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Modernisation of the Swiss Vertical Reference System

Authors: E. Borlat, J. Carrel, S. Guillaume, U. Marti, A. Schlatter and D. Willi

INTRODUCTION

Stable and precise reference systems
over time

→ Local physical height system

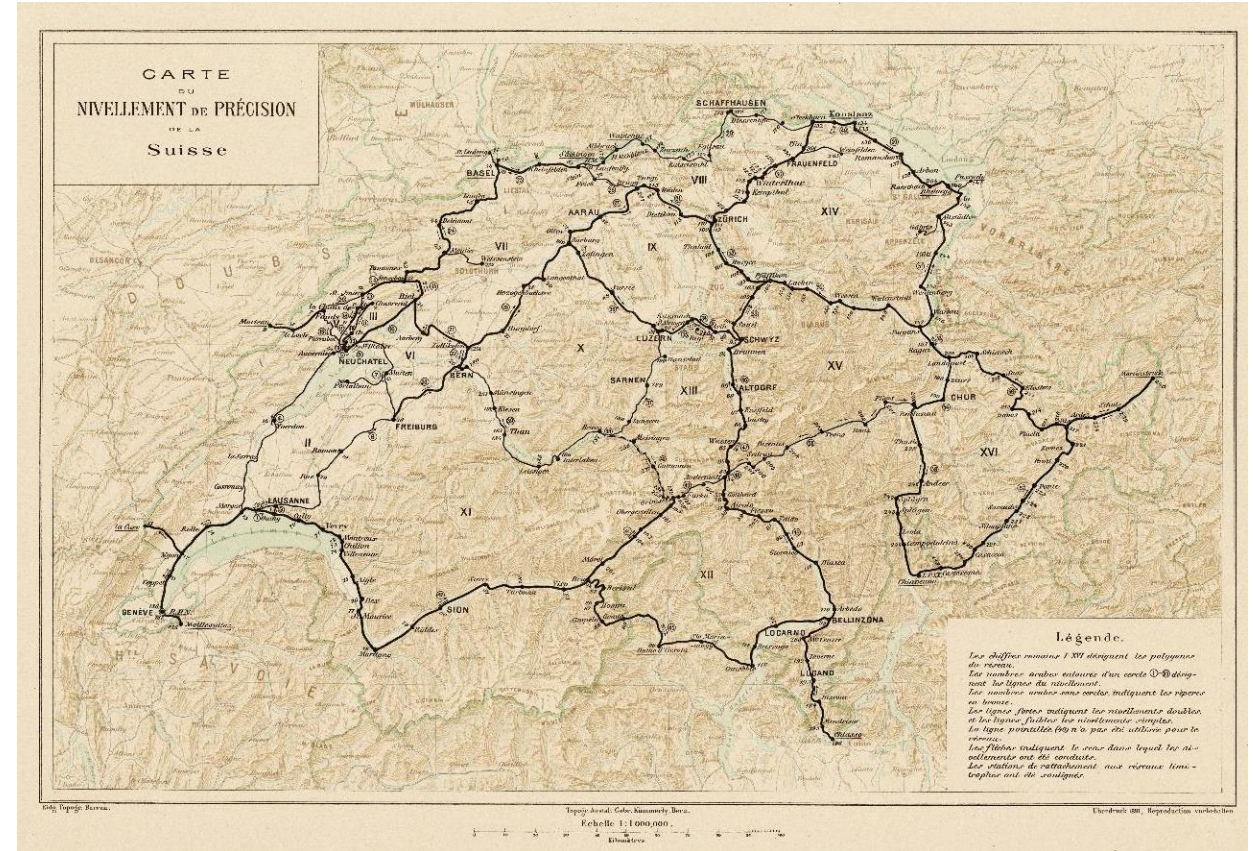
WHAT IS THE SITUATION IN SWITZERLAND TODAY?

LN02

National precise levelling 1902



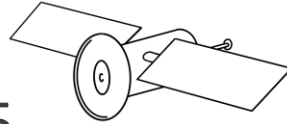
- Nivellement de précision of the Swiss Geodetic Commission 1864 – 1891
- Basis for national leveling 1902
- Established on leveling measurements without gravity corrections
- Still the official height system in Switzerland today (!)



WHAT IS THE SITUATION IN SWITZERLAND TODAY?

LHN95

National height network LHN95



- Orthometric heights
- Used for scientific purposes and large infrastructure projects
- Used for GNSS height determinations through the geoid (CHGeo2004) and the HTRANS transformation.

