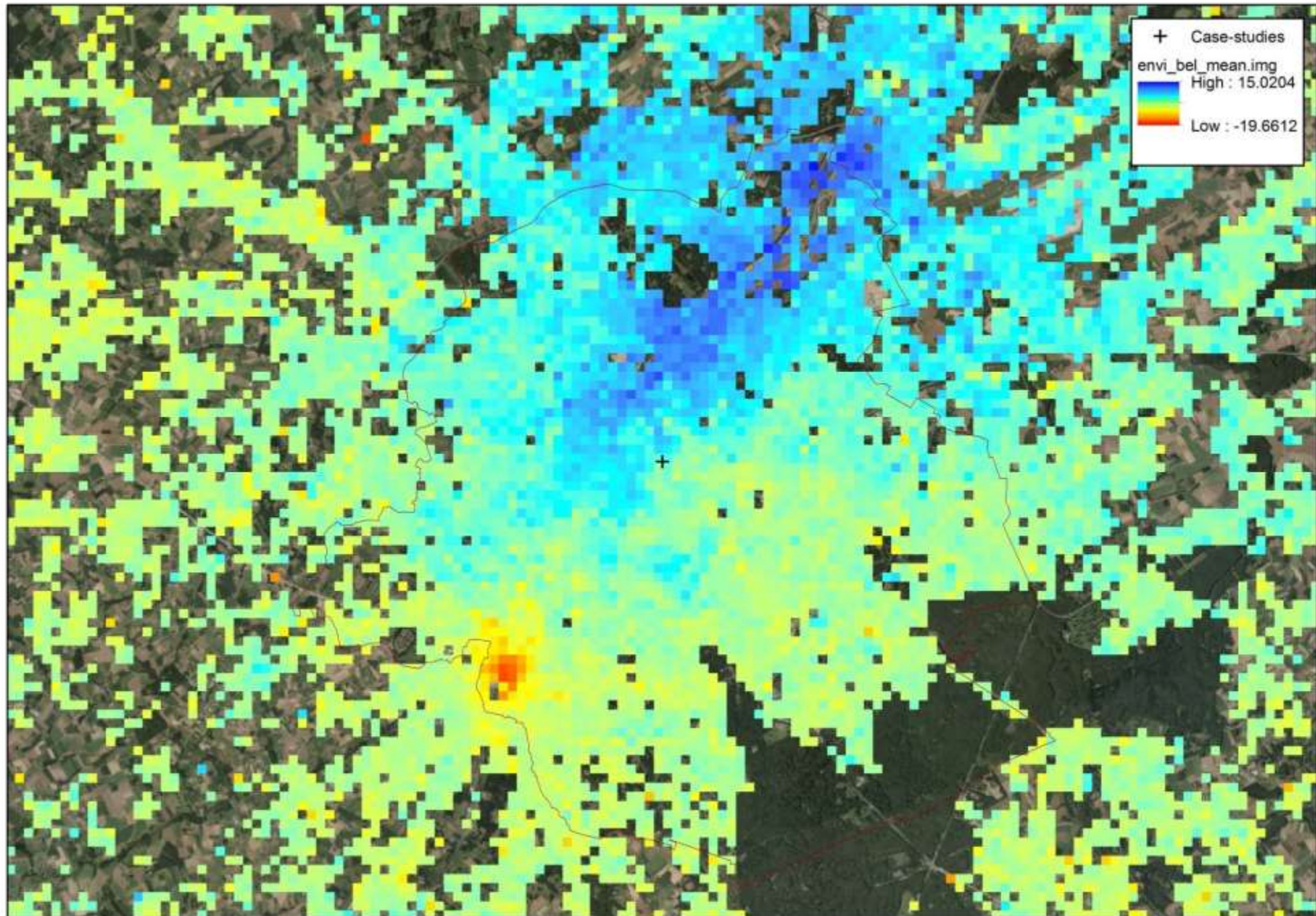
Brussels: ERS mean velocity



