



XXVII FIG CONGRESS

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Volunteering
for the future –
Geospatial excellence
for a better living

Static and dynamic measurements of the historic wooden church building in Domachowo



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The problem / motivation

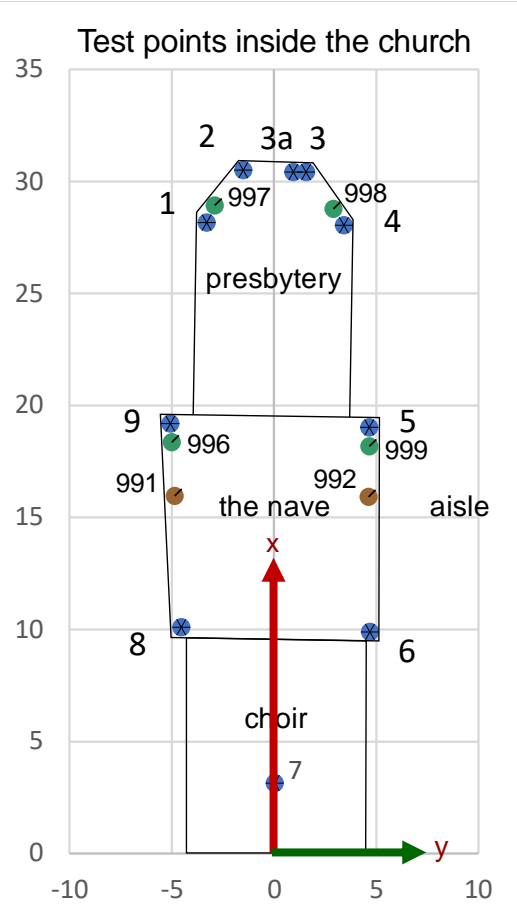
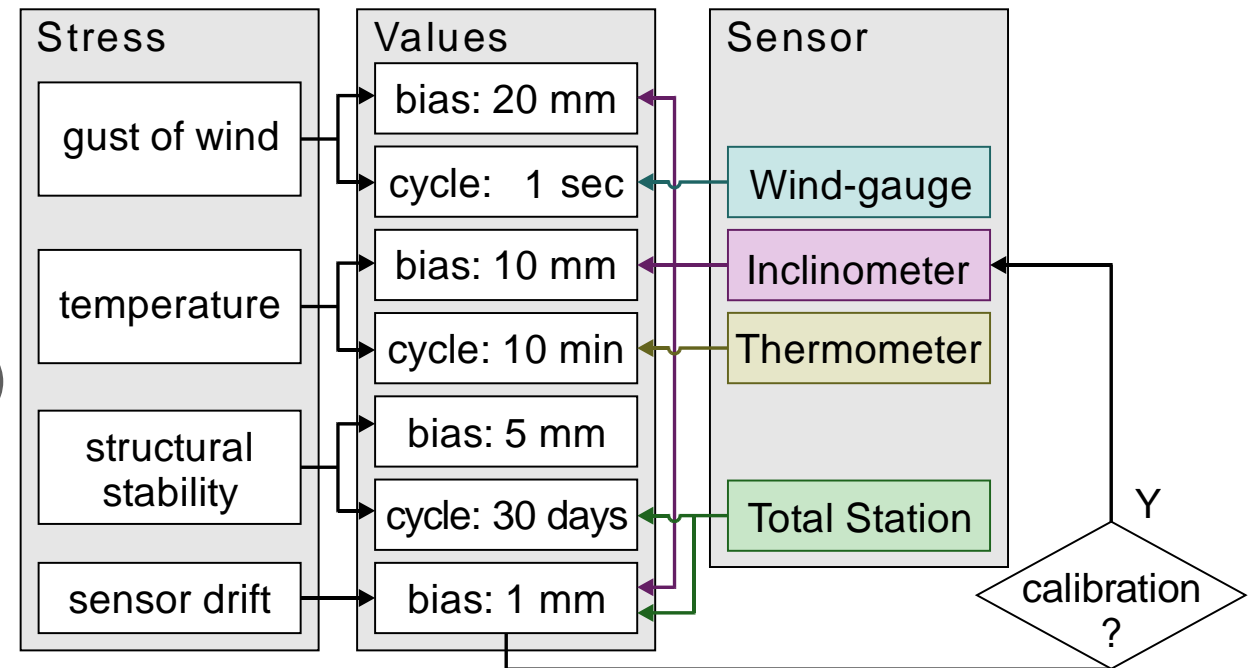
1. Why to measure old wooden building? Short story of motivation
2. Signs of damage, requires reinforcement in some places