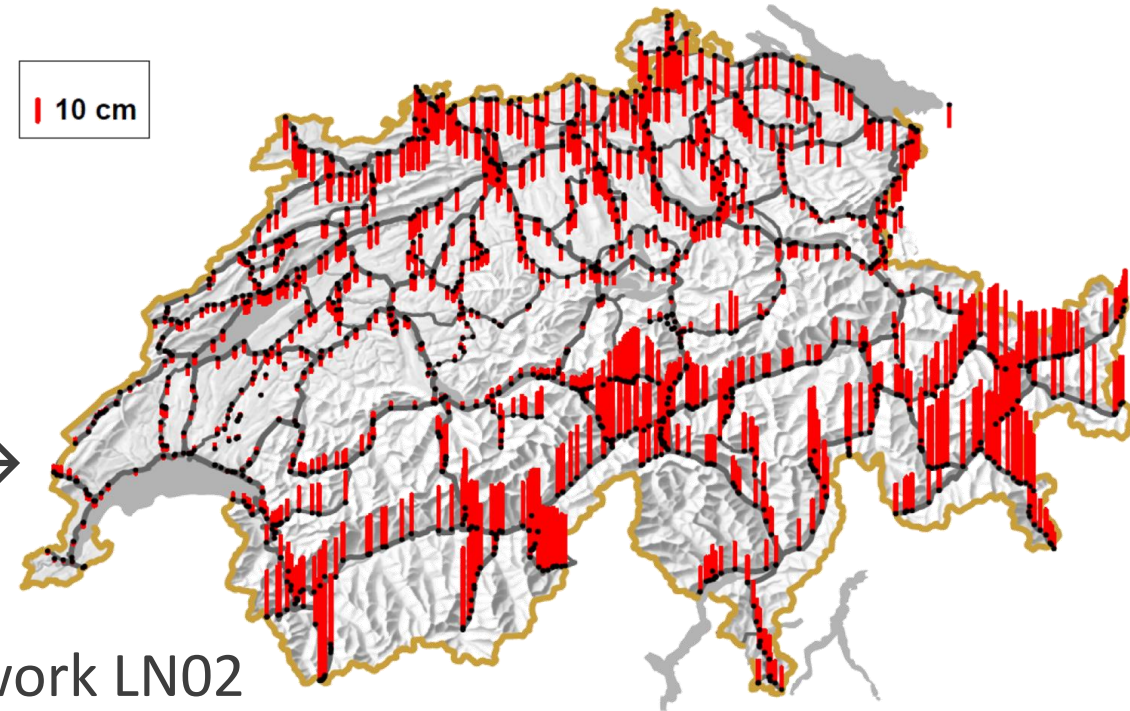
WHAT IS THE PROBLEM?

- Inaccuracy of old measurements
10 to 20 cm
- Alpine uplift of 1 - 2 mm per year
Since 1902 approx. 10 to 20 cm (!)

