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on Laser Ranging
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The results of two-color observations

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Realization of SLR two-color observations

Zimmerwald (7810): from August 2002 to January 2008
titanium-sapphire laser 423 nm and 846 nm
new Nd:YAG laser from March 2008

Concepcion (7405): from May 2003 to November 2009
titanium-sapphire laser 423 nm and 846 nm
only 846 nm from December 2009

Now, no any SLR station with two-color observations

Future: new SLR station in Wettzell?
titanium-sapphire kilohertz laser,
comparison of normal points for both colors
Other stations?

Method of measurements

- ★ common start channel for both colors
- ★ separately stop channel: two detectors, two time interval counters (event timers)
- ★ common calibration for both colors
- ★ determination of differences point by point between results in two colors → too low accuracy

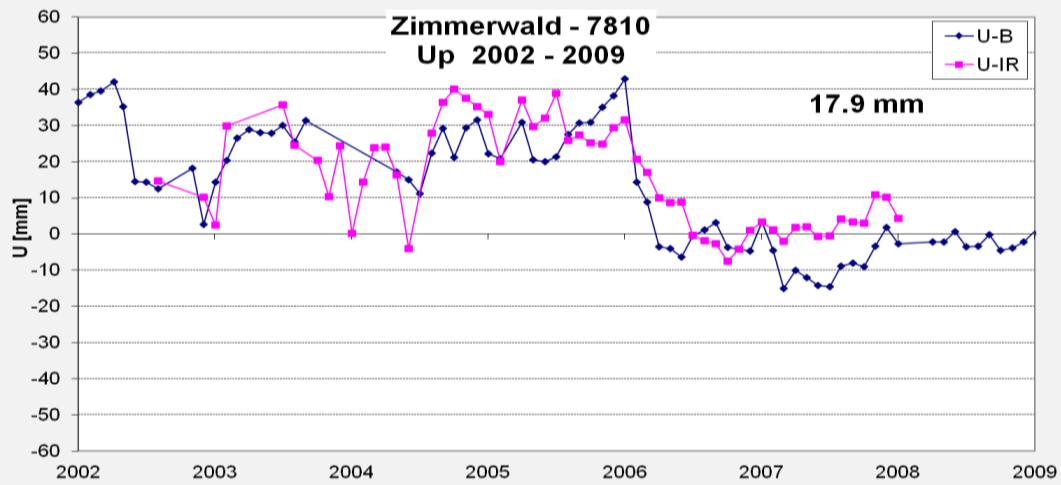
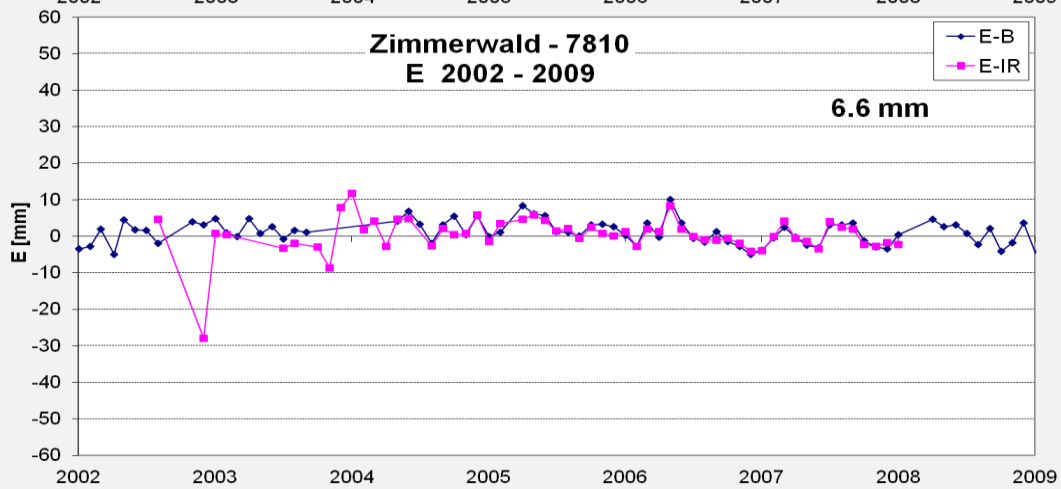
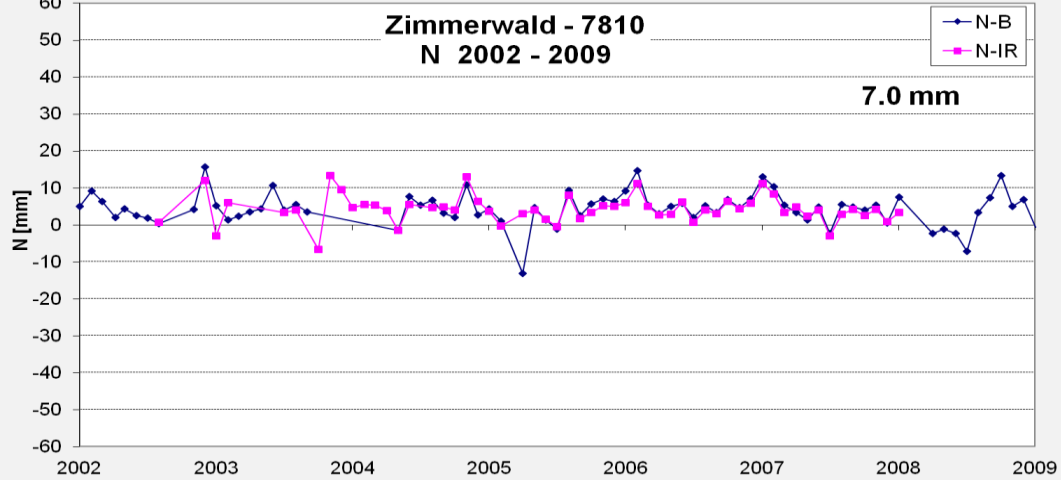
Importance of two-color laser ranging

