Standards for Checking GNSS Surveying Systems – The Actual Status

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Key words: GNSS, ISO Standard 17123-8, Calibration, Checking GPS

SUMMARY

GNSS positioning systems are nowadays standard equipment for versatile applications in surveying and geodesy. Therefore it is urgently necessary to have in conjunction with a quality management system standardised procedures for checking and calibrating of these measuring systems. ISO / TC172 / SC6 has already elaborated for different surveying instruments standards for determining the precision by suitable field procedures. Recently a new draft was prepared to propose methods for checking satellite positioning systems: GNSS field measurements systems in real-time kinematics (RTK). The paper will introduce these and additional recommendations to present on the one hand the actual status to stimulate on the other hand the discussion in this field of all involved practitioners.

ZUSAMMENFASSUNG

GNSS bzw. GPS Vermessungssysteme gehören heute zur Standardausrüstung für unterschiedliche Anwendungen im Vermessungswesen und in der Geodäsie. Deshalb sind standardisierte Verfahren, insbesondere in Zusammenhang mit Qualitätsmanagement-systemen gemäß ISO 9000, für die Überprüfung und eventuell auch Kalibrierung dringend notwendig. ISO / TC172 / SC6 ist z.Zt. dabei, eine entsprechende Norm auszuarbeiten. Der Stand der Diskussion um diese Norm 17123, Teil 8 „GNSS field measurement systems in real-time kinematic (GNSS RTK)“ist Gegenstand der Präsentation. Zusätzlich werden andere Verfahren vorgestellt, um den Dialog für eine für die Praxis zweckmäßige Prüfanweisung zu stimulieren.

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1. INTRODUCTION

Checking and calibration of measuring devices are traditional tasks of all metrological oriented engineers. The necessity for this is justified in the fact that all measuring processes are influenced by random, but also by systematic errors. Also surveyors have the task and duty to report reliable measurement results and reasonable accuracy data. In the past years, however, new technologies and an increasing complexity of the measuring equipment, and this applies in special to GNSS(GPS)-measuring systems, complicated the introduction of new testing methods and made it even impossible in some areas. The associated discussion about the proven procedures for testing individual components in comparison to the comprehensive system check / calibration is in full course (Hennes, Ingensand, 2000, Rüeger, Brunner, 2000, Heister, H., u.a., 2005). Regarding the special sensor technology treated here, the question, which is the preferred procedure, can not clearly to be answered. Nevertheless, the antenna calibration is a testing method already practised since longer (Wübbena u.a., 2000, Rothacher, 2001, Wanninger, 2002), which gained importance in particular in connection with the reference station networks. However, for these procedures special calibration facilities and high expertise are necessary. Since the functionality of the individual components both of hard and software is not known in detail anymore to the normal GPS user only the system testing remains for the geodetic practice. In doing so, it should not be excluded to examine thereby individual influence parameters.

Unfortunately until today no standardized procedures for field testing / checking were finally worked out, although GPS was already introduced for approx. 15 years as a geodetic positioning technique. Apart from the general necessity to make such testing methods available for practice a modern quality management system (ISO 9000) additionally requires also a confirmation system for measuring devices. This usually contains among testing of the functionality also still the traceability of the measurand. In the following presentation a review of testing methods is given, partly still suggestions in discussion, partly already established testing procedures. For a deepened view of checking / testing / calibrating of GPS real time systems is referred to Fuhlbruegge, 2004.

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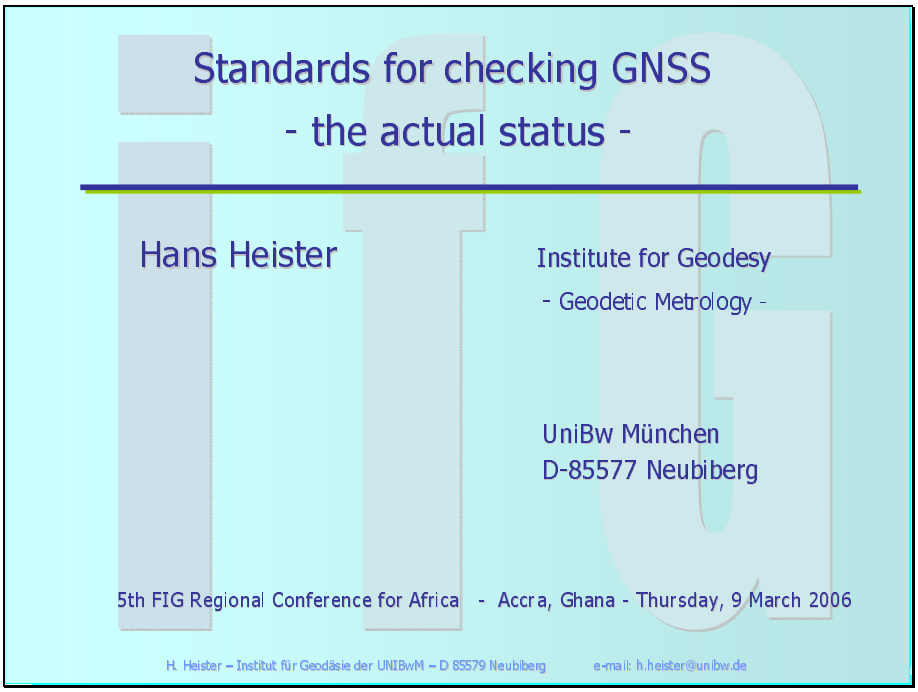

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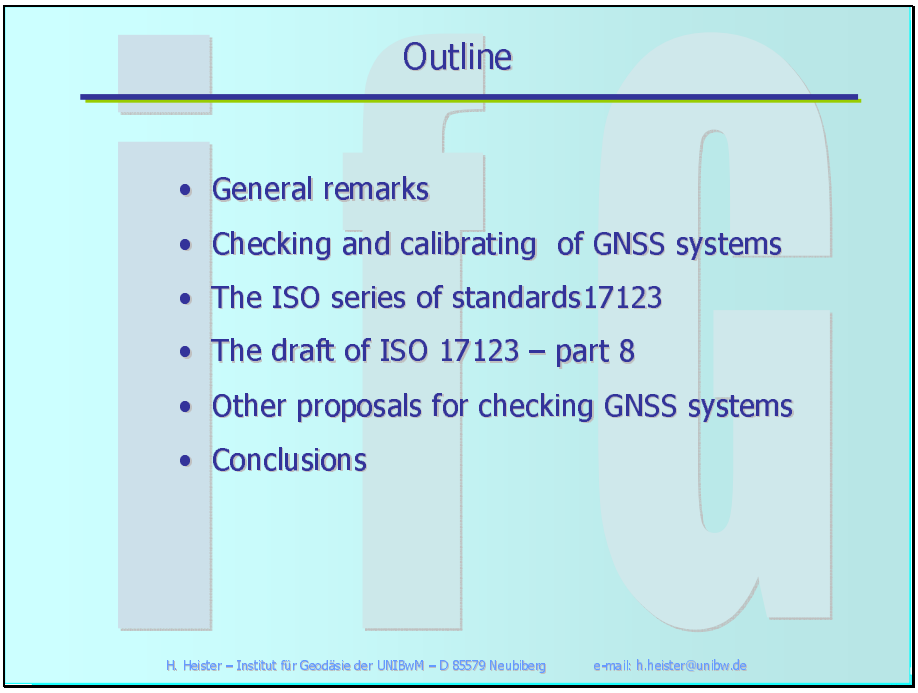

