EPN DENSIFICATION
*** ESSENTIAL EXTENSION ***

AMBRUS KENYERES

CHAIR OF EPN DENSIFICATION WORKING GROUP

A BARON - A CAPORALI – F DE DONCKER - B DROSCAK – A DURET - P FRANKE – I GEORGIEV – D HANSEN – L HUISMAN – O KHODA – K MOROZOVA – J NAGL – X PAPANIKOLAOU – E PARSEULINAS - P PIHLAK - G STANGL – M VALDES - M RYCZYWOLSKI

- C BRUYNINX -

L JIVALL – S LAHTINEN – D PRIZGINIENE – OB TANGEN - M WEBER - AI KURT

AND MANY MORE . . .

EPN DENSIFICATION

SINEX LEVEL COMBINATION OF NATIONAL DAILY/WEEKLY SOLUTIONS TO REALIZE ***HOMOGENEOUS, DENSE*** EUROPEAN LEVEL **POSITION AND VELOCITY** PRODUCT, CONSIDERED AS DENSIFICATION OF THE ITRF AND ETRS89

MAIN FACTS – PROS AND CONS

- DISTRIBUTED GNSS PROCESSING, BUT CENTRALIZED INTEGRATION
- CLEANED AND HOMOGENIZED METADATA,
- **COMBINED SOLUTION FREED FROM OCCASIONAL REFERENCE FRAME DEFINITION WEAKNESSES – NATIONAL REALIZATIONS HOWEVER VERY WELCOME!**
- **TIMES SERIES TO CHECK AND COMPARE STATION PERFORMANCE,**
- **MATHEMATICALLY RIGOROUS COMBINATION BASED ON FULL VAR-COV INFORMATION WITHOUT ANY COMPROMISE!**
- INDEPENDENT TEST OF THE NATIONAL NATIONAL ETRS89 REALIZATION,
- **IMPORTANT CONDITION:** HOMOGENIZED PROCESSING OPTIONS – EPN GUIDELINES AND REPROCESSING