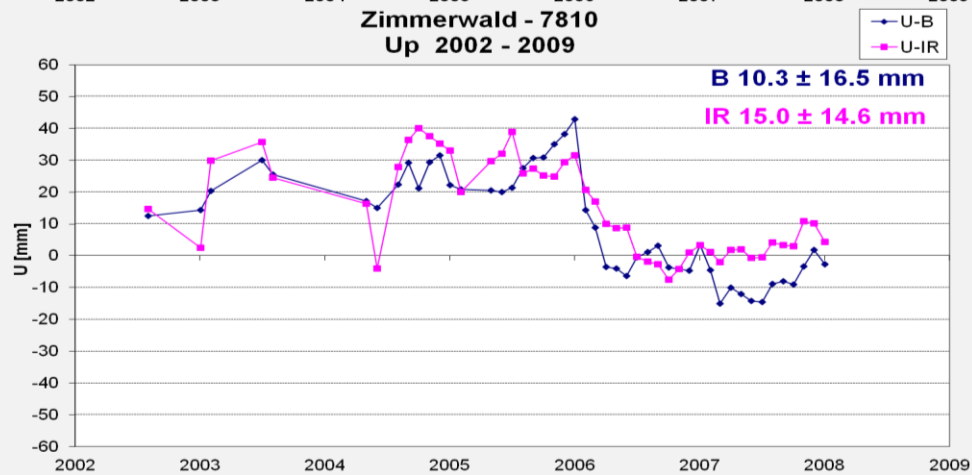
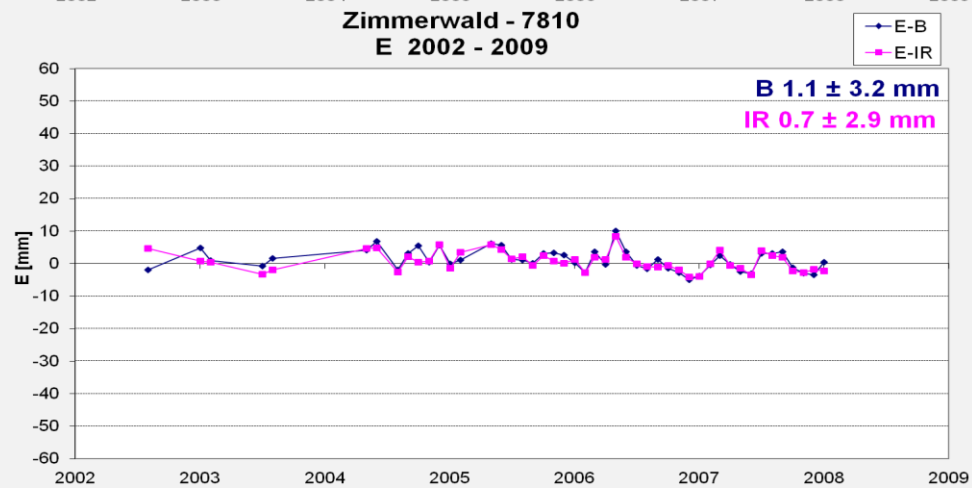
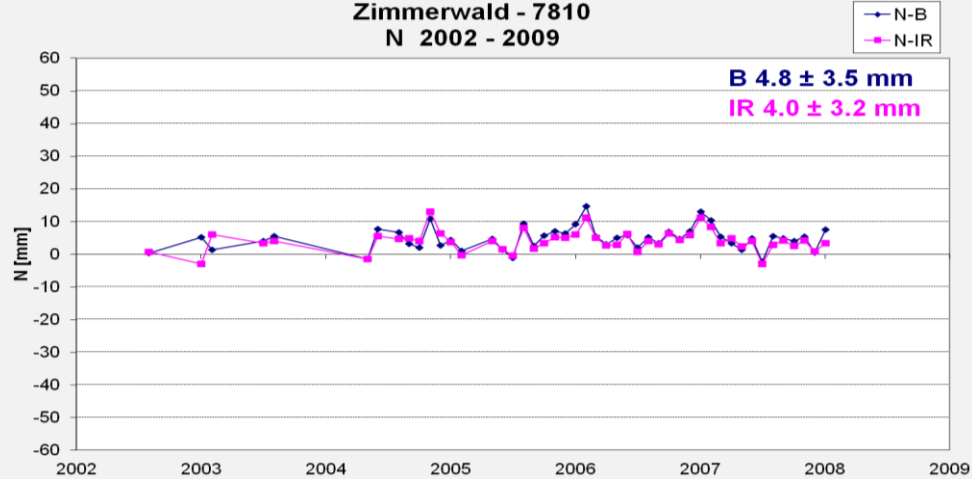
current atmospheric model for determination of atmospheric correction is insufficient for better accuracy of SLR measurements