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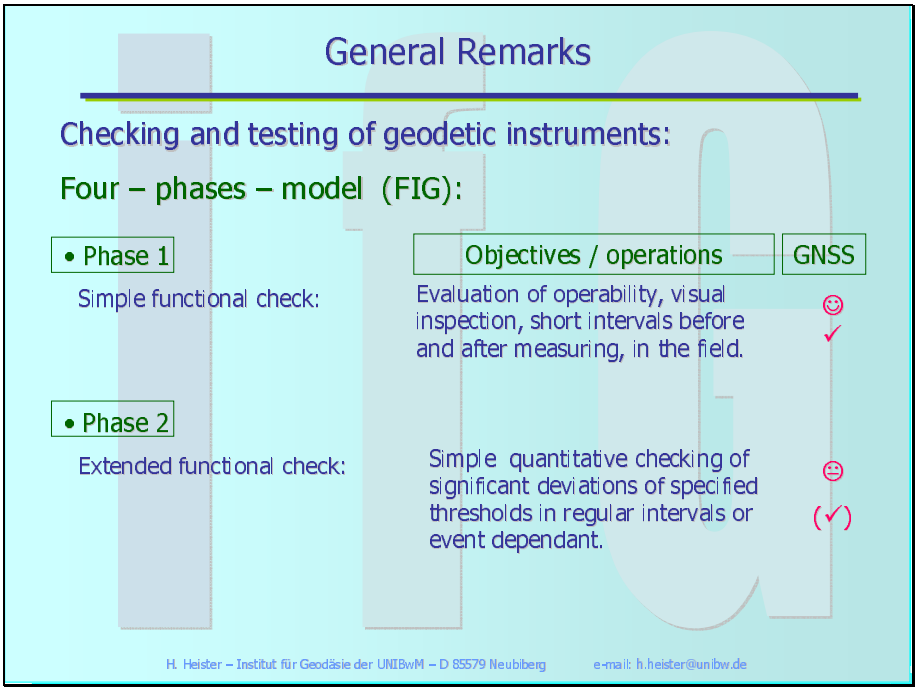

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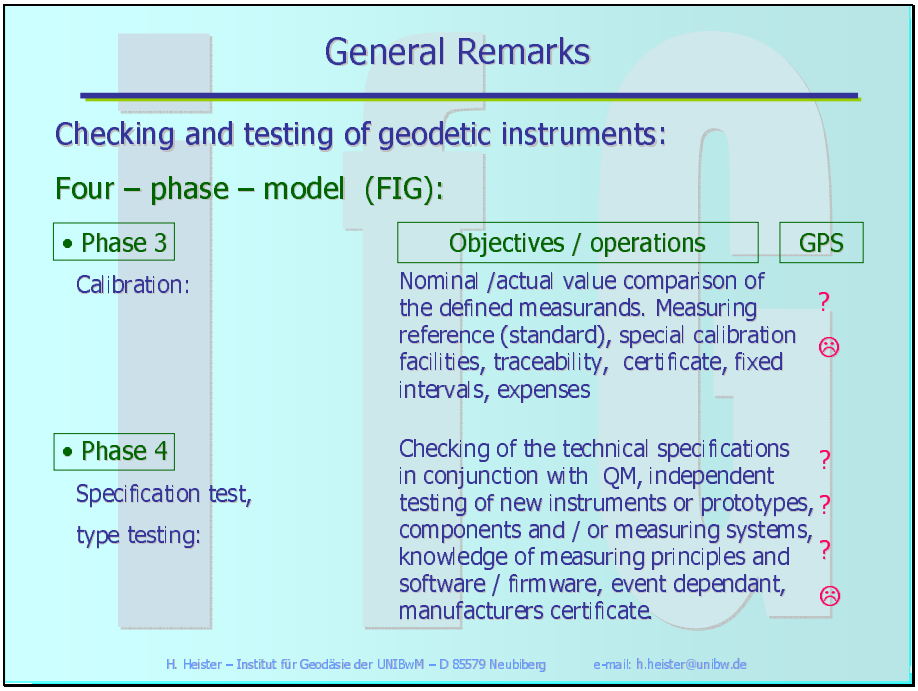

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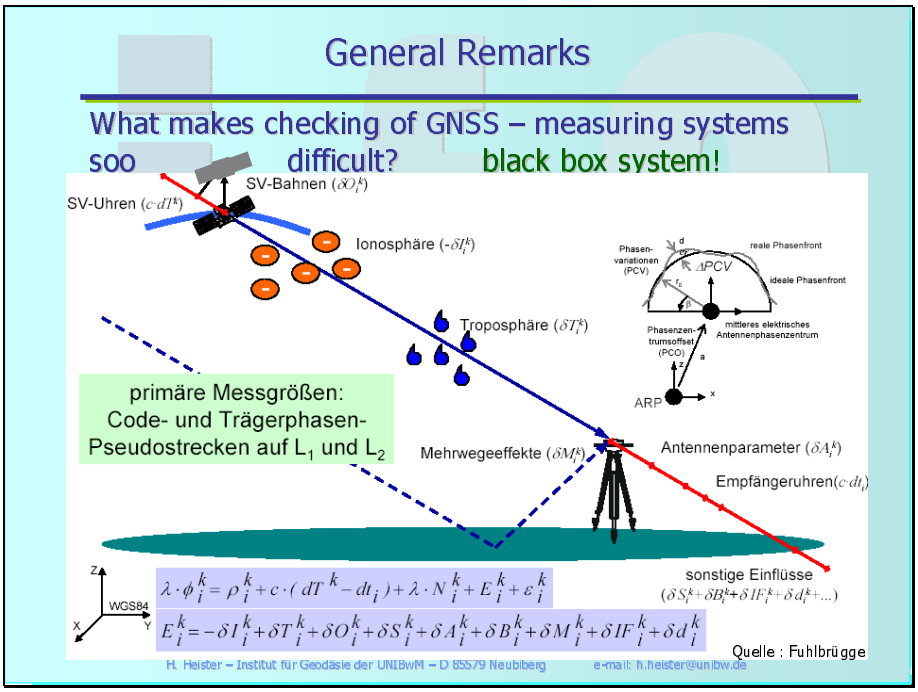

