EPN Densification Project
A comparative analysis of position and velocities of a denser network

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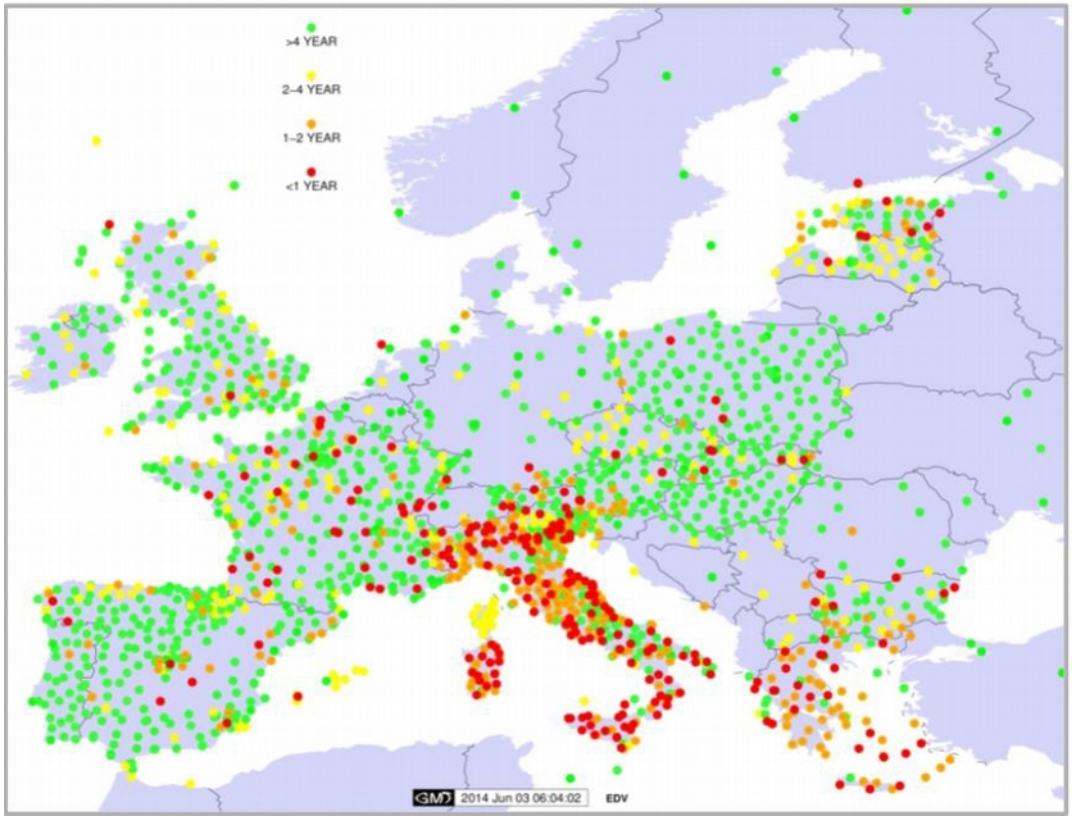
The EPN Densification Project

- Started 2011
- National weekly solutions combined with EPN weekly
- Timewise stacking of the resulting dense weekly solutions with CATREF
- Analyse time series to detect soln's and edit; iterate
- Compute dense crd/vel IGb08/ETRF2000
- Collect metadata



From C. Bruyninx presentation at REFAG 2014

The reference data

- File name : C1778.SNX (SSC format), released Jul.28 2014 (corrected Oct.16, 2014)
- Reference epoch: 2010.0 (corr. 2005.0)
- Datum: ITRF2008
- Time span of stack: gpswk 900:1778
- NEQ stacking by CATREF
- Reference coordinates/velocities from the latest cumulative solution, Class A sites

The tested data

- UPA cumulative solution of national network (the weekly SINEX files provided to the RF Coordinator)
- Reference epoch 2010.0
- Datum: IGb08
- Time span of stack: 1632-1778
- NEQ stacking by BSW52 ADDNEQ2
- Reference coordinates/velocities from the latest cumulative solution, common Class A sites

Some practical problems

- Assignment of DOMES number (fictitious vs. true) and site name (duplicates): possible conflict with IGN DOMES if new names and DOMES are not cross checked with IGN
- Time frame: Sinex files < wk1632 may not be repro2 (both nationals and EPN!)
- Numbers and epochs of soln's and edit: depend on judgment of analyst and adopted thresholds
- Constraints: MC on crd of EPN_A: what about Vel? (never discussed)
- Original National weekly SINEX files may be modified by RFC, but it is unclear how the information comes back to the data provider (example: DOMES, site renaming, soln's, edited epochs..).
- Better: National SINEX are provided as 'perfect' to the RF Coordinator, otherwise sent back for change (like for RINEX)

What has been tested

- Soln's, edited data
- CRD's at epoch (2005.0)
- Vel's

Soln's are of the greatest concern, as it can be a very subjective and therefore debatable decision.