3. Decision – at first **geodetic monitoring**

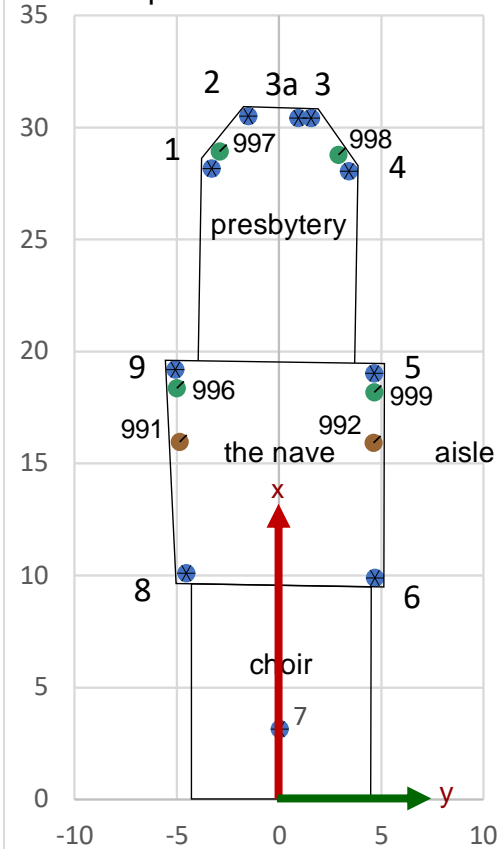
Potential sources of instability of the structure, displacements, survey methods

1. Expected sources of displacements:
 - a) structural stability
 - b) weather conditions
 - c) sensor drift (apparent bias)
2. 'Static' behaviour (slow changes)
 - tachymetric surveys
3. 'Dynamic' behaviour (fast changes)
 - inclinometric surveys



‘Static’ measurements and interpretation of results

Test points inside the church



1. Static measurements – Total Station Leica TCRP 1201+

- EDM precision: 1 mm ± 1 ppm
- HZ/V precision: 1"

Survey session:

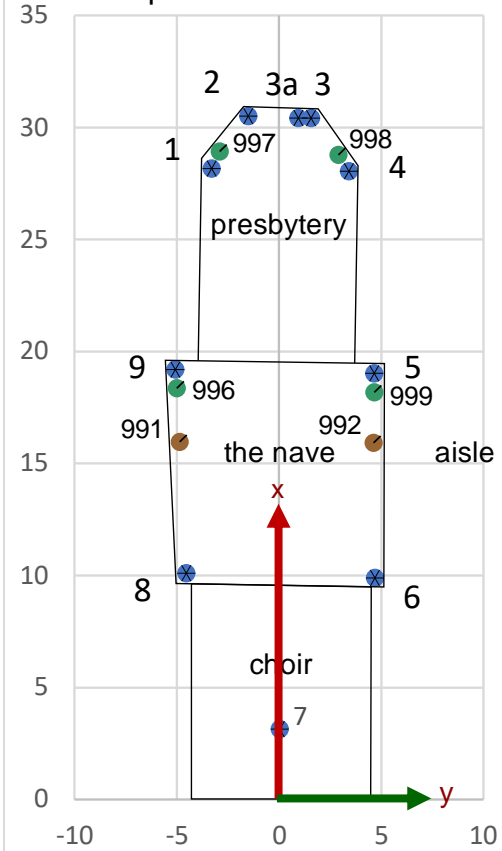
- 2 reference points
- aiming at 9 reflective targets
- 2 full series
- data adjustment