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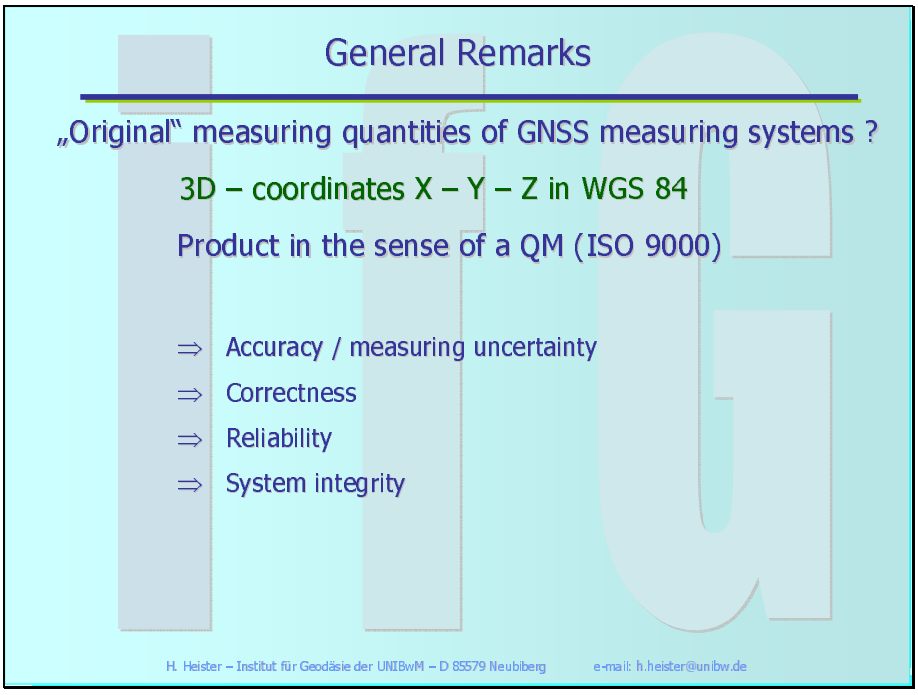

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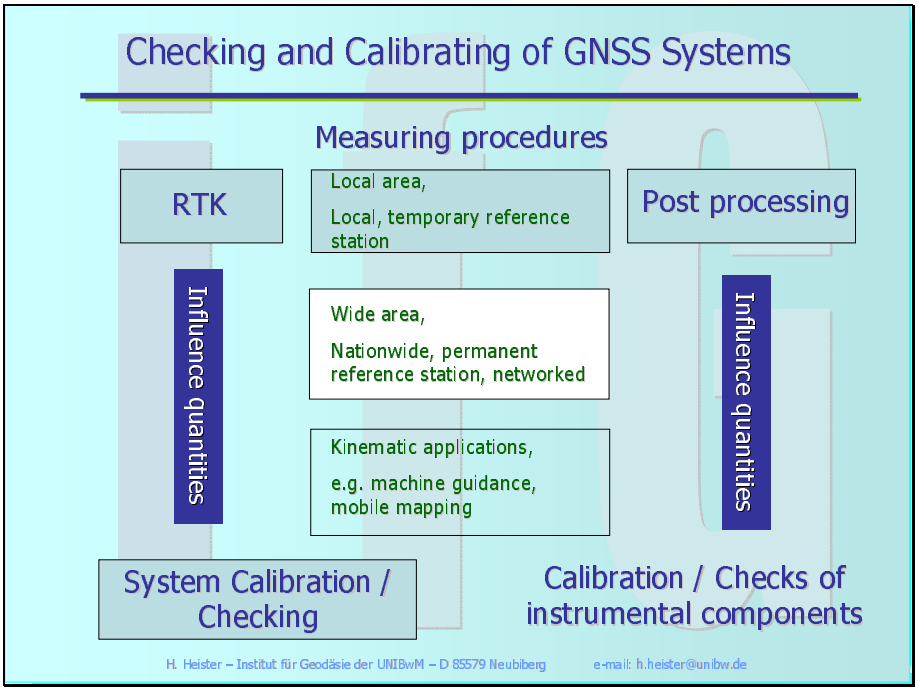

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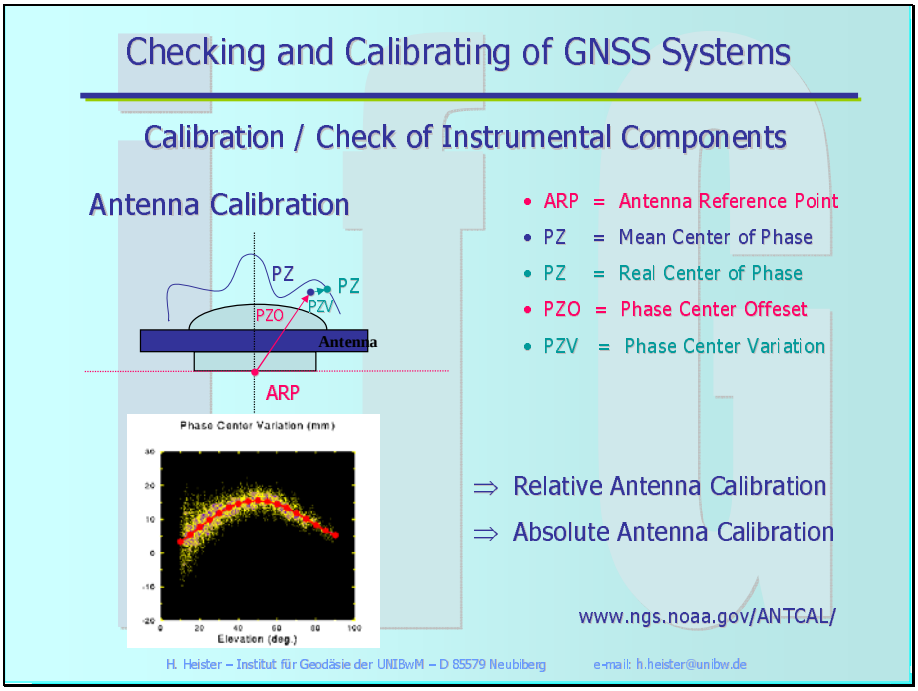