LATEST ACHIEVEMENTS

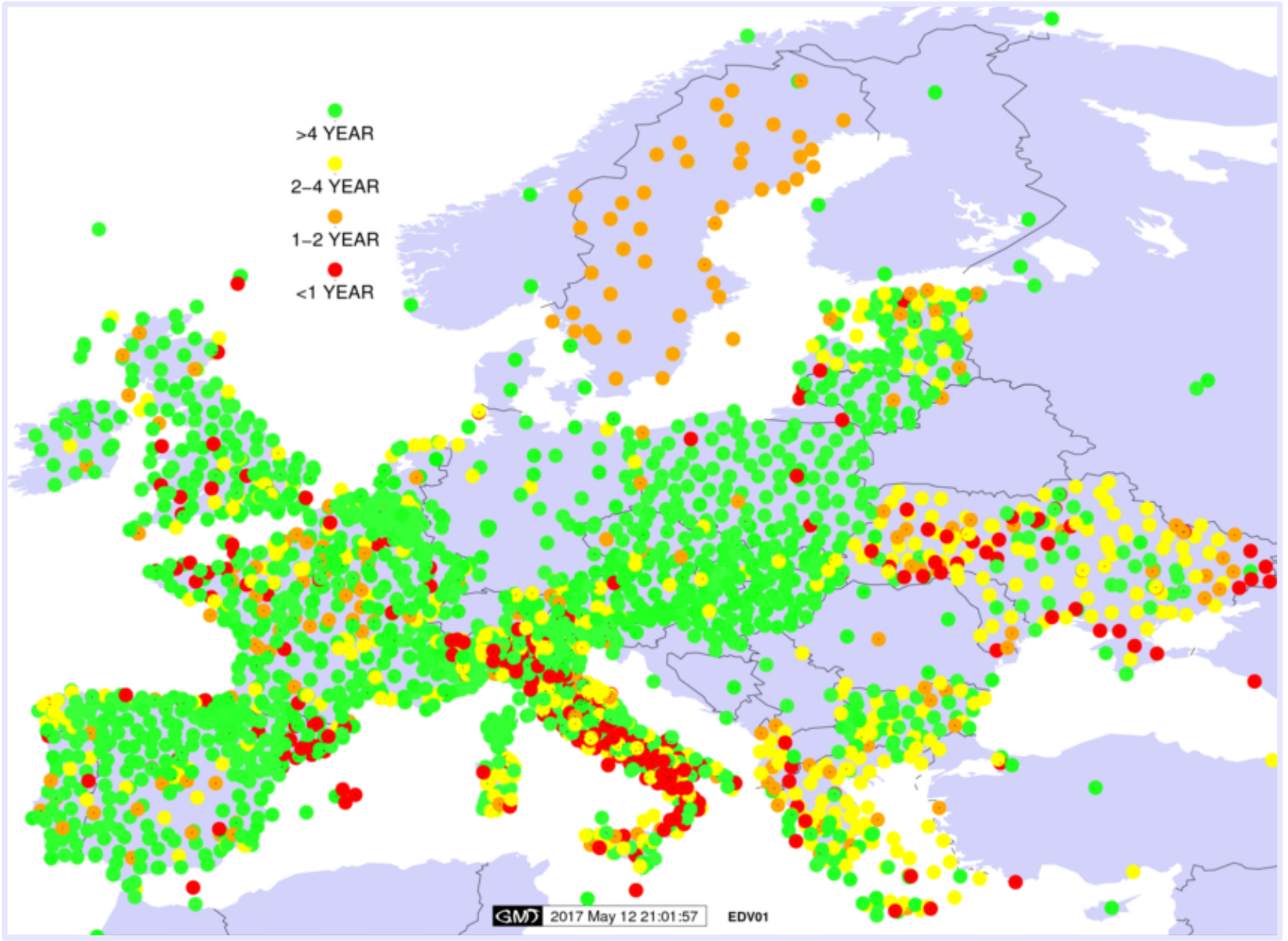
SOLUTION, CLOSE TO PUBLICATION, WAS PRESENTED AT THE WROCLAW SYMPOSIUM

IN THE MEANTIME HOWEVER EXTENSIONS, UPDATES WERE MADE AVAILABLE:

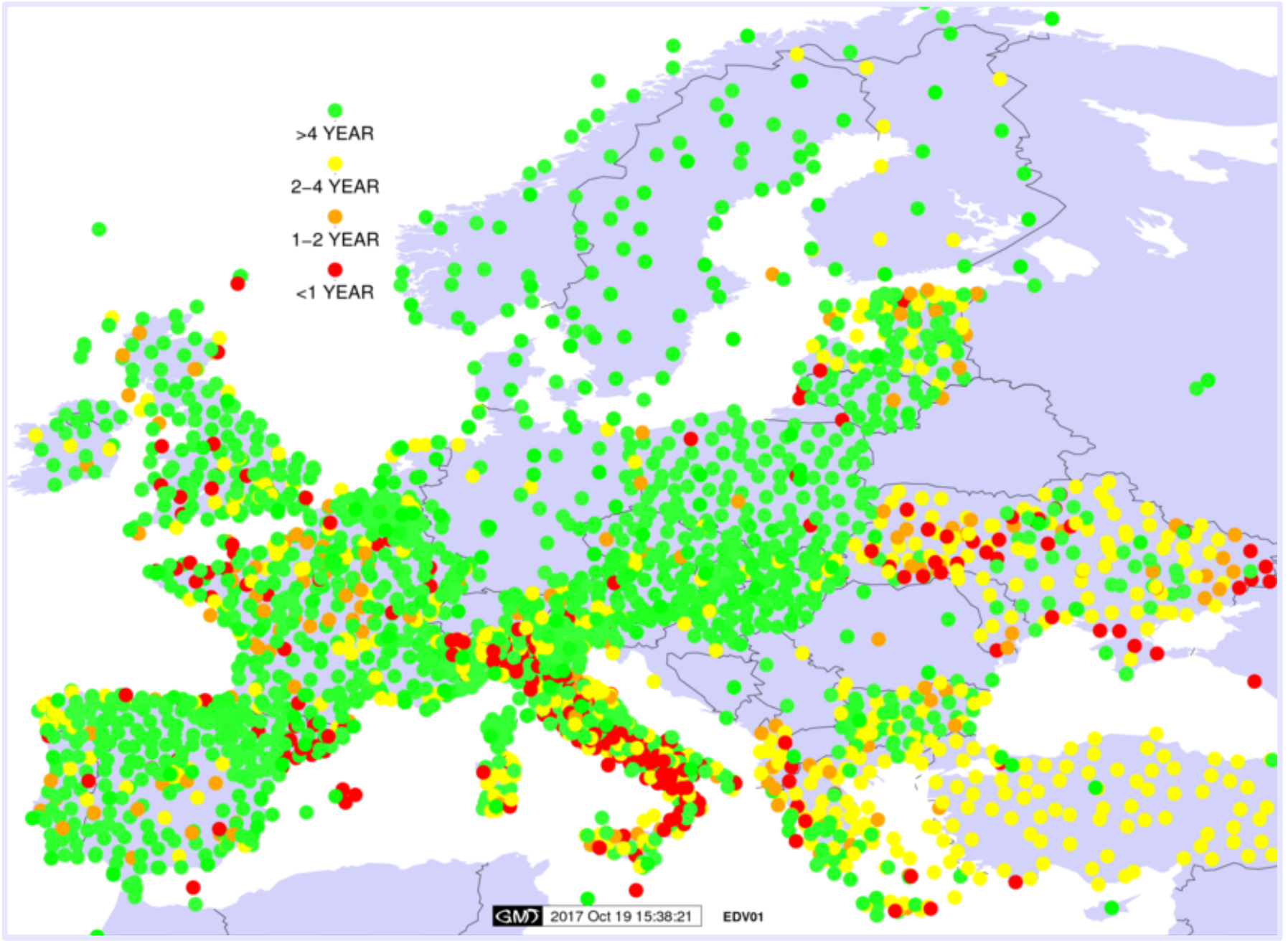
- NORDIC SOLUTIONS (DEN – FIN – NOR – SWE – ISL) WERE MADE AVAILABLE DURING SUMMERTIME (NEQ-COV/D-W)
- GENERAL COMMAND of MAPPING HAS AGREED TO PROVIDE THE TURKISH CORS SOLUTIONS

