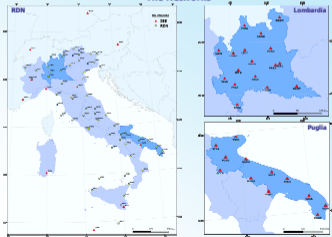


Sensitivity of local permanent networks estimates with respect to the elaboration parameters

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Local GNSS permanent networks materialize, through their stations coordinates estimation and distribution, the global reference frame; the estimates are provided by the classical network adjustment process, including near reference IGS or EPN permanent stations used as constraints. GNSS data modeling is still a research field: for this reason, IERS conventions as well as IGS and EPN guidelines, are periodically updated in order to reflect the state of the art. The purpose of this work is to evaluate the differences in the adjustment results and quality indexes provided by the adoption of different network adjustment approaches. Different elaboration approaches have been analyzed and the relevant results have been compared on two Italian local GNSS permanent network, located in completely opposite conditions: the first network is in Lombardia Region, in the northern, pre alpine Italy, the second network is in Puglia Region, in the southern, mediterranean, Italy; for Lombardia network, one year of data has been analyzed; for Puglia network, six months of data are available and have been considered. From a technical point of view, the use of IGS and EPN stations as constraining references could degrade results accuracy in zones where they are too sparse, like for example central-southern Italy: a possible solution is to adopt a national zero order permanent network: it should be adjusted in IGS and used to constrain the adjustment of local networks. A test zero order network has been established by IGM (Istituto Geografico Militare, the Italian Cartographic Institute), that is called RDN (Dynamic National Network). All RDN stations are permanent, but are managed by several and independent institutions that, in this test phase, are not automatically transferring the data to IGM. At the present, only two weeks are available and have been analyzed; at the paper final writing, one month of results will be available.

The Networks



Network	# PSs	Average distance between PS's	Web
RDN	61	65 km	http://www.igmi.org
LOMBARDIA	17	50 km	http://www.gpslombardia.it
PUGLIA	12	60 km	http://gps.ut.puglia.it

Methodological comparisons

All elaborations performed with BSW5.0, by stochastically constraining IGS PS's to their IGS05 published coordinates.

- Soft Constraints (SC):** IGS PS's constraints standard deviations of 2 mm and 4 mm in planimetry and height.
- Hard Constraints (HC):** IGS PS's constraints standard deviations of 0.2 mm and 0.4 mm in planimetry and height.
- No Gradients (NG):** hourly ZTD estimates for each PS, no horizontal gradients estimation.
- Yes Gradients (YG):** as NG, but daily horizontal gradients estimates for each PS.

LOMBARDIA PSs						
	ZEAST (mm)	ZNORTH (mm)	ZHEIGHT (mm)	Z	M	
NG / SC	0.0	1.8	-0.4	7.0	0.0	1.7
NG / HC	0.0	1.4	-0.4	7.0	0.0	1.6
YG / SC	0.0	1.2	-1.3	9.3	0.0	1.4
YG / HC	0.0	1.1	-0.7	9.6	0.0	1.3

PUGLIA PSs						
	ZEAST (mm)	ZNORTH (mm)	ZHEIGHT (mm)	Z	M	
NG / SC	0.0	1.8	-0.9	6.1	0.0	1.6
NG / HC	0.0	1.2	-0.8	4.4	0.0	1.3
YG / SC	0.0	1.2	-1.7	4.4	0.0	1.3
YG / HC	0.0	1.0	-0.7	4.6	0.0	1.1

A significant statistic improvement is provided by the NG->YG transition: it wasn't completely expected, because of the local nature of the networks. The SC->HC doesn't really change the results, contrary to the idea that a stronger weight to constrained stations might improve the repeatability of the adjusted stations. Best quality indicators (final multibase RMS's, here not shown) are provided by SC/YG solution: however, differences are never significant. Comparison of the interpolated coordinates and velocities are still under progress, but first analyses don't show significant differences. More detailed analyses and further comparisons will be described in the final paper.

References comparisons

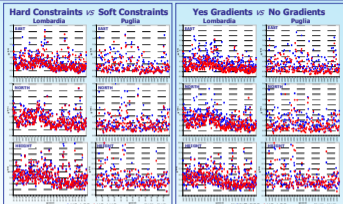
To compare the adjustment of local networks in IGS versus zero order national network (RDN) the following approach has been adopted:

- direct adjustment of local PN's in IGS;
- adjustment of RDN in IGS by the same approach;
- adjustment of local PN's in RDN, without constraining of others IGS stations;
- comparison of 3. and 1.

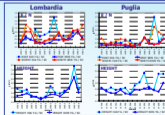
At the present, only two weeks are available and have been analyzed; at the paper final writing, one month of results will be available.

Conclusions

The first tests have been performed and discussed. In future, further analyses will be made on the IGS05 versus ITRF05 choice in constraining IGS PS's and on the application of Ocean Loading tables; moreover, the use of RDN will be tested with a greater data set.



In the graphs: for each day, for each component f (East, North, Height) $\pm \sigma_f = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}}$ where \bar{x} is the predicted / from a linear interpolation on all the solutions.



LOMBARDIA PSs						
	ZEAST (mm)	ZNORTH (mm)	ZHEIGHT (mm)	Z	M	
YG / SC IGS	0.0	0.7	-1.7	3.2	0.0	0.7
YG / SC RDN	0.0	0.4	-1.1	1.8	0.0	0.6

PUGLIA PSs						
	ZEAST (mm)	ZNORTH (mm)	ZHEIGHT (mm)	Z	M	
YG / SC IGS	0.0	1.2	-1.4	3.9	0.0	1.1
YG / SC RDN	0.0	0.5	-1.8	2.0	0.0	0.8

By introducing RDN, repeatabilities of local networks improve; "final" (BSW5.0 COMPARE) coordinates estimates change of few millimeters, but considering that at present only two weeks of results are available, these differences cannot be considered significant: more data are needed.

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