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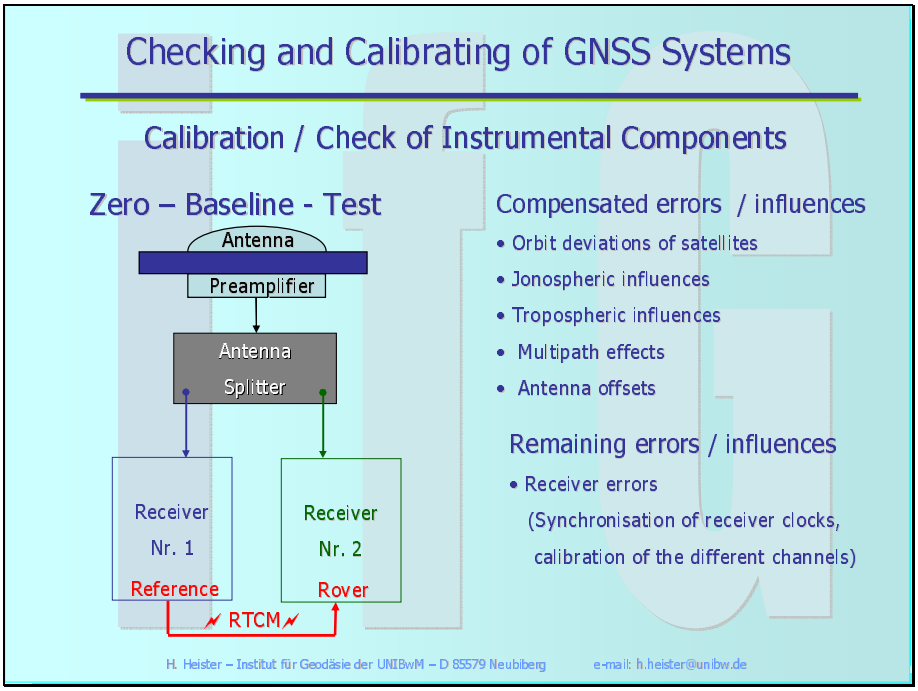

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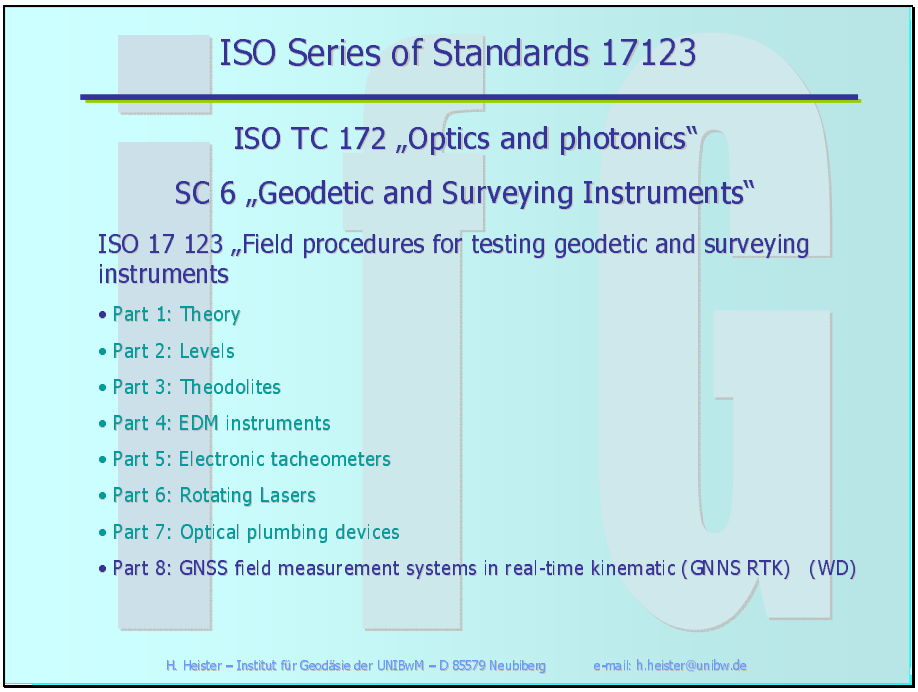

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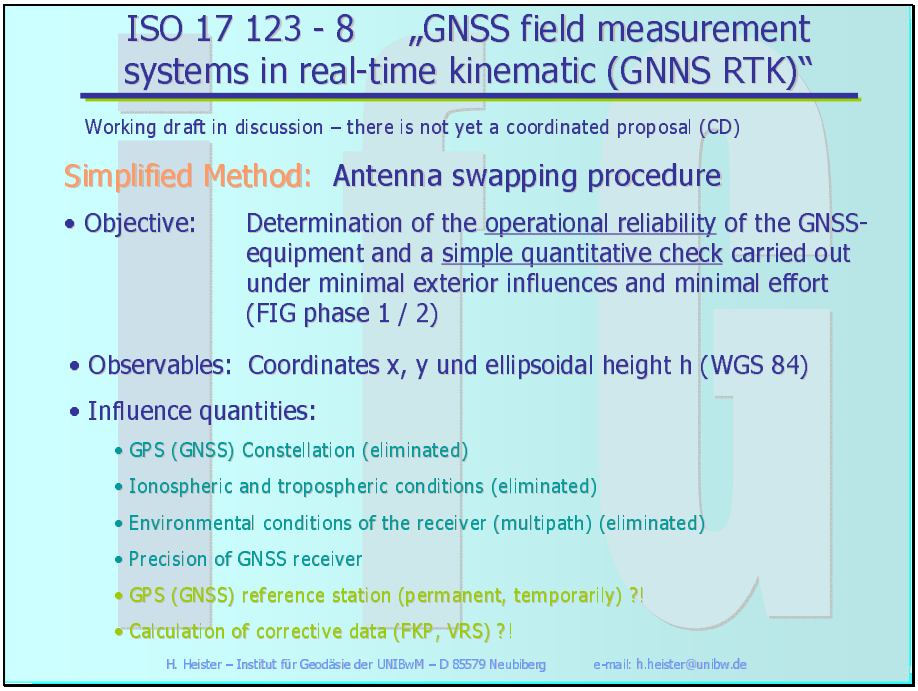

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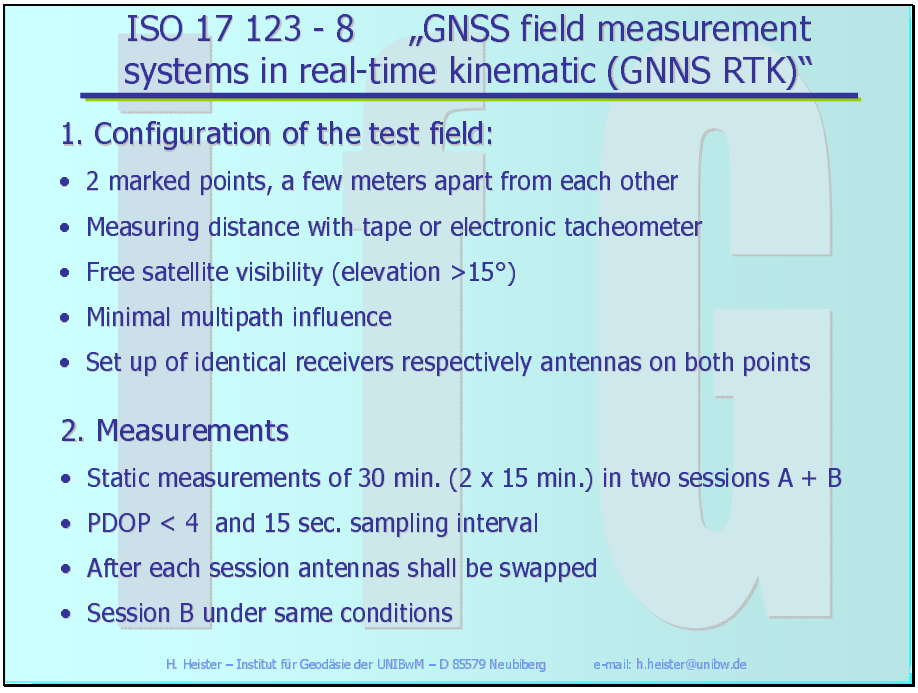