We have verified that there are differences in our soln's. This makes it very difficult the comparison of coordinates, but will not affect velocities

By default we edit data according to the ADDNEQ2 output, where outliers are identified, and update the cumulative STA file accordingly

Comparison of the Coordinates

- EPN_A estimated coordinates (MC) vs original official coordinates from EPN site

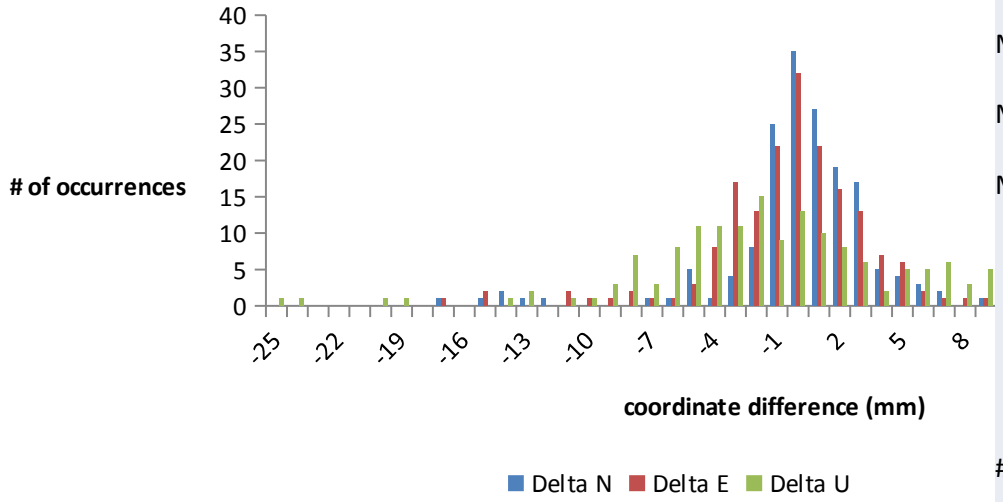
		N	E	U
|	| RMS / COMPONENT	0.82	1.96	3.79
|	| MEAN	0.25	0.14	0.89
|	| MIN	-2.02	-2.1	-7.66
|	| MAX	1.37	9.24	8.27

NUMBER OF PARAMETERS : 0

NUMBER OF COORDINATES : 87

RMS OF TRANSFORMATION : 2.46 MM

Comparison of coordinates UPA vs. Ambrus (densifying sites with more than 2 yrs data)