Frequency – 1 month period, stable weather

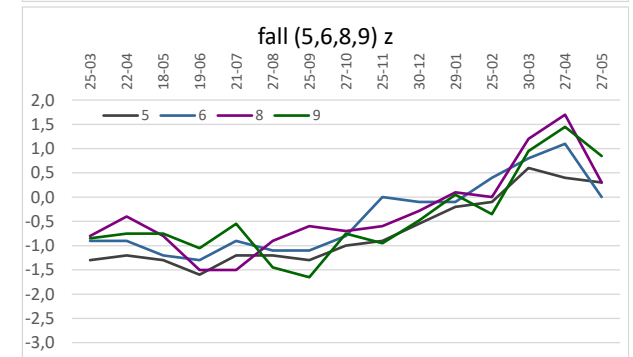
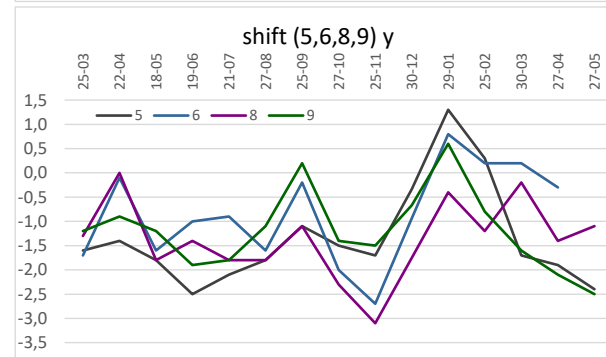
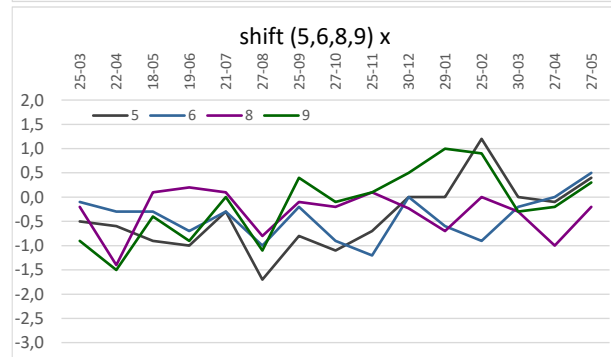
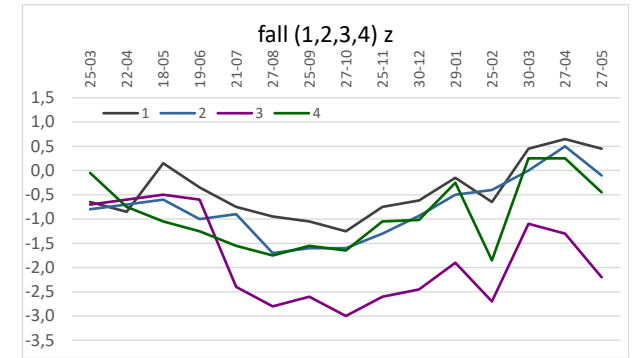
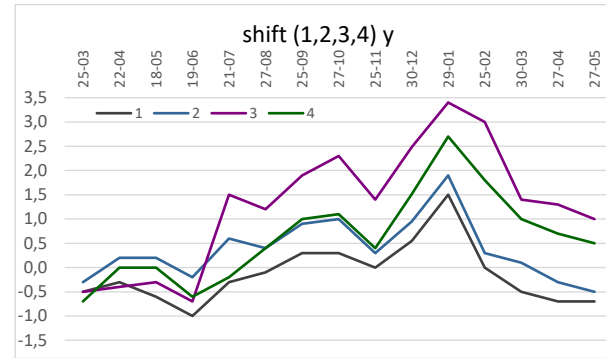
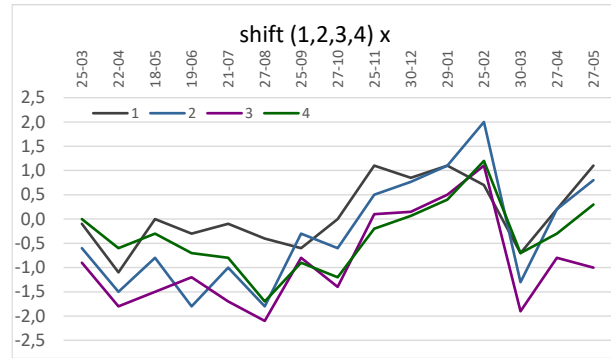