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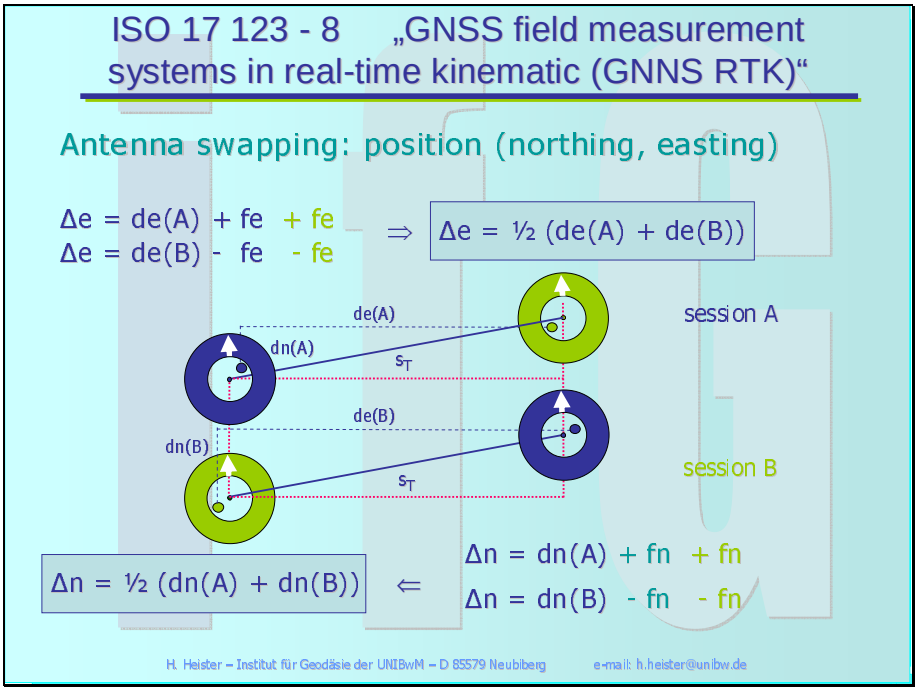

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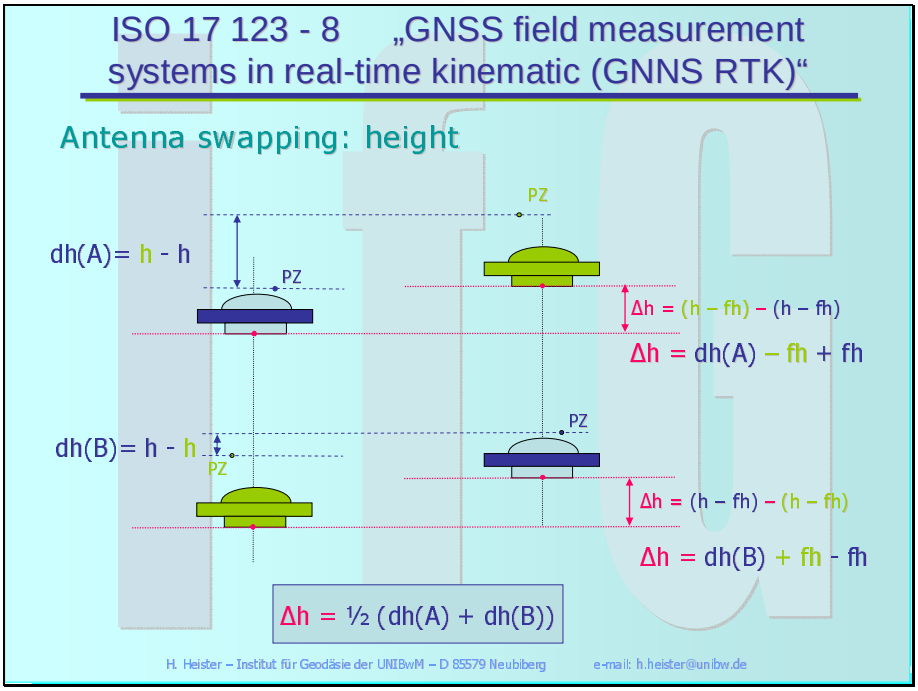

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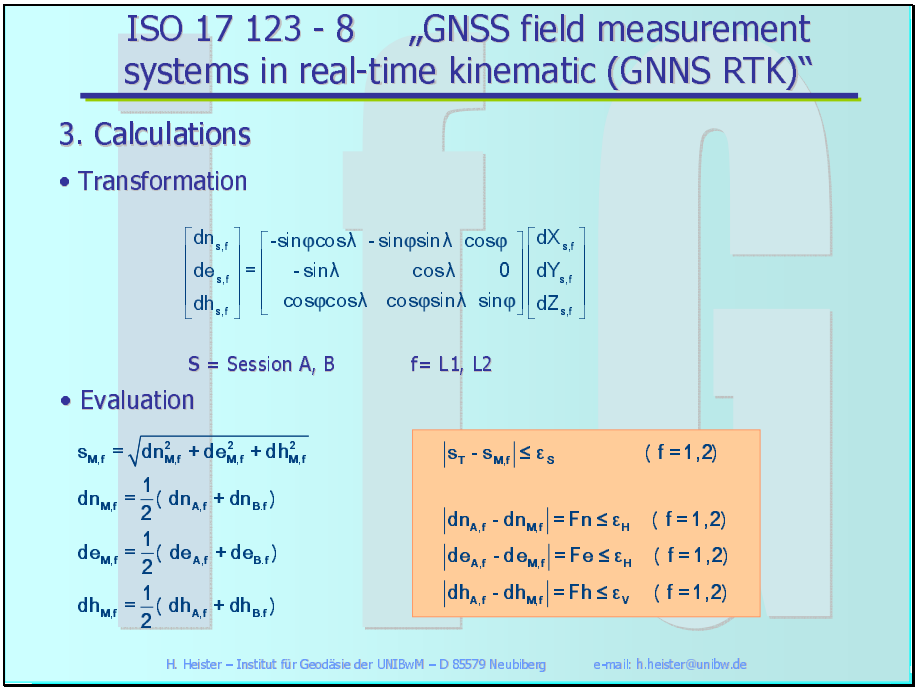