the atmospheric correction limited SLR accuracy to 3-5 mm

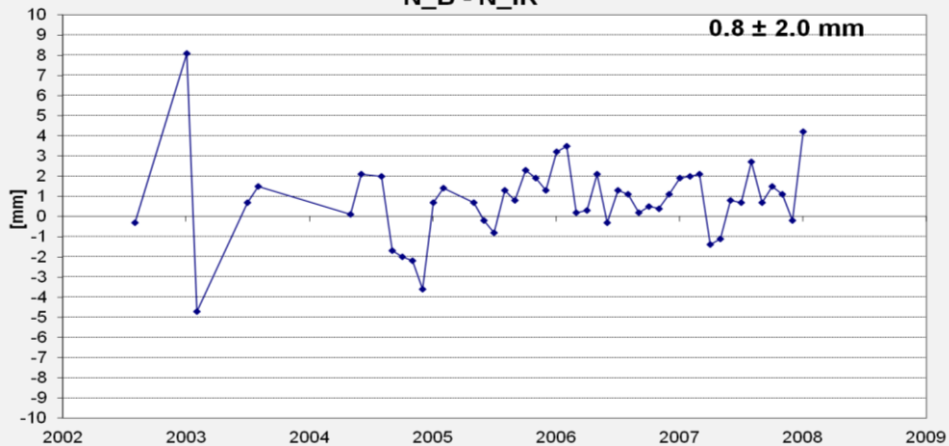
two-color laser ranging should improve accuracy to minimum 2 mm

previous tests of two-color observations were insufficient due to too low sensitivity of detector (streak camera)

