Discontinuities in the IGS tracking stations coordinate time series

Paulo Jorge Mendes Cerveira, Robert Weber

Institute of Geodesy and Geophysics

University of Technology, Vienna, Austria

email:mendes@luna.tuwien.ac.at

Introduction. We investigated the weekly SINEX coordinate time series solutions of the CODE Analysis Centre and the IGS combination, which is merged from coordinate solutions of eight Analysis Centres (ACs). These coordinate series cover a 4.5 years period ranging from August 1999 till February 2004. Only stations providing more than 156 GPS weeks data over the mentioned period interval have been considered. The time series contain numerous non-stationary or transitory characteristics (e.g. because of earthquakes or antenna height changes), which are an important part of the signal. The dyadic form of the DHWT (Discrete Haar Wavelet Transform) is applied to the mean-centred data after the data was pre-filtered by the FMH (Finite Median Hybrid) filter. Jumps are indicated by large values of the wavelet coefficients on the finest scale. We compared annual amplitudes and vertical trends of IGS and CODE coordinate solutions, where considerable differences are pointed out. To detect and remove remaining discontinuities in station coordinate time series is an indispensable condition for exploring semi-annual and seasonal variations.

MODEL → TIME SERIES = OFFSET + LIN.TREND + ANNUAL TERM + SEMIANNUAL TERM

$$dh = a_0 + b_0 \cdot t + A \cdot \sin(\omega_1 \cdot t + \varphi_1) + B \cdot \sin(\omega_2 \cdot t + \varphi_2)$$

TRANSFORMATIONS

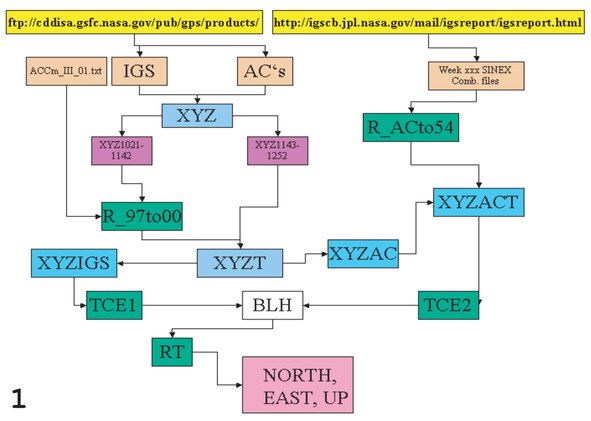

FIG 1

STATIONS

IGS
CODE

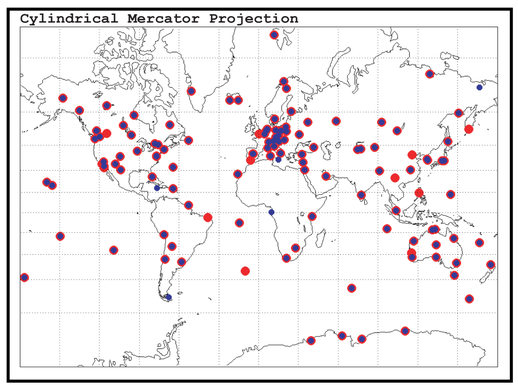

FIG 2

PERIODS

STATIONS > 156 GPS WEEKS

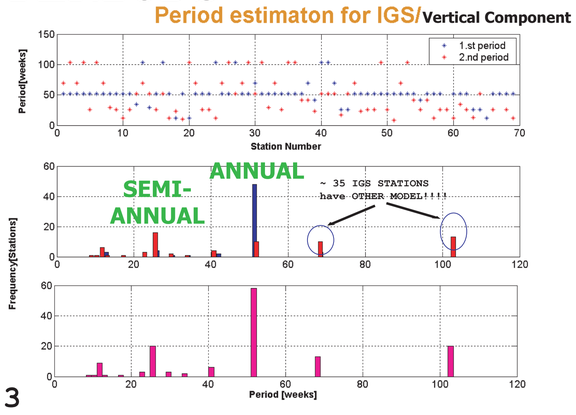

FIG 3

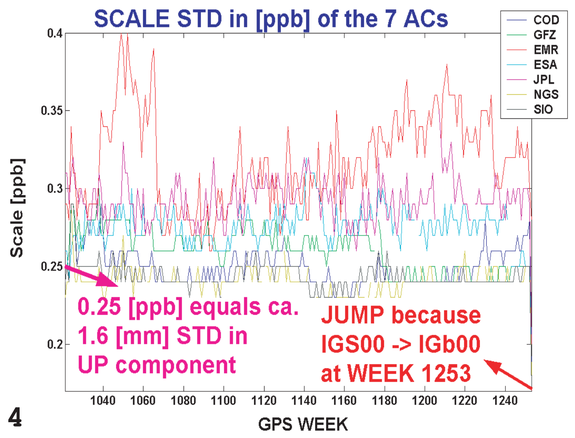

FIG 4

IMPORTANT QUESTION:

WHY does CODE produce vertical annual amplitudes ~2 times larger than IGS?