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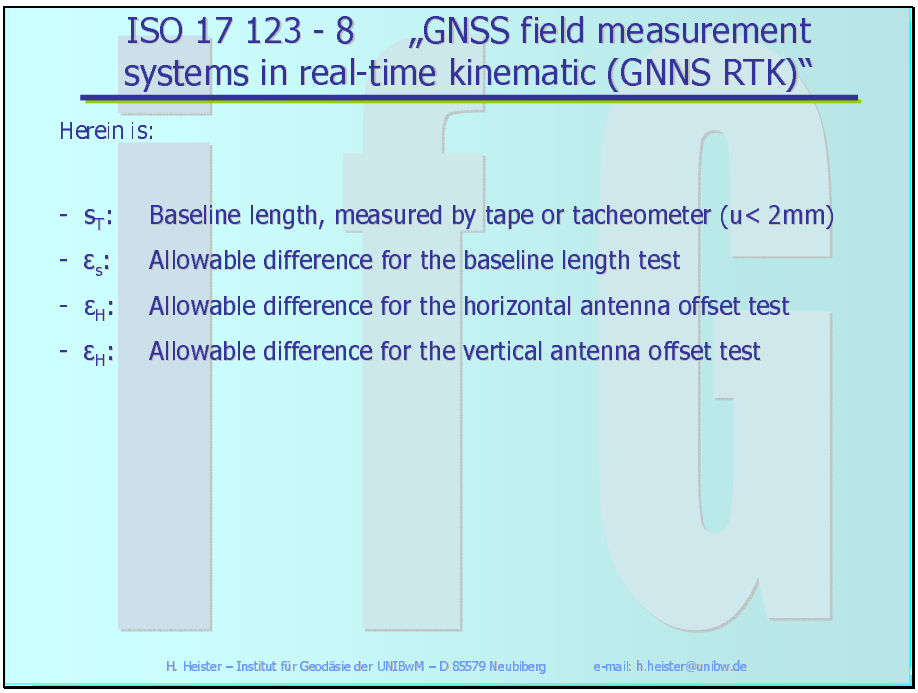

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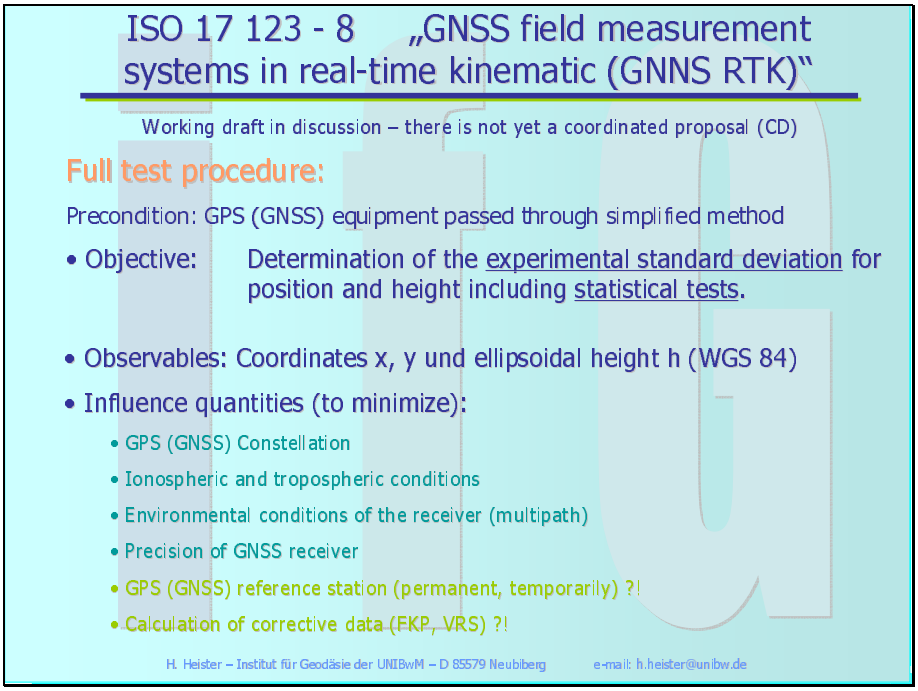

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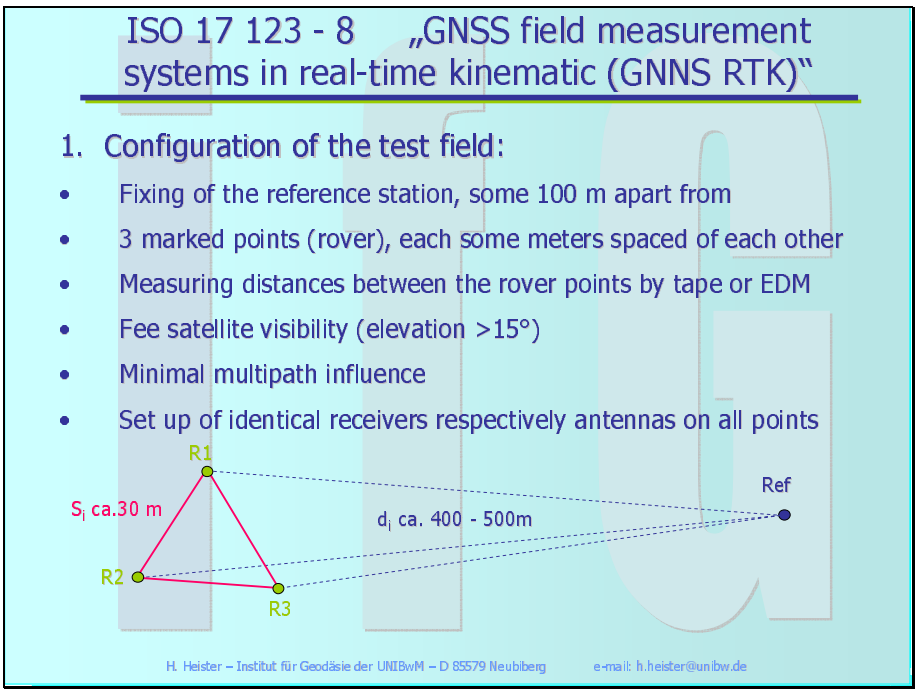