  MILESTONE IN EUREF'S HISTORY
- IGN SPAIN PROVIDED A REPROCESSED SOLUTION
- BUL AND GRE ANNOUNCED REPROCESSING
- OLG (CEG, MON, GRE) STEP BACK, PART OF IT TAKEN OVER BY NTUA

SINEX AVAILABILITY AS OF MAY



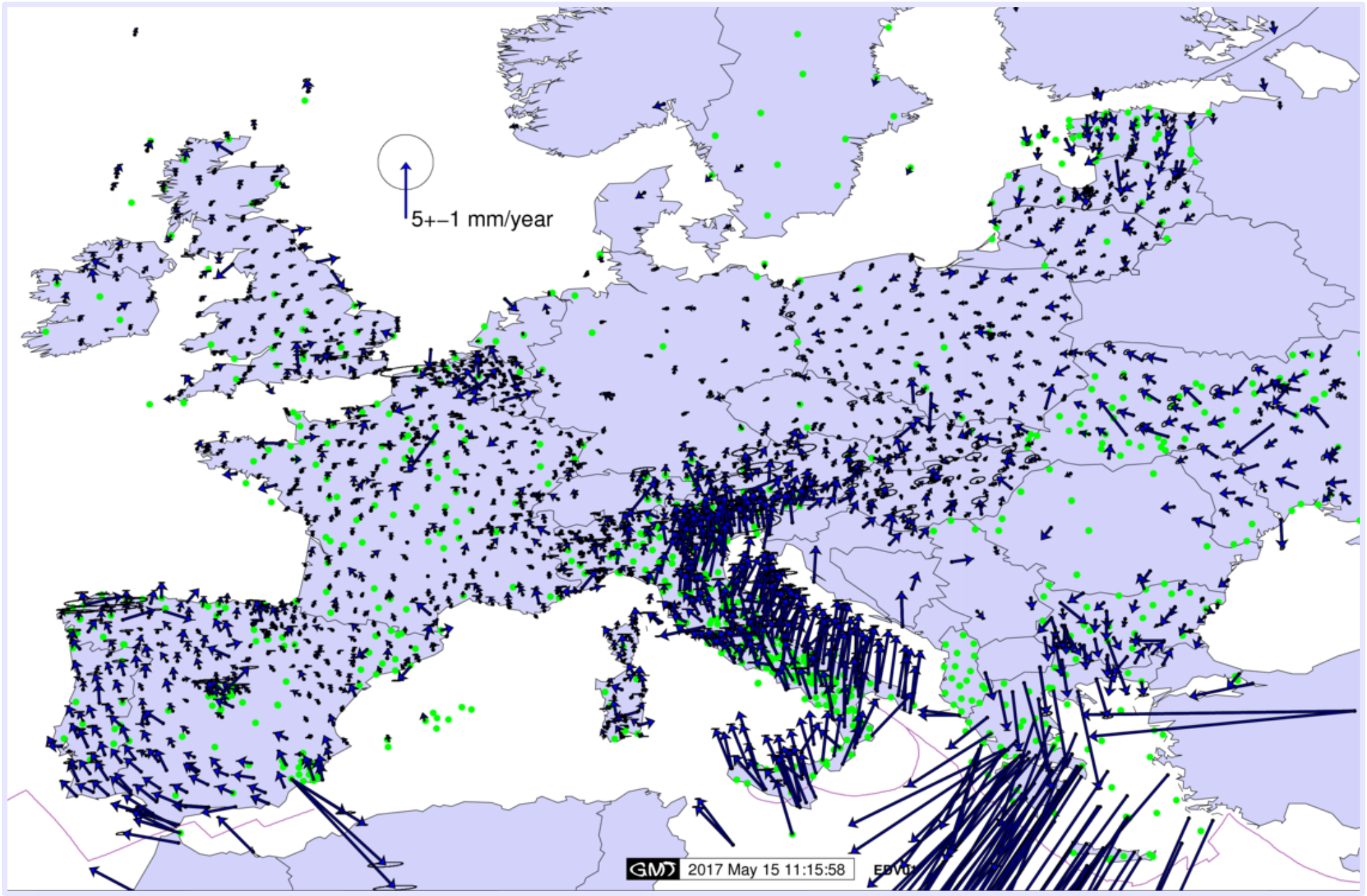
SINEX AVAILABILITY AS OF OCTOBER



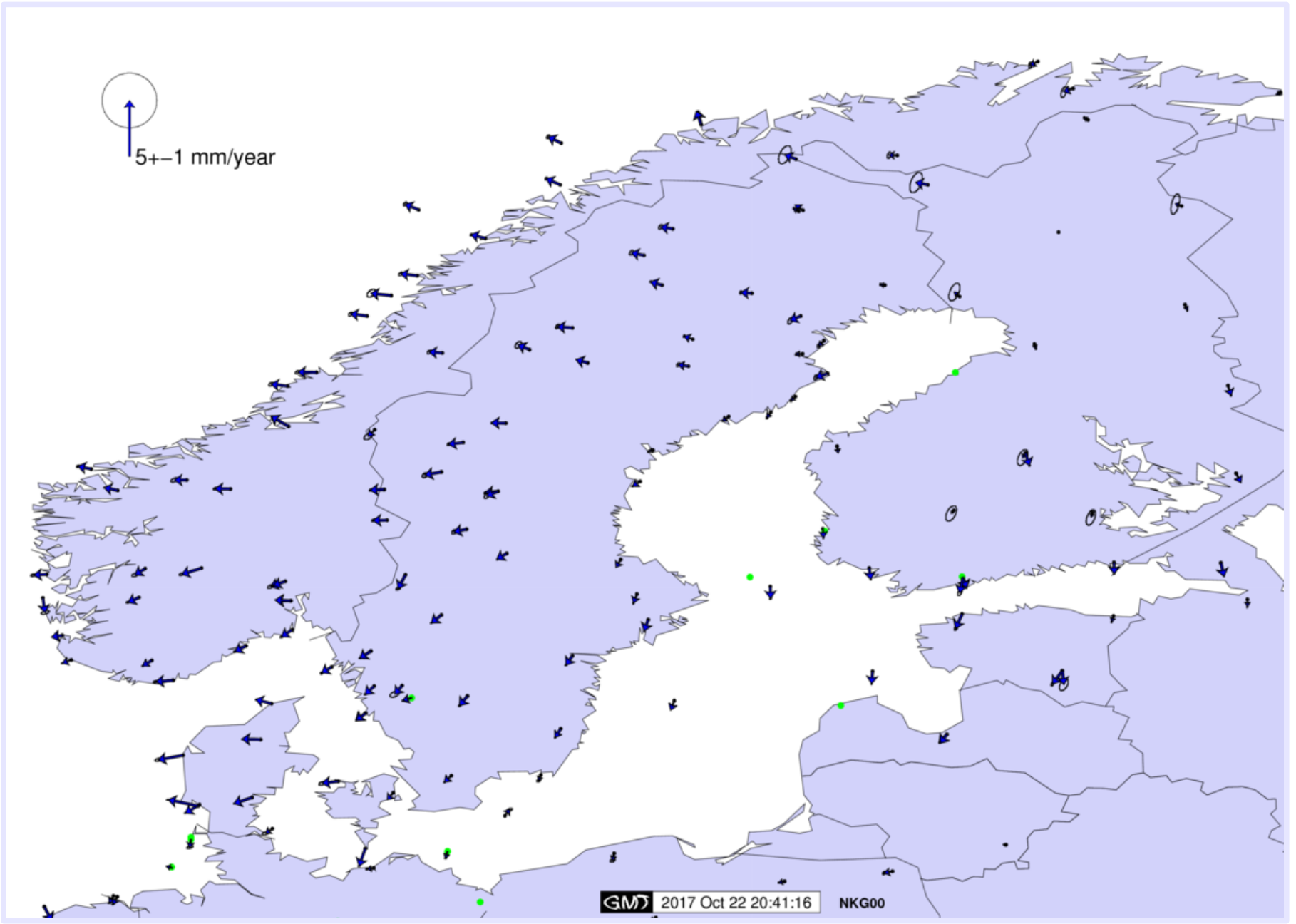
FURTHER EXTENSION?

- GERMANY: NEGOTIATIONS THROUGH UNIVERSITIES, SCIENTIFIC GROUPS REQUESTING SAPOS DATA
- SERBIA: LETTER WAS SENT, NO RESPONSE YET
- ROMANIA: NEGOTIATIONS THROUGH EPOS
- SLOVENIA: DATA MAY AVAILABLE, PROCESSING SUPPORT IS NEEDED
- CROATIA: NO SUPPORT
- BOSNIA: NO CONTACT, NO PROCESSING
- SWITZERLAND: NO SUPPORT