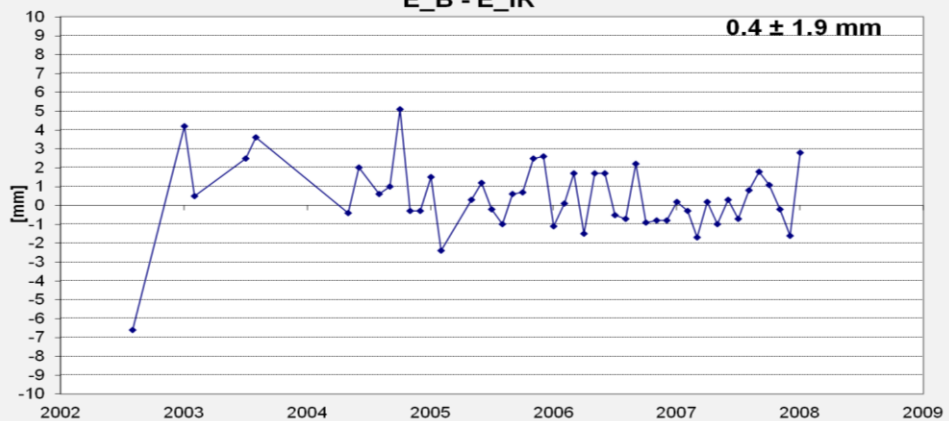




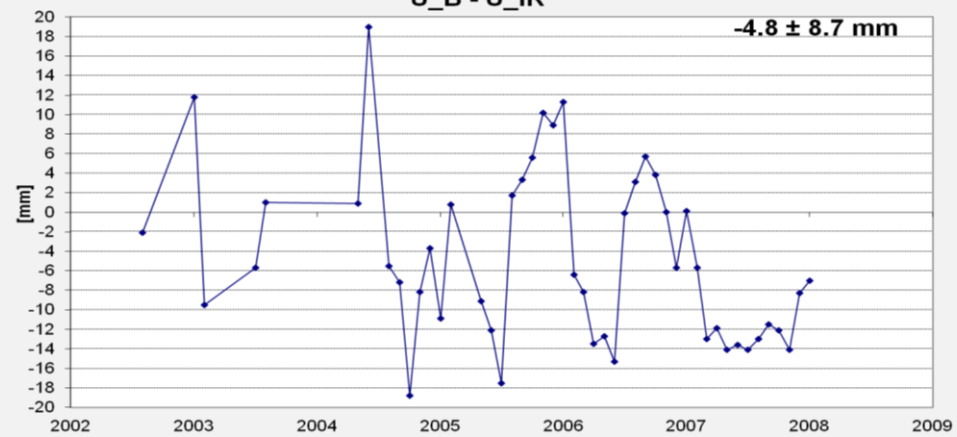
ZIMMERWALD - 7810