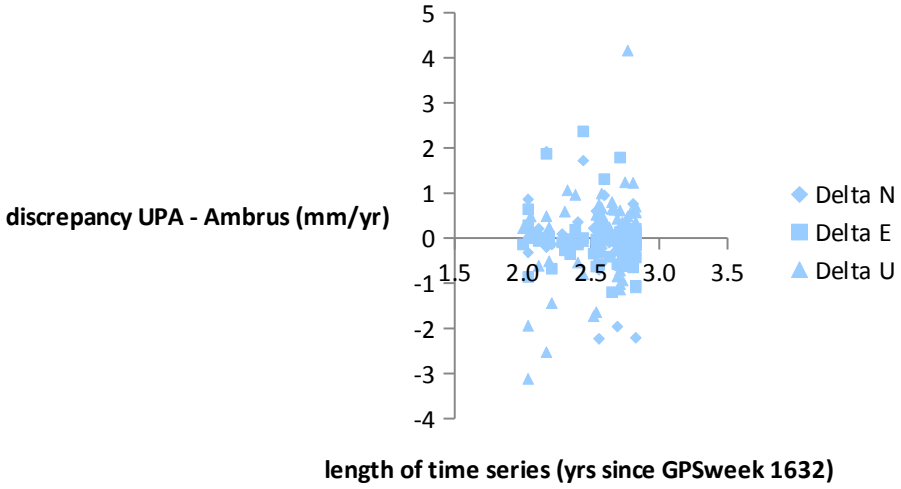


	N	E	U
RMS / COMPONENT	4.12	3.56	7.59
MEAN	1.51	0.39	0.61
MIN	-13.34	-14.73	-24.57
MAX	14.25	13.43	24.35

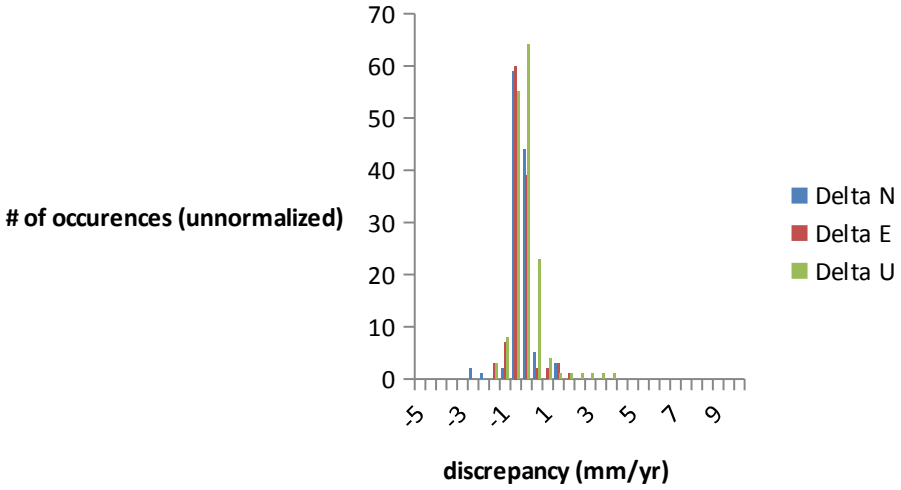
# OF PARAMETERS :	0
# OF COORDINATES :	531
RMS OF TRANSFORMATION :	5.38

- Discrepancies in the coordinates arise in several cases from the mismatch of the solution numbers
- It is therefore highly desirable that the contibuting centers define the solution numbers, based on their knowledge of the national network
- Same applies to the data editing (outliers)

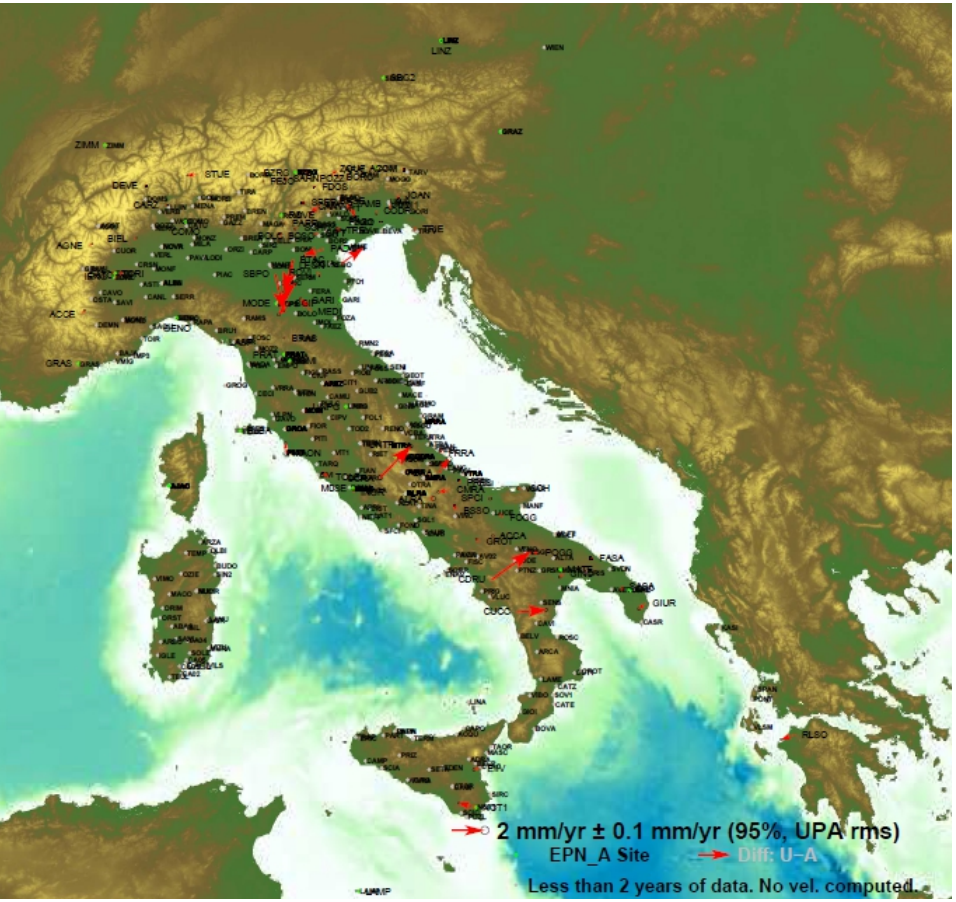
Statistics of discrepancies in the velocities