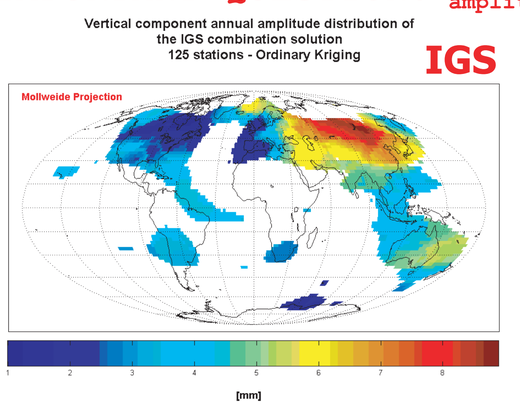

FIG 5

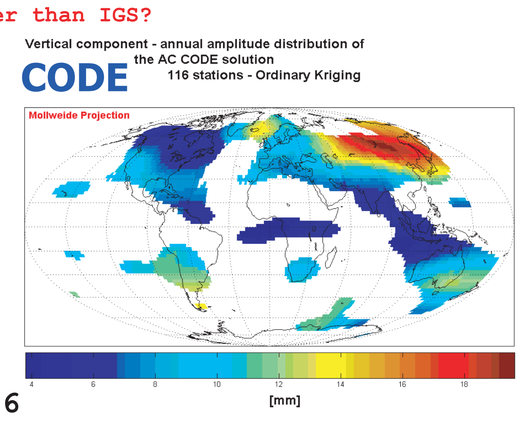

FIG 6

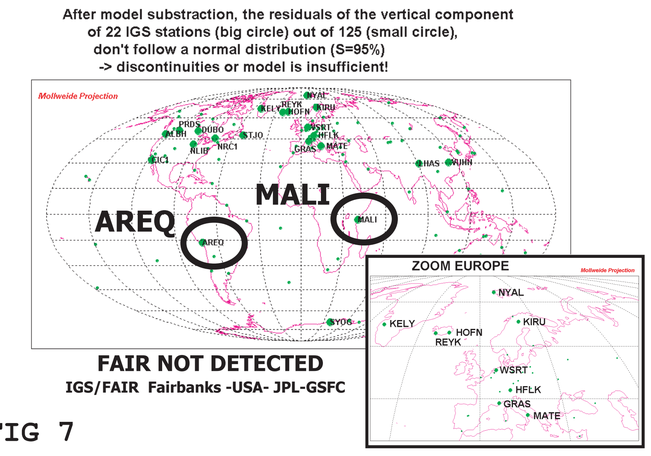

FIG 7

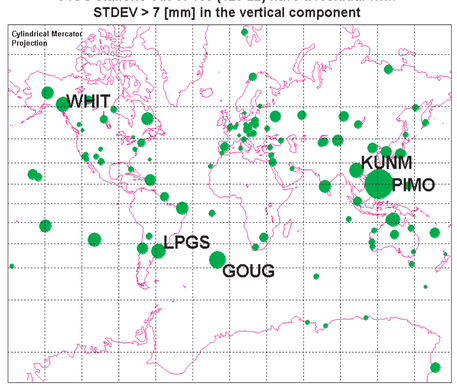

FIG 8

AREQUIPA

Huge discontinuity in NORTH, EAST and UP component for IGS/AREQ Arequipa -Peru- JPL B° : -16.46551711 L° : -71.49279643 H[m] : 2488.919