N_B - N_IR



ZIMMERWALD - 7810
E_B - E_IR

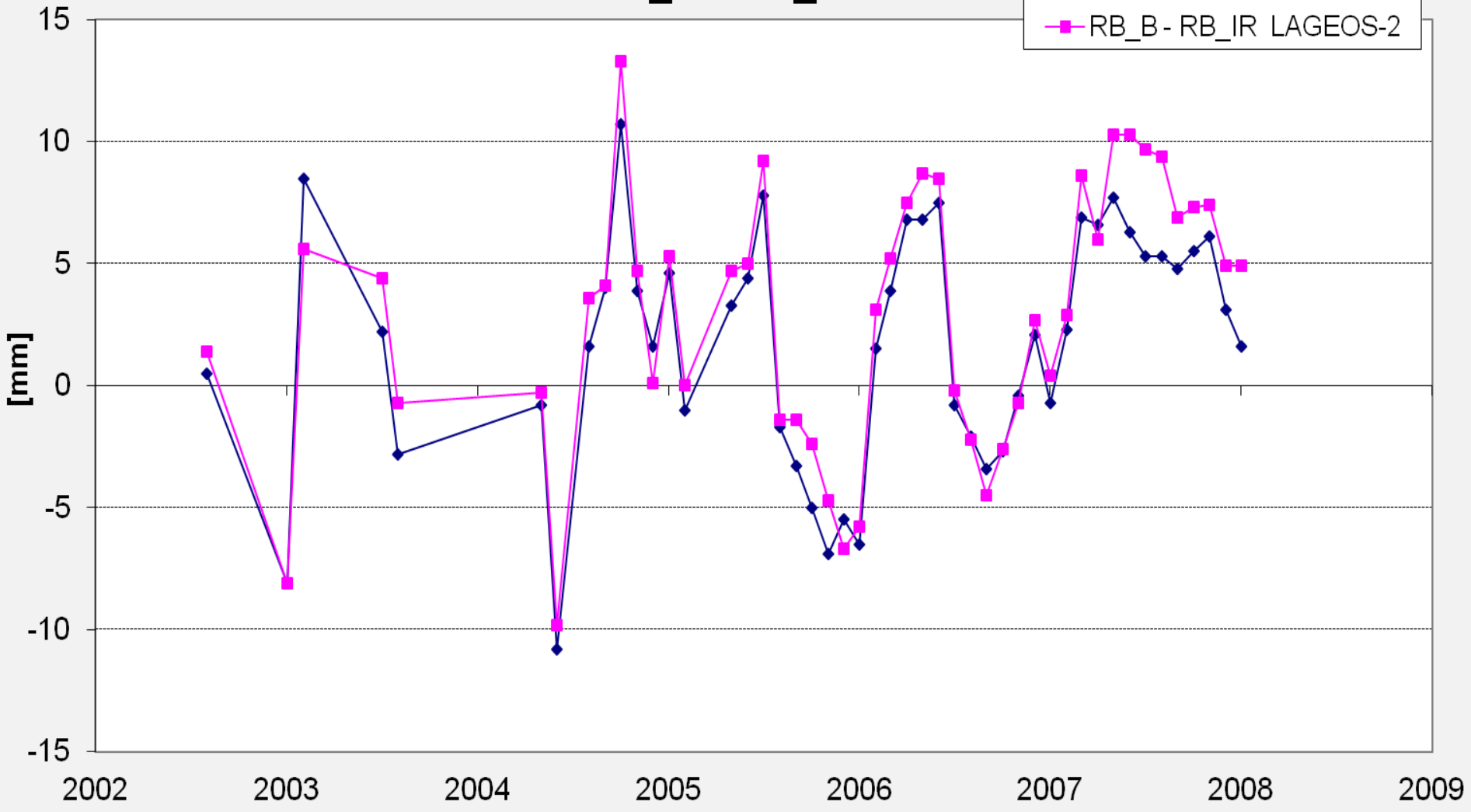


ZIMMERWALD - 7810
U_B - U_IR



