An innovative procedure for 2D PWV monitoring on a wide and orographically complex area with existing infrastructures

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INPUT DATA

- ZTD estimations from GNSS permanent stations (PSs) network (Fig. 1)
  - 181 GNSS PSs from Global, International, National and Regional networks
  - average spacing: 40 km in French-Italian border region
  - 3 sub-networks according to PS age
  - 15 common stations → stable reference frame
- Pressure (P) and Temperature (T) observations from NOAA meteorological stations (Fig. 2)
- Digital Terrain Model (DTM) → ASTER GDEM

RESULTS AND VALIDATION

- PWV maps (Fig. 3a)
  - Low density approach: two-hourly data + low resolution (∼ 10 km) → a posteriori monitoring
  - High density approach: 6 minutes data + high resolution (∼ 250 m) → near real-time monitoring
- \( \Delta \text{PWV} \) maps: differentiation of PWV maps with respect to a "calm moment" (Fig. 3b) → orographic effect removal → evolution of PWV in space and time
- Heterogeneity Index (HI) maps: obtained from \( \Delta \text{PWV} \) spatial variability, indicator of severe event occurrence (Fig. 3c) → localization in space and time

VALIDATION

- ZTD estimations: comparison with IGS official products (Fig. 4)
- PWV maps: comparison with meteorological re-analysis from WRF model
  - 2D difference map (Fig. 5a) → differences mainly located on high altitude areas
  - PWV time series on PSs at different heights (Fig. 5b)
  - section along complex topography (Fig. 5c)
- \( \Delta \text{PWV} \) maps: section along complex topography (Fig. 5d) → orographic effect removal
- Heterogeneity Index maps: comparison with \( \Delta \text{PWV} \) maps and occurred rain in different situations (Fig. 6) → statistical validation + HI improvement

FIGURE 4: ZTD DIFFERENCES

FIGURE 5A: GPS PWV (mm)

FIGURE 5C: GPS (150 m a.s.l.)

FIGURE 5D: ZTD DIFFERENCES

FIGURE 6A: OCCURRED SEVERE EVENT

FIGURE 6B: PWV TIME SERIES ON IGS

FIGURE 6C: ZTD (300 m a.s.l.)

FIGURE 6D: ZTD (120 m a.s.l.)