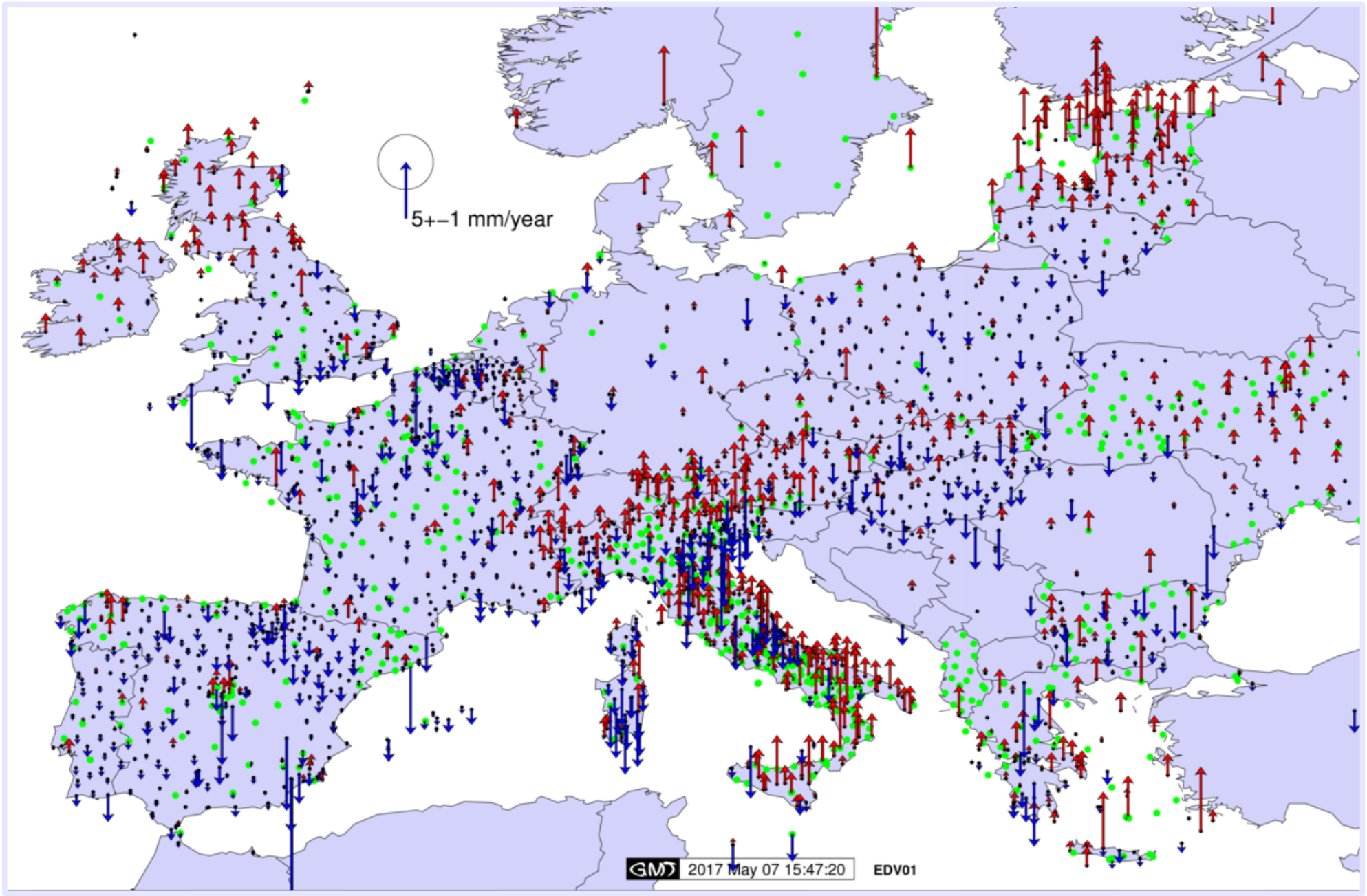
ETRF2000 VELOCITIES L> 3 years



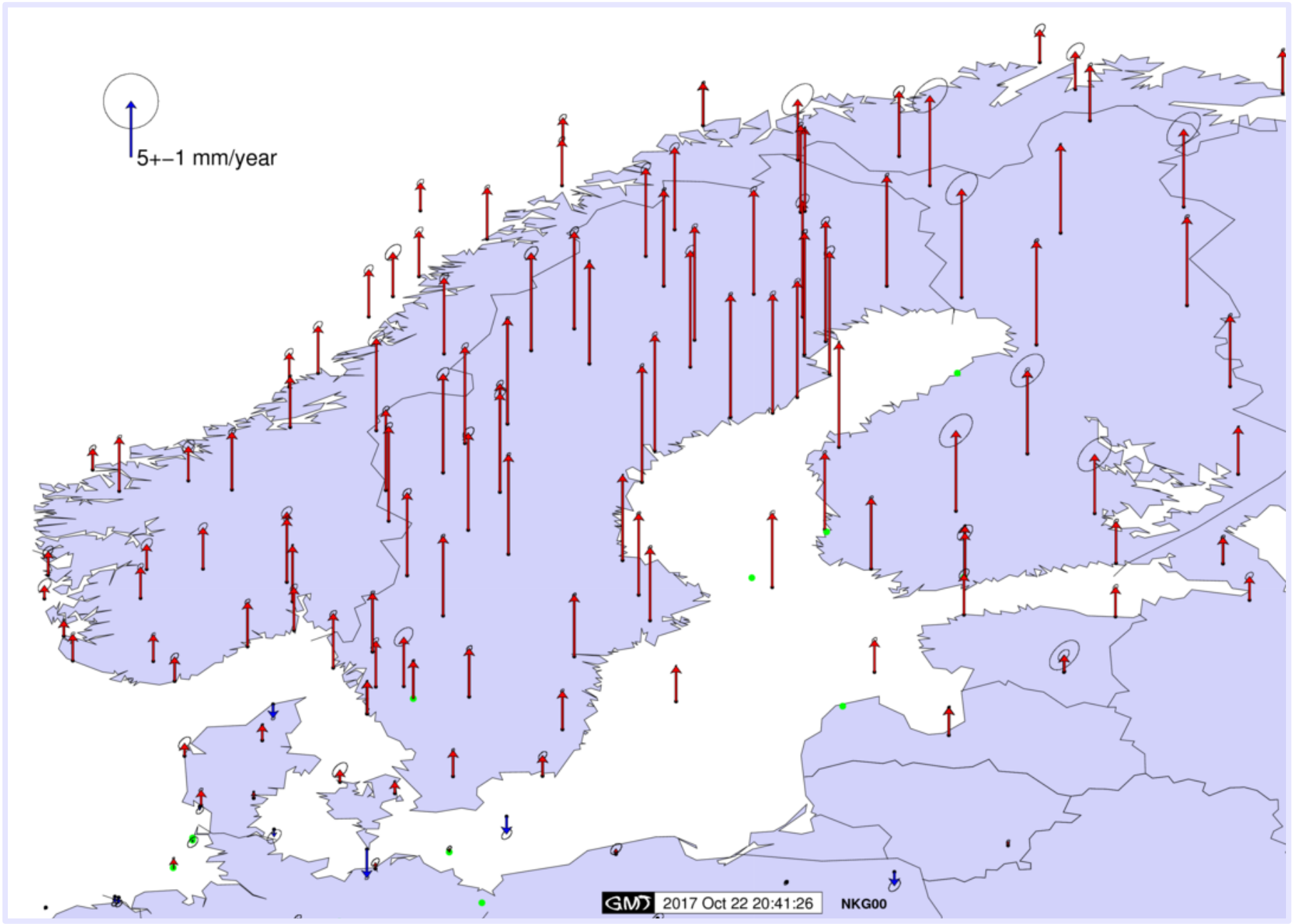
ETRF2000 VELOCITIES – NORDIC PART



UP VELOCITIES L> 3 years



UP VELOCITIES – NORDIC PART



LINKS WITH OTHER GROUPS

EPOS

- EUREF LINKS IN GENERAL
- EPN DENSIFICATION vs PRODUCTS.GNSS.COMBINED.VELOCITY
- ***DENSIFICATION INPUTS ONLY INCLUDED IN EPOS IF SINEX PROVIDERS GIVES THEIR CONSENT***
- NO NATIONAL LEVEL SINEX WILL MADE AVAILABLE FOR EPOS, ONLY COMBINED DAILY/WEEKLY ONES
- EPOS AT PRESENT: INGV&UGA-CNRS PAN-EUROPEAN SOLUTIONS