ZIMMERWALD - 7810

RB_B - RB_IR

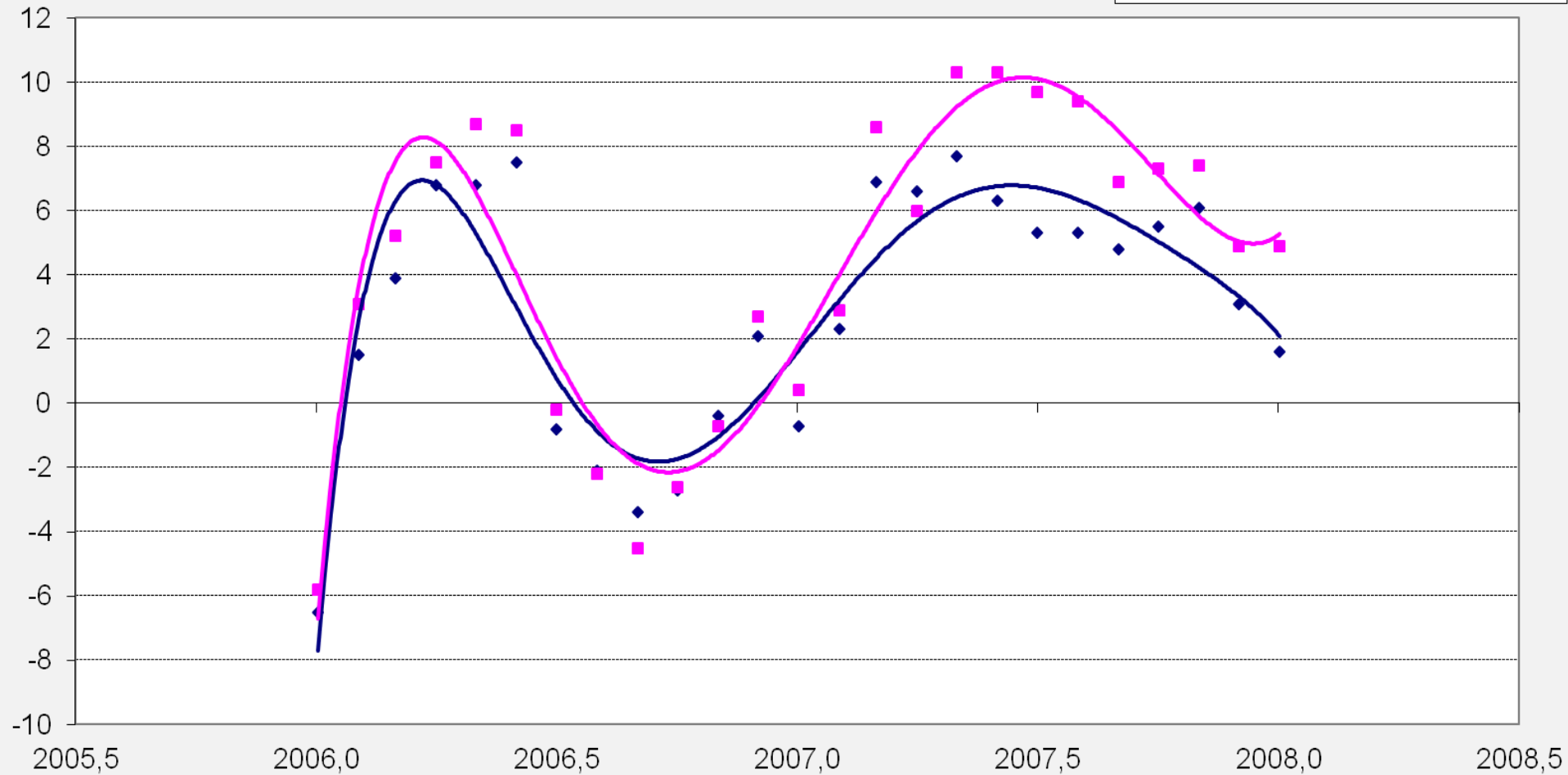


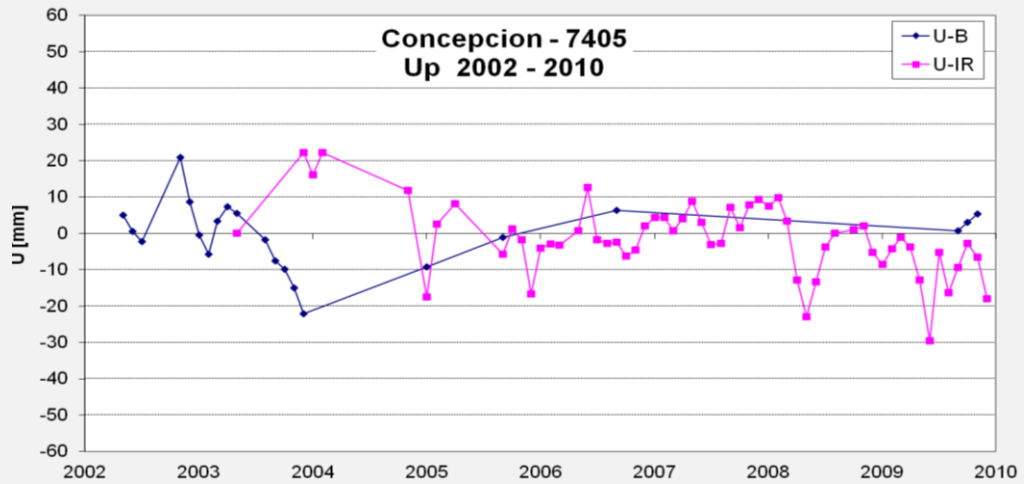