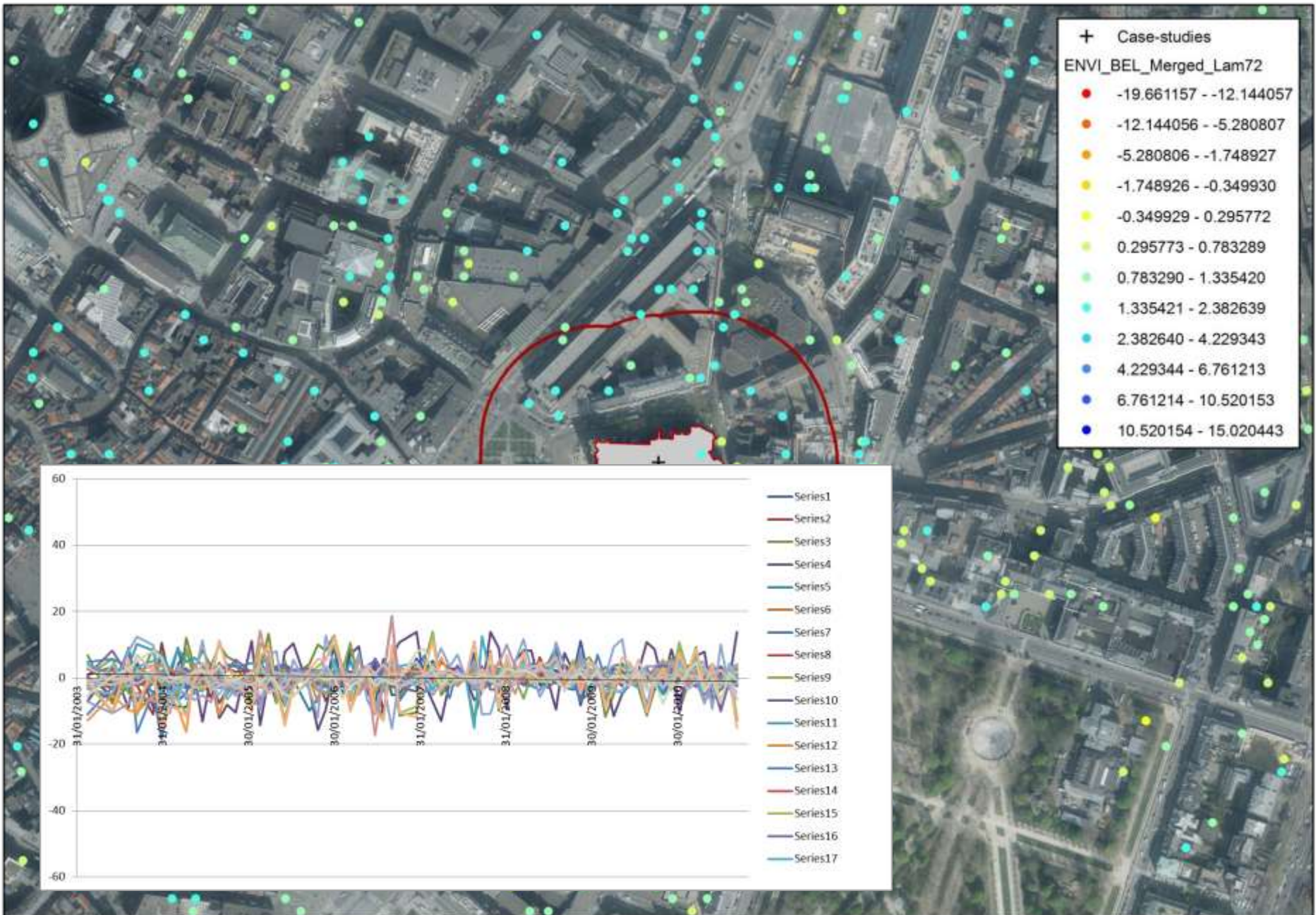
Brussels (Cathedral of Saint-Michael & Saint-Gudula): ERS PSI points