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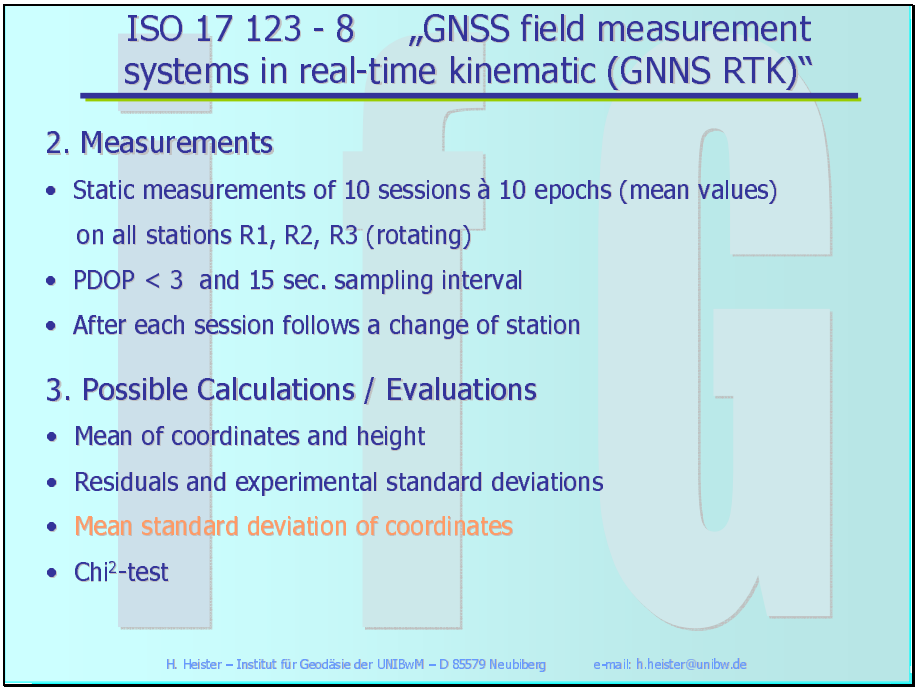

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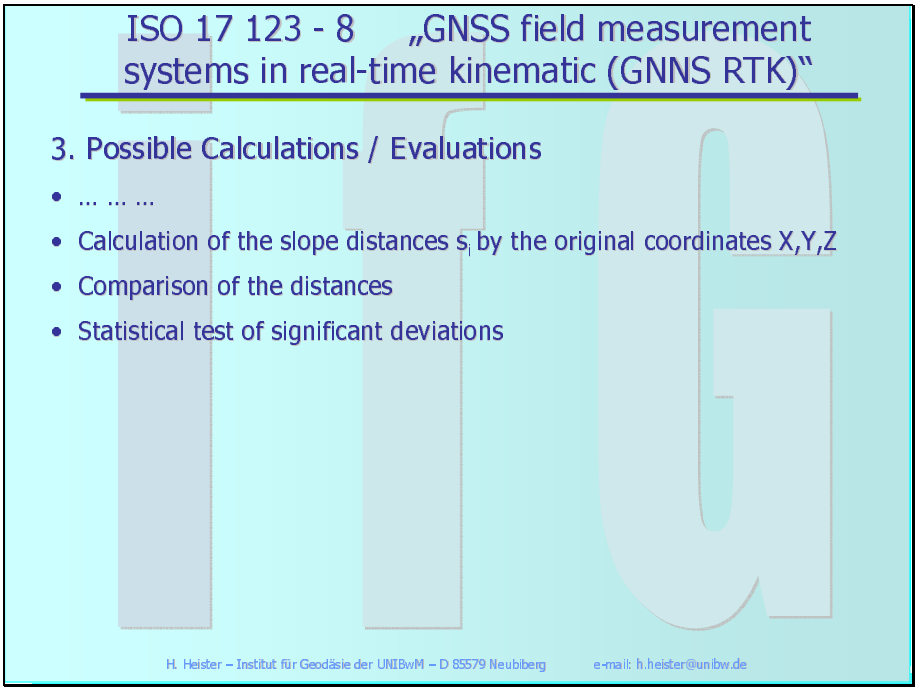

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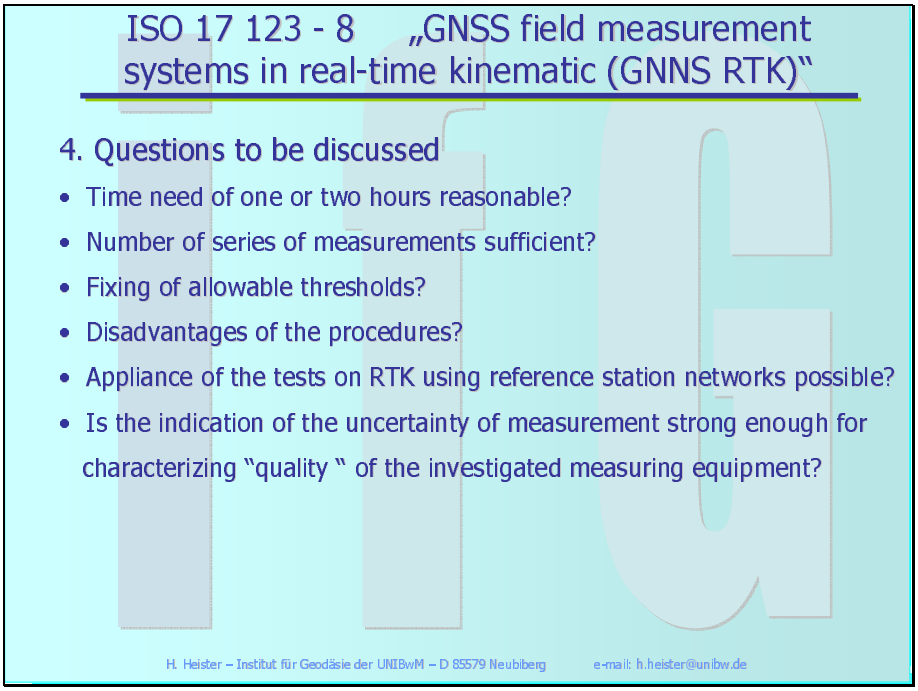