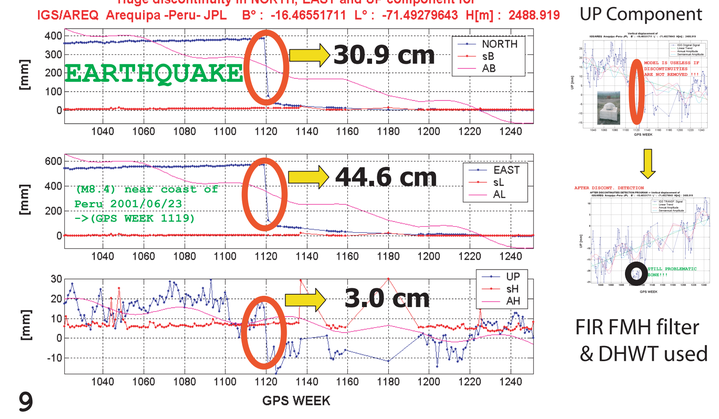

FIG 9

IGS

125-5 STATIONS

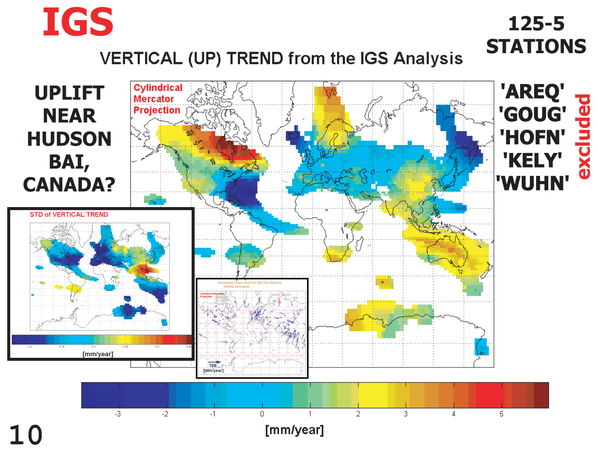

FIG 10

CODE

116-4 STATIONS

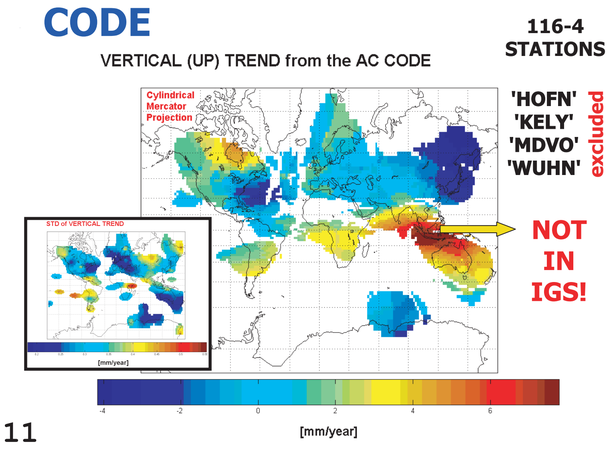

FIG 11

MALINDI

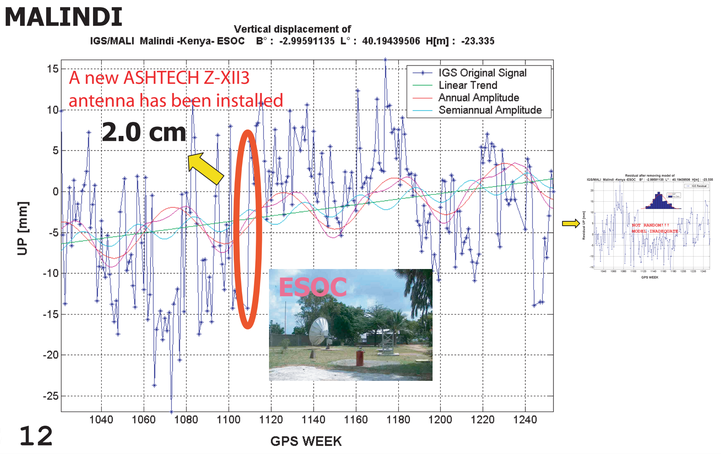

FIG 12

Conclusions:

- Inaccurate transformation parameters (Fig 1 & Fig 4), to align the ACs solution to IGS00, affect the IGS weekly combination solution considerably.
- CODE station coordinate series show abnormal large annual amplitudes (geocenter signal or tropospheric modelling?)(Fig 5 & Fig 6).
- Our model is inadequate for ~30% of the analysed IGS stations (vertical component) (Fig 3 & Fig 7)! Residuals don't follow a normal distribution!
- Improved discontinuities detection strategies are absolutely necessary to obtain reliable horizontal and vertical coordinate trends (Fig 9 & Fig 12).

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