'Static' measurements and interpretation of results

Test points inside the church

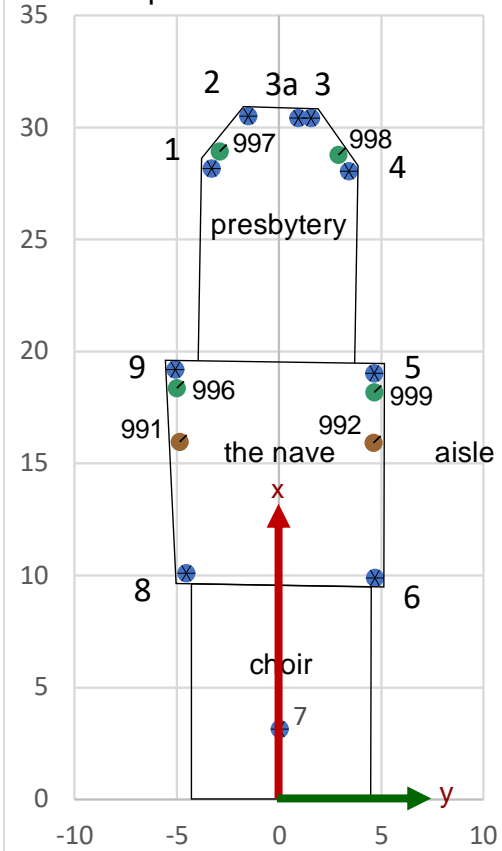


1. Static measurements – Results after 10 months of monitoring



'Dynamic' measurements and interpretation of results

Test points inside the church



2. Dynamic measurements – 2-axial inclinometers

- measuring range: 60°
- resolution: 0,001°
- precision 0,005° ± 0,001° drift (time, temperature)
- WiFi/Internet connection

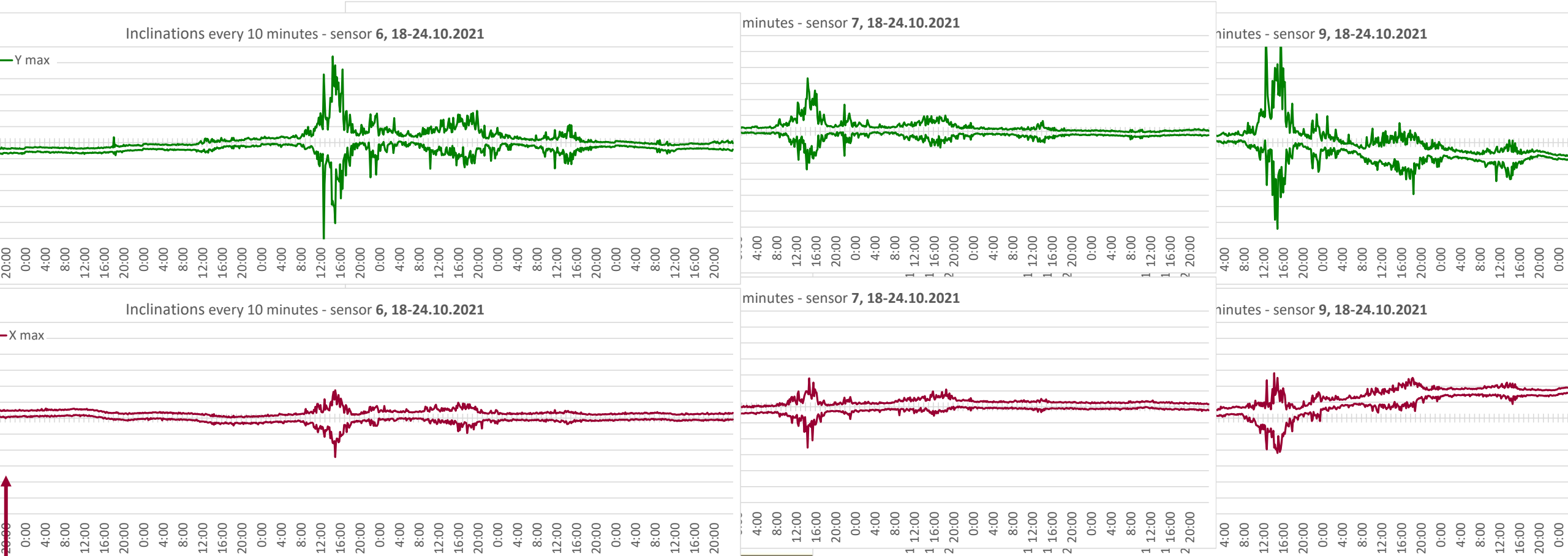
Practical settings:

- 2 Hz frequency of readings
- conversion into displacements (a stiff beam with a hinge)

Aggregation to 10-minute packages – selection min and max values to illustrate extreme values



Results of ,Dynamic' measurements – october 2021



Results of ‚Dynamic‘ measurements – inclinations vs weather

Conclusions

- 1) variability in time
- 2) construction sensitive to wind and temperature
- 3) sensor corrections related to static measurements

Future works

- 1) sensor drift modeling and parametrization
- 2) comparison two types of inclinometers
- 3) measurements after the strengthening the structure