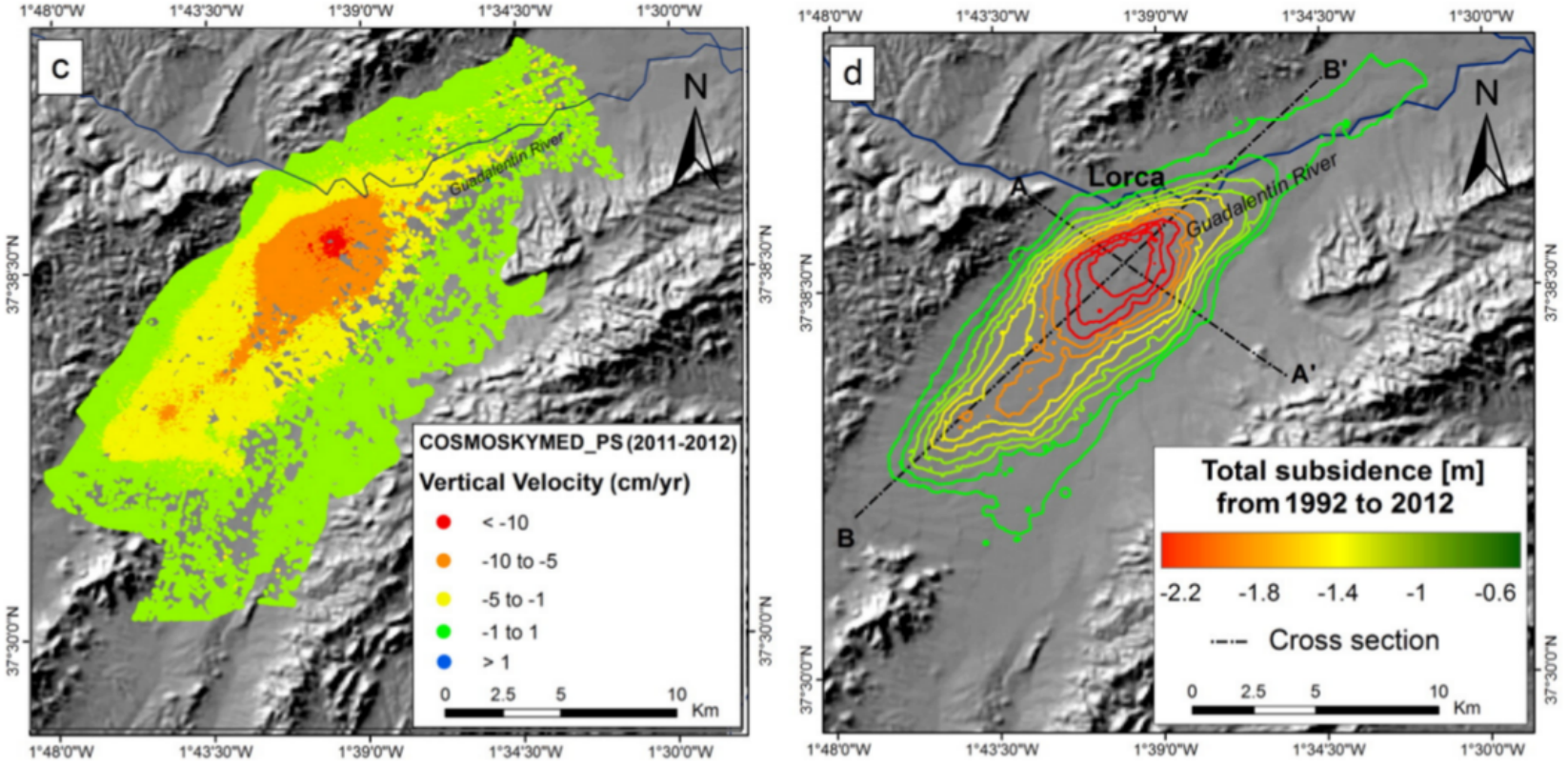
LINKS WITH OTHER GROUPS

EUROPEAN GROUND MOTION SERVICE

- WILL BE AN EU PROJECT FOR SURFACE DEFORMATION MONITORING USING SENTINEL RADAR INTERFEROMETRY (REVIVAL OF TERRAFIRMA)
- MEETINGS WITH EUREF REPRESENTATION (WS, ML)
- WHITE PAPER HAD BEEN DISTRIBUTED TO THE GB MEMBERS
- EUREF/EPN IS LISTED AS PARTNER
- MUTUAL INTEREST (INTERFEROGRAMM REFERENCING vs HEIGHT CHANGES MONITORING