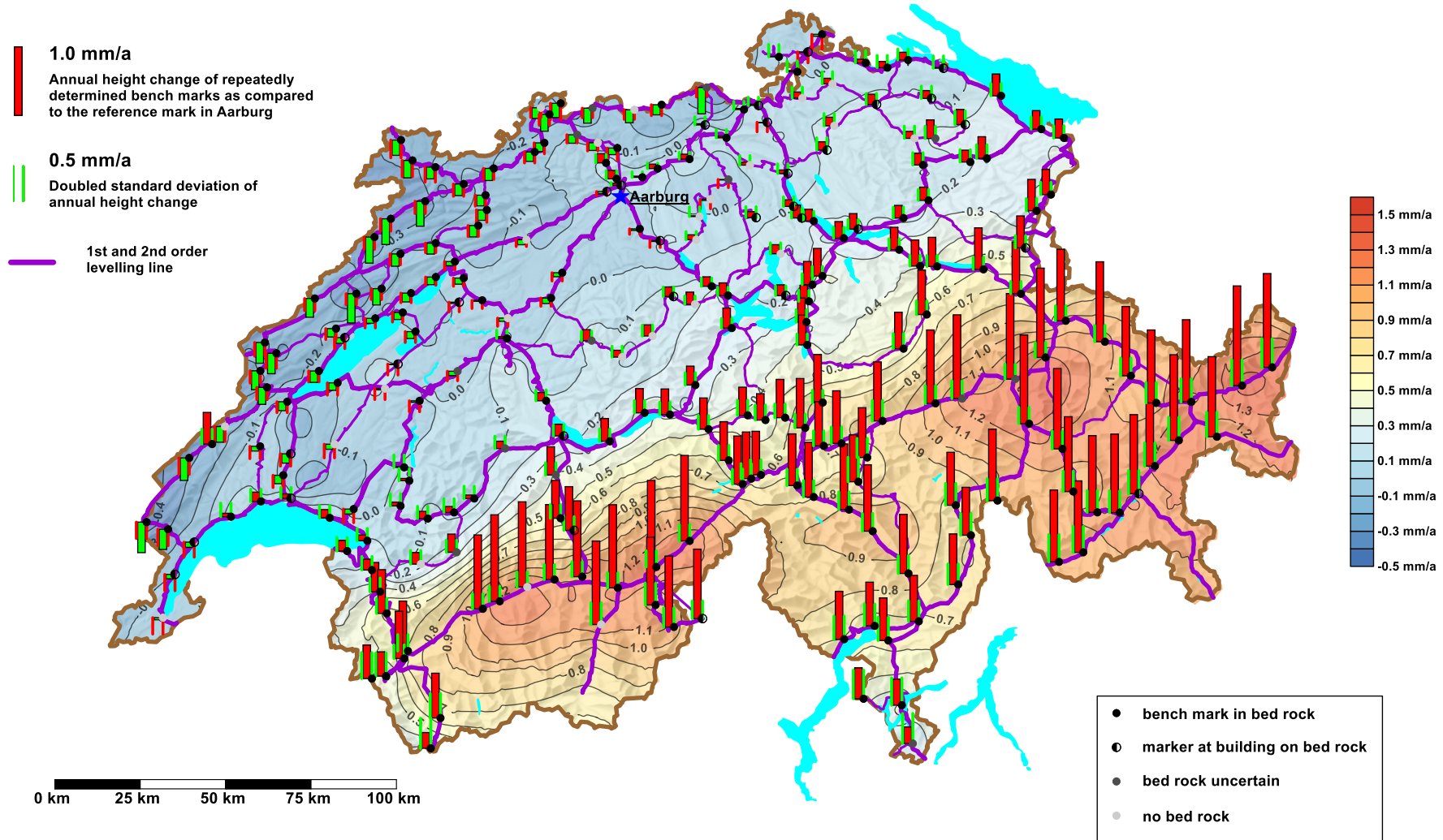
Total differences between LHN95 and LN02 →

Consequences

- Inconsistency / constraints of the current network LN02
- Inaccuracies and susceptibility to errors in hybrid networks with levelling and GNSS
- Systematic devaluation of GNSS measurements

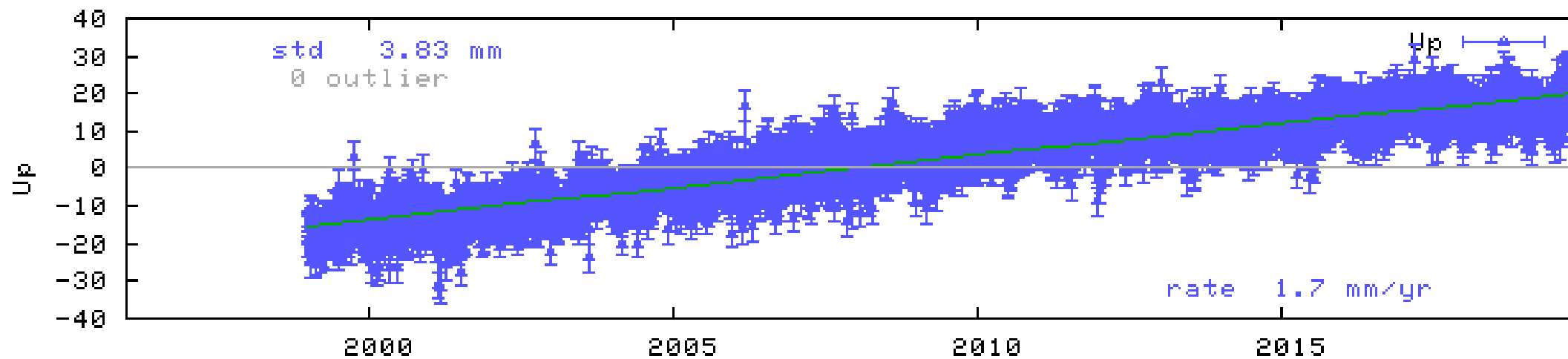


ELEVATION CHANGES IN SWITZERLAND



ALPINE UPLIFT IN DAVOS

Mean uplift: 1.7 mm / year (GNSS time series)