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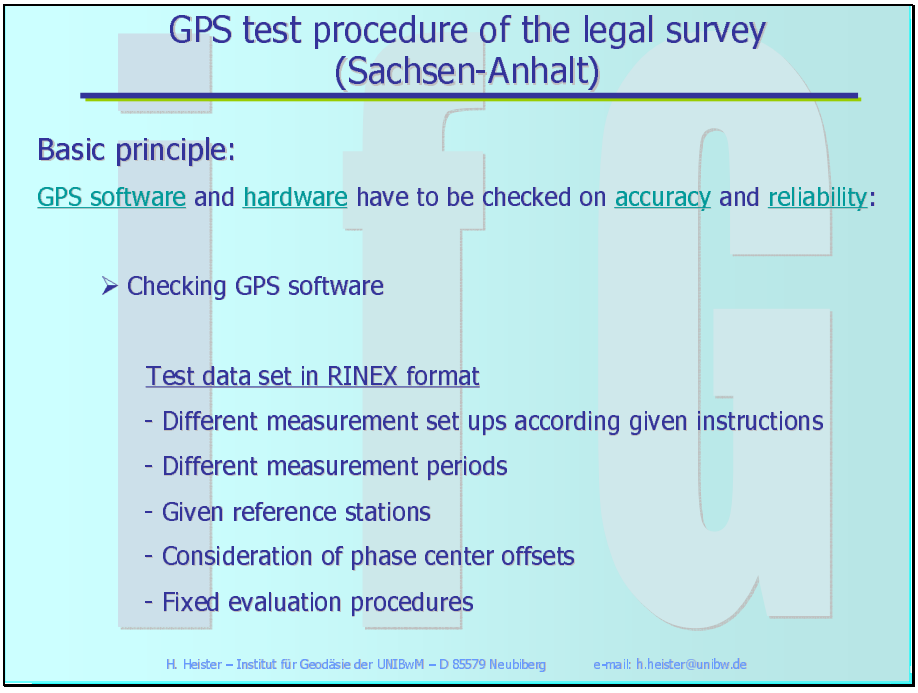

Folie 23

GPS test procedure of the legal survey (Sachsen-Anhalt)

- Checking of GPS-Software

  Proof of calculations (QM)

  - Baseline evaluation
  - Multi station evaluation
  - Position coordinates and standard deviations
  - Nominal / actual value comparison

- Checking of GPS hardware

  Measurement set up

  - Selected legal stations of the reference network (SANREF)
  - Five independent series of measurement à 2 sessions (official instructions)

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Folie 24

GPS test procedure of the legal survey (Sachsen-Anhalt)

- SANREF - stations > 12 km to ref.station < 30 km
- Optimal measuring conditions,
- Measurements at different dates

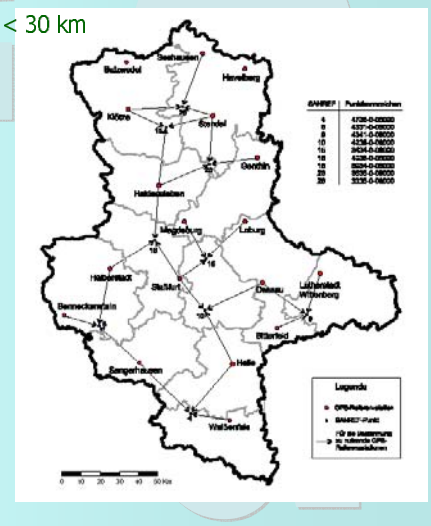
  and

  different satellite constellations

  4, 5 and > 5 satellites

  elevation > 15°
- Evaluation of all GPS measurements

  equivalent to software test



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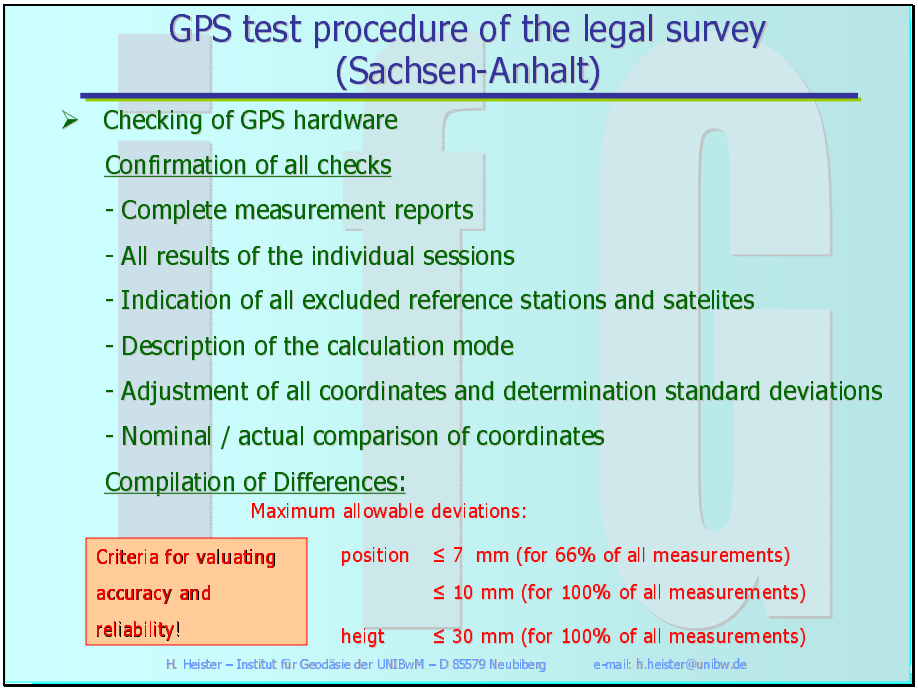

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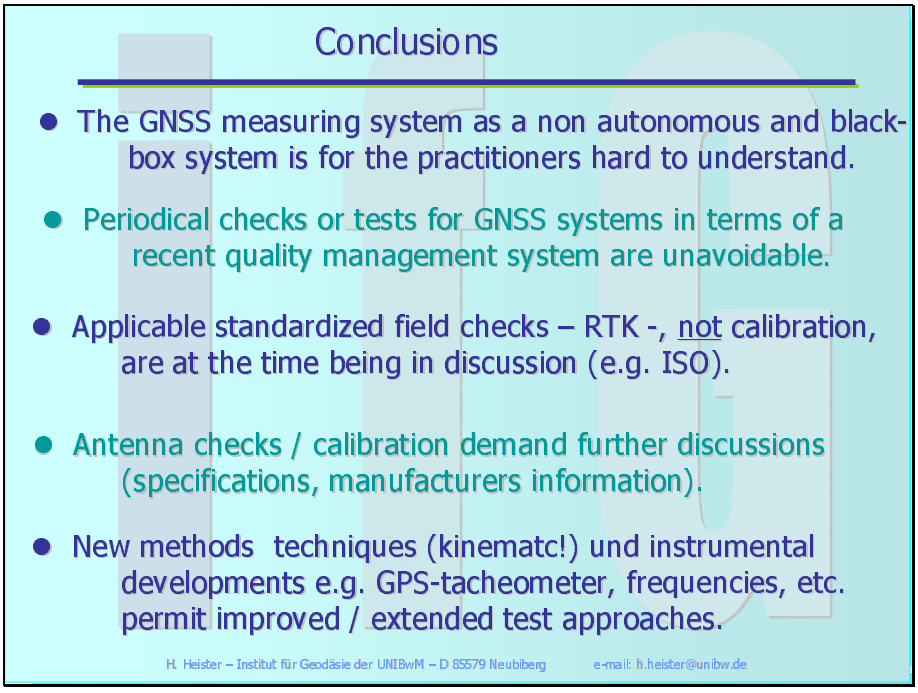

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BIOGRAPHICAL NOTES

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