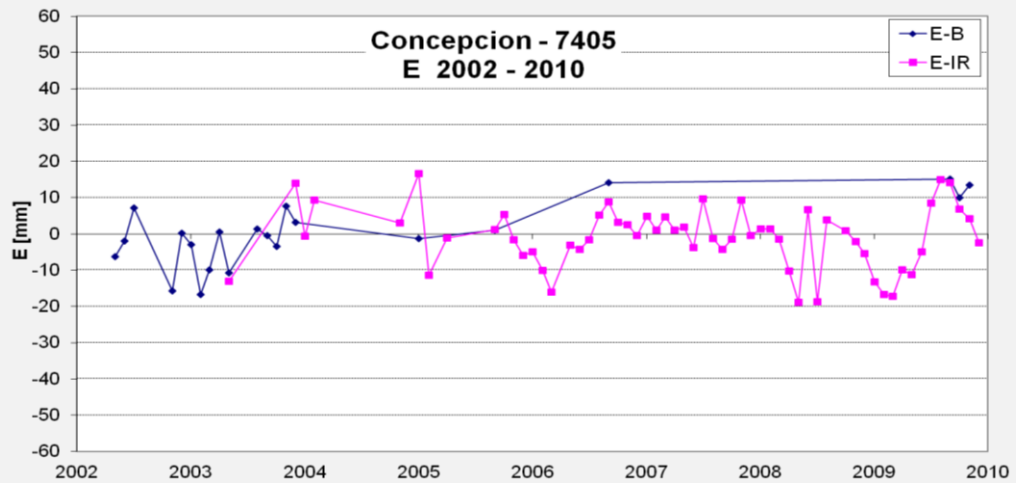
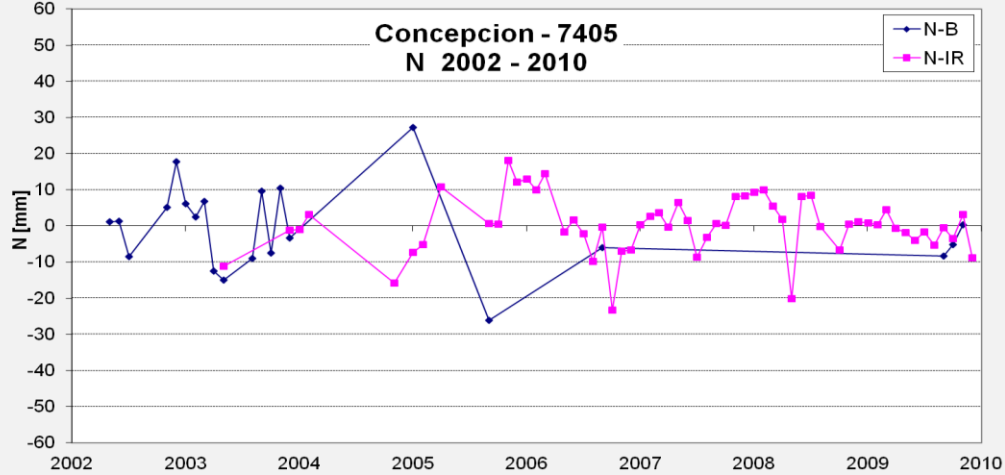
ZIMMERWALD - 7810