STATE OF THE WORK

Study on the modernisation of the Swiss height reference system and frame

Part I - Basics, state of the art and international comparison

→ Published

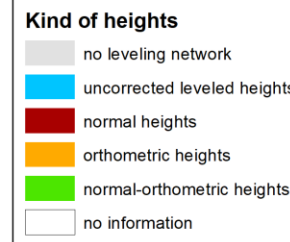
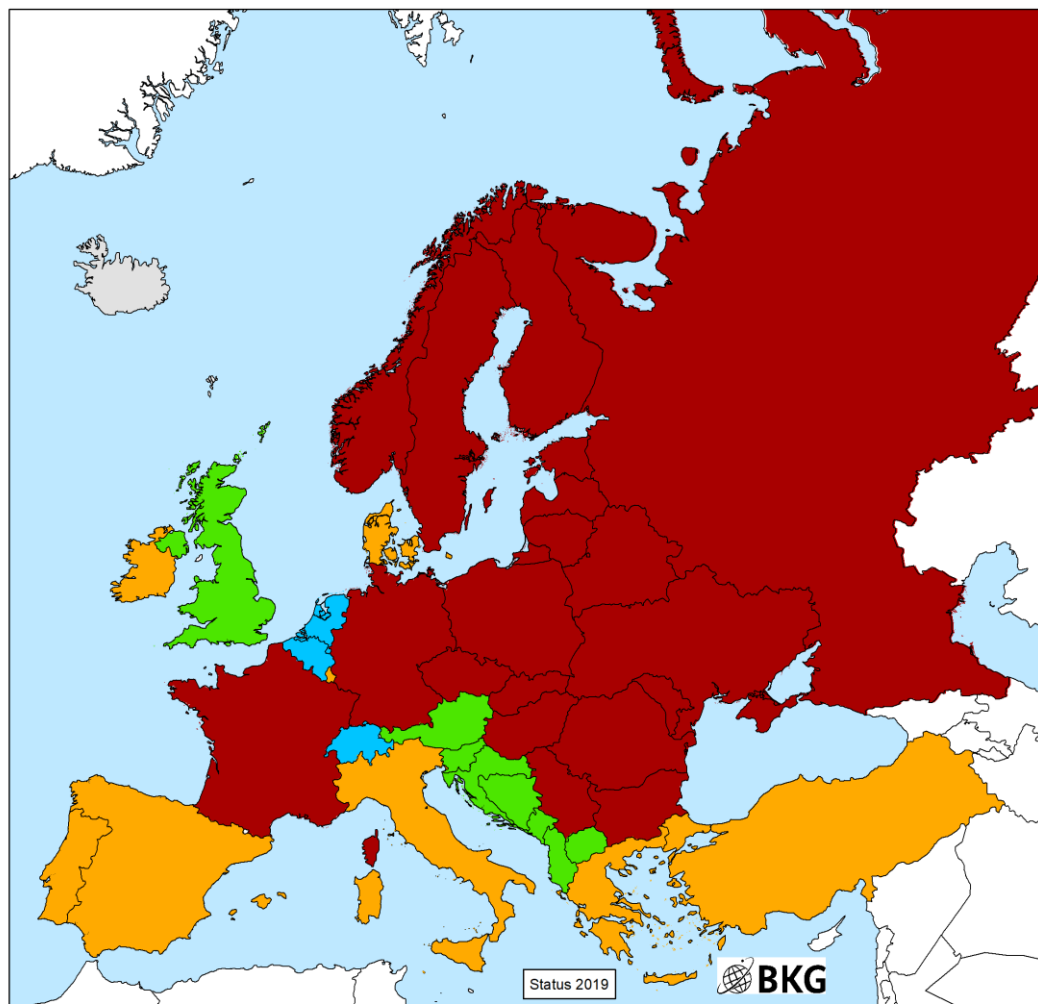
Part II - Definition of the system and analysis of the technical consequences

→ End of consultation

MAIN TECHNICAL ORIENTATIONS FOR CHVRS

	CHVRS
Origin/Reference	W_0 subject to realisation
Type of altitude	Normal height
Normal gravity field	GRS80
Tidal system	Mean-tide
	CHVRFxxxx
Realisation of origin	No net translation on several reference points
Kinematic	Kinematic model (CHVKMxxxx)
Geoid	CHQGEOxxxx

WHY NORMAL HEIGHTS?



AGENDA'S PROPOSAL FOR INTRODUCTION CHVRS

2024 – Development of the technical basis and tools at swisstopo

2025 – Proofs of concept with 1 to 2 cantons

2026 – Analysis of the results

2027 – Decision by swisstopo management



Introduction

From 2028, with the 2028 - 2031 strategy period for cadastral surveying

FURTHER INFORMATION ON THE PROJECT

Website (FR + DE) :



<https://swiss-height-system.heig-vd.ch/>

Publications :

- Study on the modernisation of the height reference system and reference frame in Switzerland

Videos :

- Video 1 : Motivations of the project
- Video 2 : Scientific basis
- Video 3 : Compatibility of reference systems