- INCREASED ROLE OF EPN DENSIFICATION

LORCA STATION

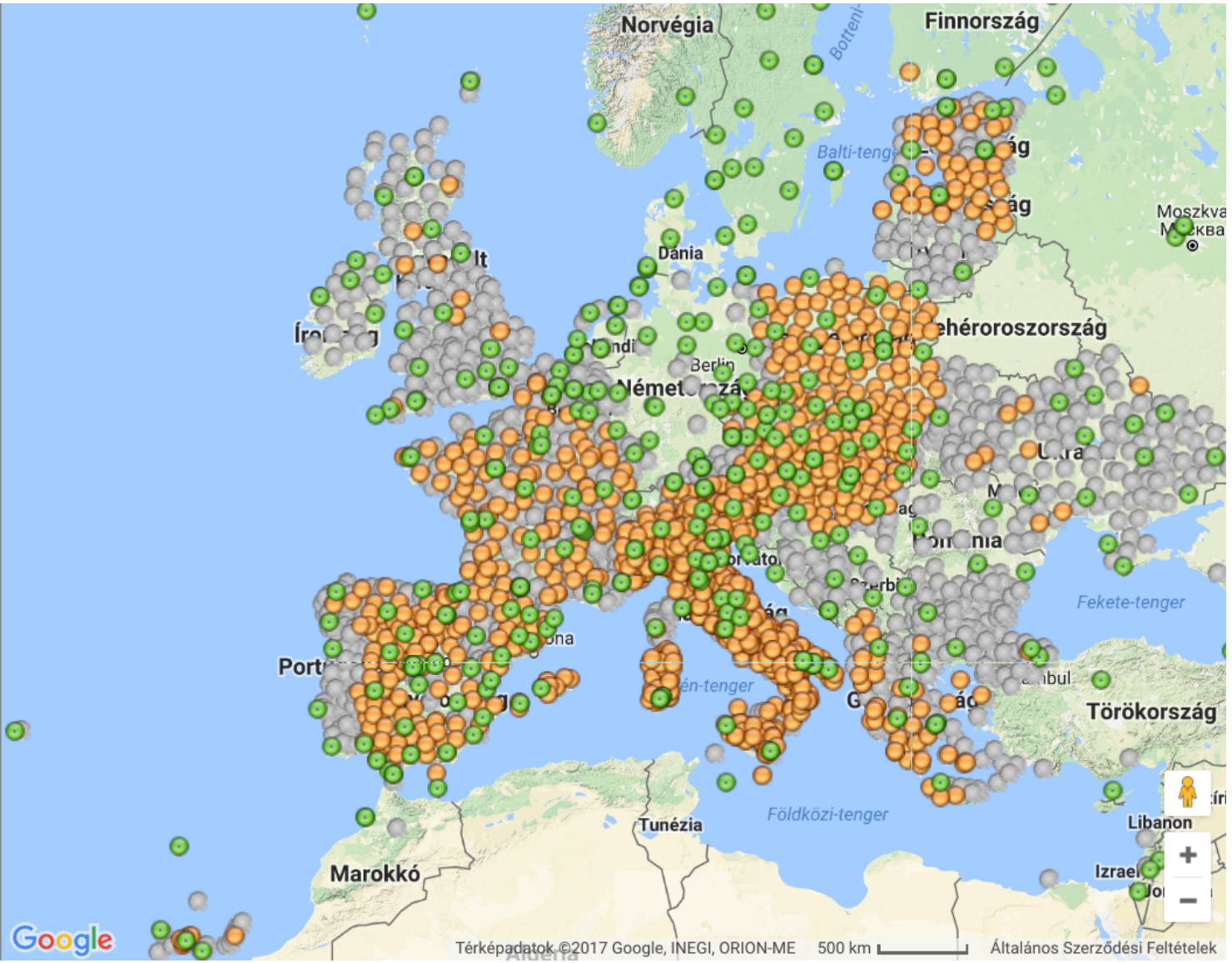
2.5 m subsidence over 20 years due to the 100-200 m ground water level drop.
We observe 100 – 73 mm/y subsidence and 13 – 8 mm/y 2D velocity



© Roberta Boni, … , Jose Fernandez, … , Oscar Mora:
Twenty-year advanced DInSAR analysis of severe land subsidence: The Alto Guadalentín Basin (Spain) case study. Engineering Geology 198 (2015) 40–52