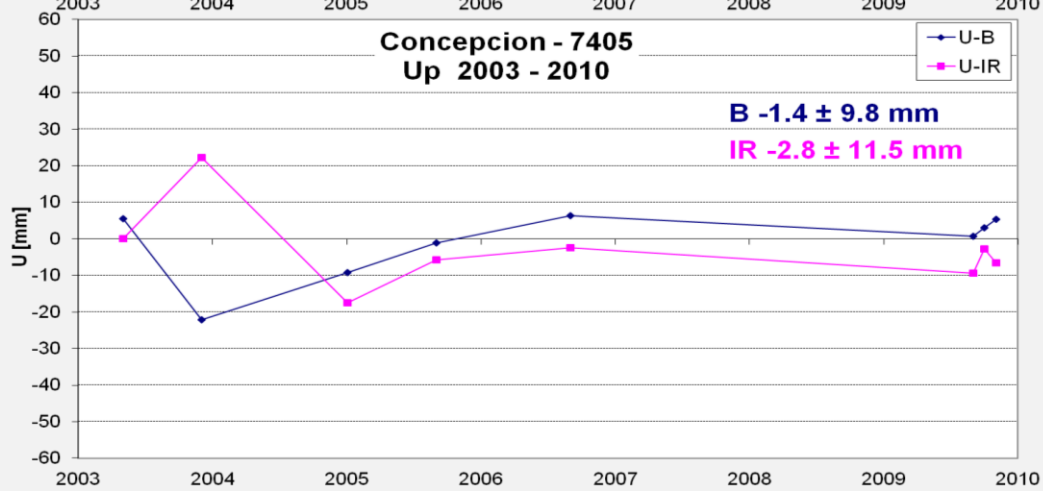
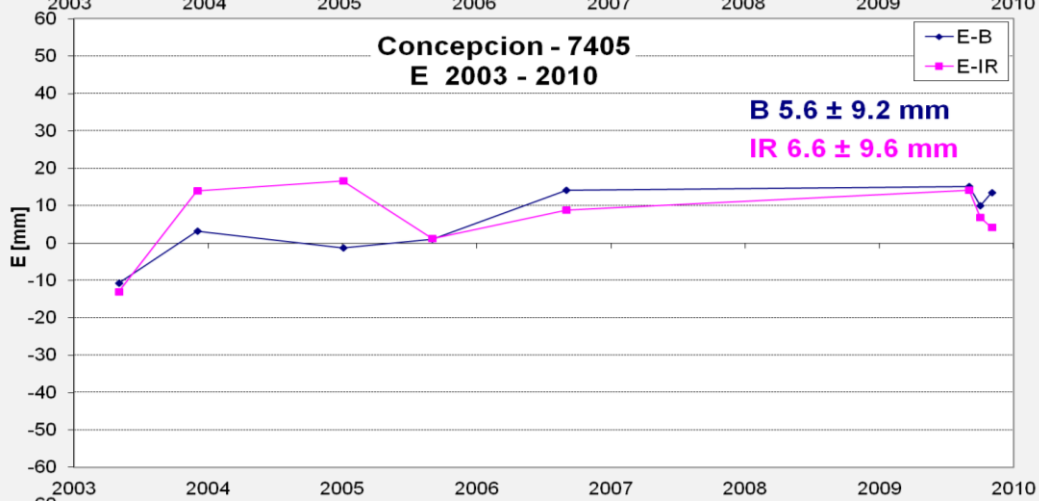
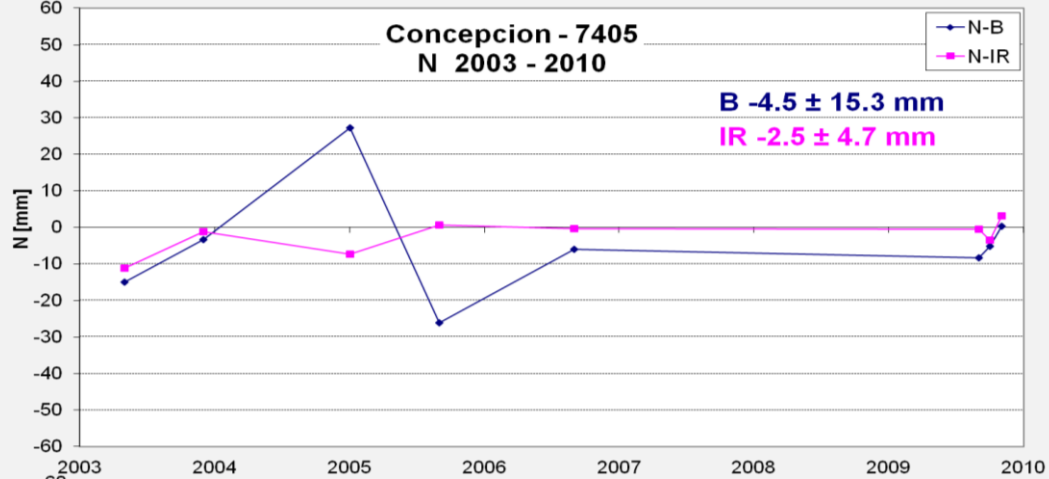
RB_B - RB_IR

◆ RB_B - RB_IR LAGEOS-1

■ RB_B - RB_IR LAGEOS-2







CONCLUSIONS

Systematic differences were detected between Range Biases for blue color (423 nm) and infrared (846 nm) in results of the six years of Zimmerwald data

Differences between two colors have character of annual wave with maximum in summer

It is very good agreement for Range Biases of LAGEOS-1 and LAGEOS-2

These differences are only in vertical component, for horizontal components the differences are below 1 mm

The reason of these differences can be the effect of differences in light velocity in atmosphere for two colors not adequate considered in current atmospheric model

Results of two-color observations in Concepcion can not to be use due to small number of common observations in both colors (only 8)

Verification of presented results now is not possible because any SLR station don't observe in two-colors

New kilohertz SLR station in Wettzell can to be able for determination of differences between two colors (423 nm and 846 nm) by comparison of normal points

In the near future the best SLR stations should to begin observations in two-colors by neodymium lasers for two wavelengths 532 nm and 1064 nm, especially that a new detectors for infrared have now higher sensistivity

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Thank you