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The Analysis of the Italian GNSS Network at the University of Padova: ETRS89 densification and Scientific GNSS Backbone Network for Italy.

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The University of Padova (UPA) contributes to EUREF in two different ways: routine and research.

Routine activities include daily processing of a subnetwork of the EPN as a EPN Local Analysis Center (LAC) and Densification Center (DAC); in parallel, a network of up to 700 permanent Italian GNSS stations is processed (GPS+Glonass operational, Galileo in test mode; rapid and final orbits), archived and checked for metadata using IGS/EPN procedures and logsheets. Routine activities also include the support to regional surveyors by delivering free RTK (GPS+GLONASS) data via NTRIP to some 200 users, on behalf of the Regional Government of Veneto, based on a network of some 30 permanent sites the coordinates of which are weekly checked for consistency with the ETRF2000.
Research activities include the derivation of a dense velocity field for the Italian area, and the active involvement in the Deformation Models Working Group (chaired by M. Lidberg), EPN Densification Working Group (chaired by A. Kenyeres), and European Dense Velocities Working Group (chaired by E. Brockmann). For the densification of the velocity field we are testing an independent approach which consists in stacking SINEX files resulting from multiyear cumulative solutions generated by several Analysis Centers contributing to the CEGRN (Central European GNSS Reference Network). The alignment to the ETRF2000 frame is accomplished by solving for Helmert parameters and for their rates, using minimal constraints on position and velocities of common EPN sites of Class A. The derived velocities are then converted to strain rates by weighted least squares collocation and the implied deformation is examined in the context of independent knowledge from seismicity and structural geology. Thematic maps of strain rates (scalar values and eigenvectors) at specific seismogenic faults in Italy are generated as a final product.

MultiGNSS has evolved into a high priority activity. A Matlab based program has been developed with capabilities to estimate coordinates, receiver clock and Tropospheric Zenith Delay solutions using simultaneously Rinex 3.0x data from GPS, Glonass, Galileo, Beidou, Navic, QZSS and SBAS satellites, and broadcast or SP3 (if available) orbit products. This work as resulted in a accurate monitoring of the system clock alignment of the GNSS constellations relative to GPS time, and of individual, receiver specific biases for about 30 permanent European multiGNSS sites contributing to the MGEX project of the IGS. For Galileo, specific studies are done on the dependence of the coordinate results on the F/NAV and I/NAV broadcast message, and on the agreement level of broadcast satellite positions relative to postcomputed (SP3) positions. The ultimate goal is to understand how interoperable the several GNSS constellations are, and hence to which extent the simultaneous use of multiple GNSS data enables the final user to derive coordinates consistent with the ETRS89 standard prescribed by the INSPIRE Directive of the EU.