Brussels: ENVISAT mean velocity

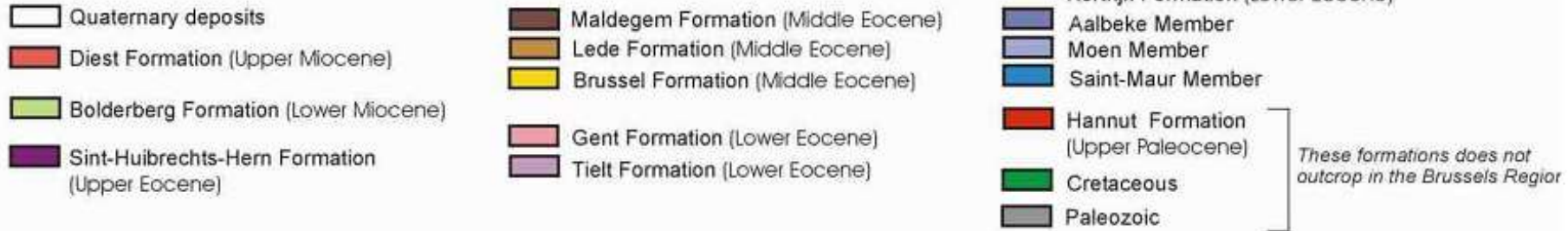


Brussels (Cathedral of Saint-Michael & Saint-Gudula): ENVISAT PSI points

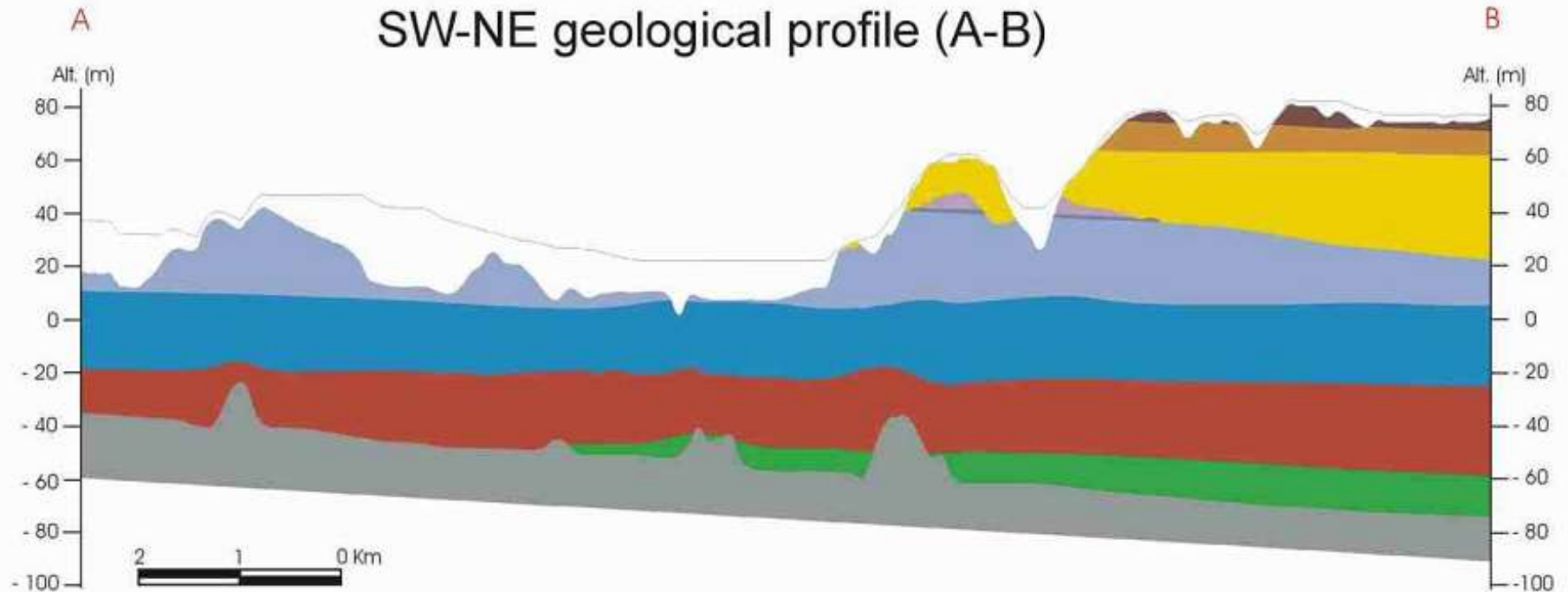


Brussels, geology

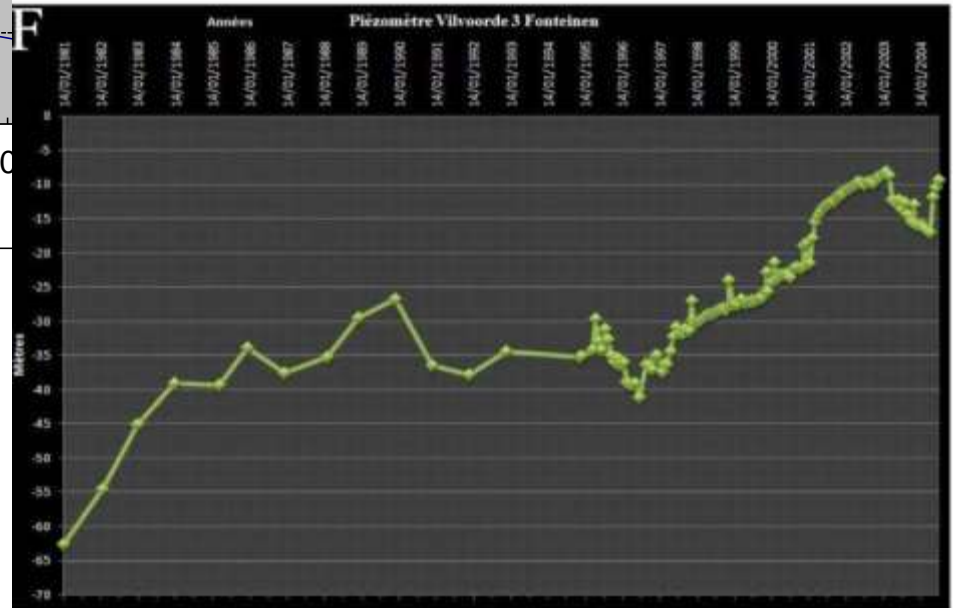
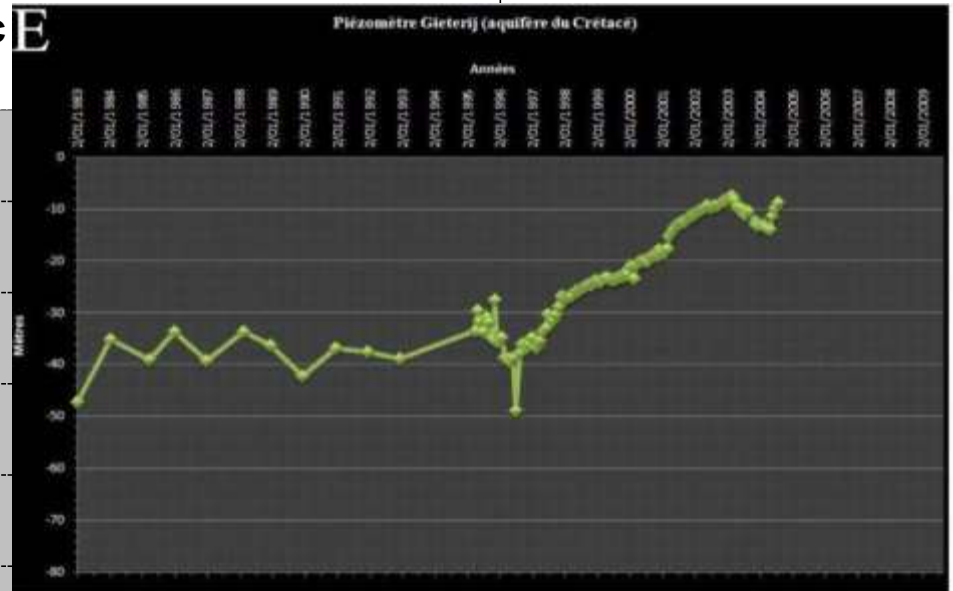
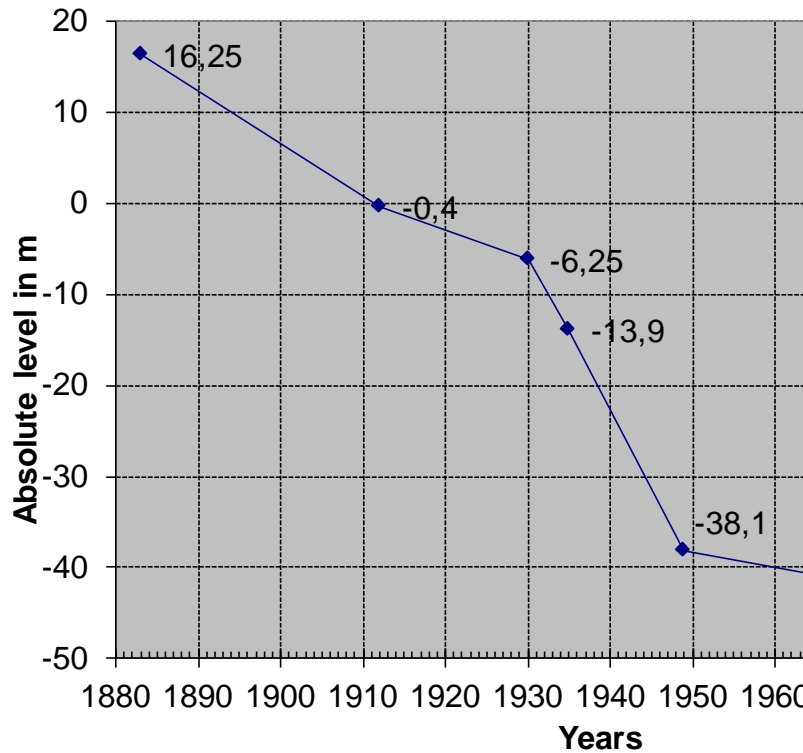
Legend



SW-NE geological profile (A-B)



Evolution of the mean piezometric level 1991



Since early 1980s: water demanding industries abandoned city centre, recharge of Cretaceous aquifer

Outlook

- Case-studies: stability analyses of built heritage at risk
- Processing of high-resolution SAR data
- Creation of risk maps at different scales
- Development of GEPATAR toolbox

The end..

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jwalstra@naturalsciences.be