EPN DENSIFICATION WEBSITE

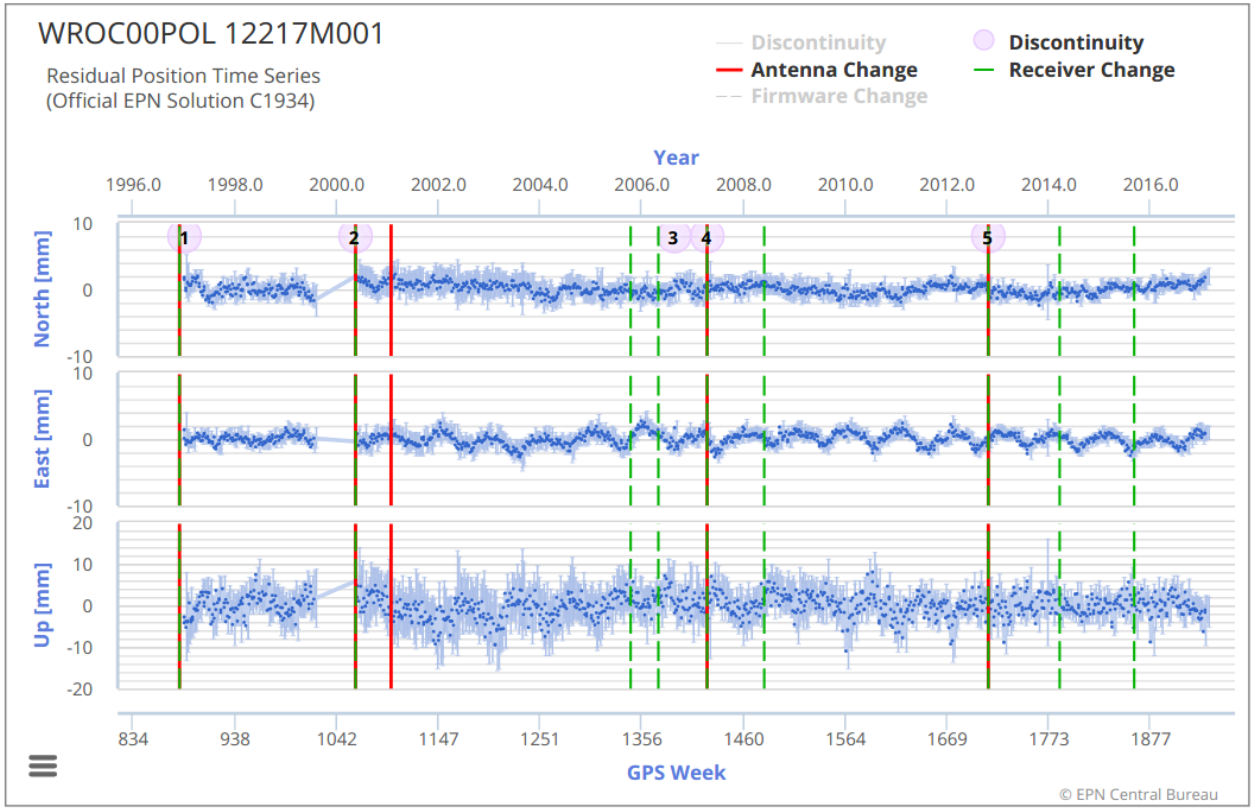
www.epncb.oma.be/_densification



- *.AC and *.OC forms are prepared and available
- partners are working on site logs
- site log submission like at EPN
- results section is still empty, but must be populated by the end of 2017

NEXT STEPS

- ALL RESULTS WILL BE IN THE EPNCB DENSIFICATION WEBSITE – FIRST AVAILABLE FOR THE PROVIDES ONLY, FOR REVIEW



Official Time Series up to week 1934

Extended Time Series up to week 1947/5

Residual Position Time Series

Position Time Series in ITRS (IGb08)

Position Time Series in ETRS89 (ETRF2000)

Official Station Velocities published by EUREF:

Frame	V_{North} [mm/yr]	V_{East} [mm/yr]	V_{Up} [mm/yr]
IGb08	14.9 ± 0.03	20.2 ± 0.02	0.2 ± 0.08
ETRF2000	0.0 ± 0.03	-0.4 ± 0.02	-0.7 ± 0.08

- COMMON PUBLICATION IS PLANNED
- EPN DENSIFICATION IS BEING SENT TO GB FOR APPROVAL

PREPARE THE PRODUCT FOR EXPLOITATION

- INSPECTION OF INDIVIDUAL STATION BEHAVIOR IN COOPERATION WITH THE STATION OPERATORS AND GNSS DATA ANALYSTS
- USE CASES
- INTERCOMPARISON OF VELOCITIES FROM DIFFERENT SOURCES
- **VELOCITY MODELING: DATA TO EUREF WG IN THIS NOVEMBER**
- DEEPENING CONNECTION TO GEOPHYSICISTS
  - CONTACT NATIONAL EXPERT GROUPS
  - EPOS INFRASTRUCTURE MAY USED FOR DISSEMINATION

STILL NOT AT THIS RELAX PHASE ...

BUT LOOKING FORWARD TO CLOSE PHASE_1 SOON