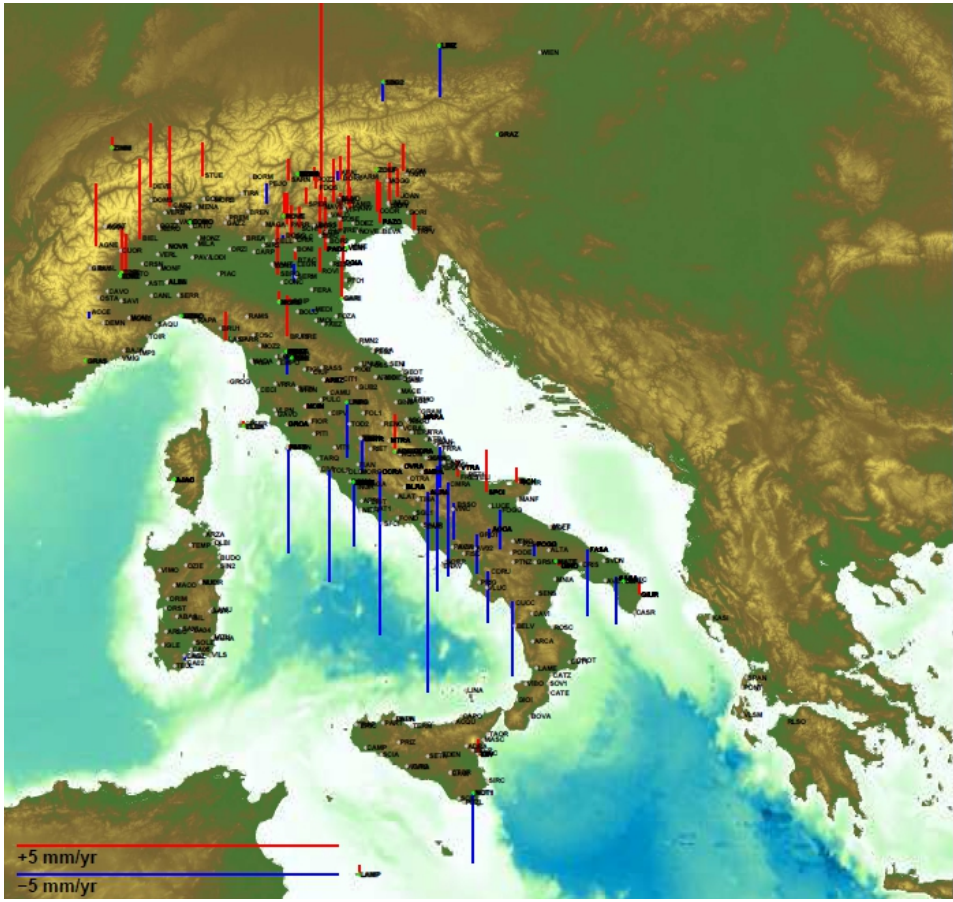


	N	E	U
	mm/yr	mm/yr	mm/yr
Mean:	-0.01	0.00	-0.06
std:	0.53	0.53	0.95
Min.	-2.23	-1.20	-3.12
Max.:	1.92	2.37	4.16
Range:	4.15	3.57	7.28



UPAvsAmbrus Comparison of hor/vert velocities for sites with >2 yrs wk 1632 to wk 1778





Conclusions

- Test of densified position/velocity solution completed with independent SW and approach, in compliance with the Guidelines for Densification of the EPN
- The two data sets to be compared have some distinct differences: EPN starts from wk 900 and includes various frames; UPA starts from from wk 1632 and is fully consistent with IGb08
- Velocities and coordinates of non EPN_A sites agree within 0.53 mm/yr horizontal and 0.95 mm/yr vertical rms, and 4 mm horizontal and 8 mm vertical rms
- Critical aspects of the entire procedure are:
  - Station renaming (4 char ID + DOMES): more coordination with IGN to ensure final values. Using 'temporary' values tend to become permanent and this can cause conflicts with IGN.
  - Identification of reset epochs (soln's) and editing: it should be left to the Sinex providers; for EPN_A adopt official soln's
  - In the absence of fully repro2 data (both EPN and nationals), it is better to start from week 1632.
- As a common practice, the contributed national SINEX should be sent to the RF coordinator already 'cleaned' and 'internationalized' under the responsability of the data provider. Soln's and edit times as well.
- It is suggested that an internal audit is implemented on a regular basis within the TWG to verify the time series and densification products.