Basic Education
Department of Remote Sensing

Cornelia Gläßer

Martin Luther University Halle-Wittenberg
Institute of Geosciences and Geography
Department of Remote Sensing and Cartography

Co-funded by the
Erasmus+ Programme
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Objectives

- Development from Diploma to BSc and MSc
- Structure and Course setting
- Content and goals
- Lectures, exercises, excursion
- E-learning and E-assessment

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ENV PRO

Pre-Diploma

basic knowledge

- Basic Cartography
- Basic GIS
- Basic Remote Sensing
- Statistics

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UNIVERSITÄT
HALLE-WITTENBERG

Diploma

advanced knowledge

- Thematic Cartography
- Applied Remote Sensing
- Mapdesign
- Geostatistics
- Block Course

lectures

exercises/block internship

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Pre-Diploma

Basic Cartography

2 CHs lecture

one full week practice " block internship"

Basic Remote Sensing

2 CHs lecture

one full week practice " block internship"

Basic GIS

2 CHs lecture

2 CHs exercises

Statistics

2 CHs lecture

2 CHs exercises

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Diploma

Thematic Cartography
2 CHs lecture

Generation and design of maps
2 CHs

Applied remote Sensing
2 CHs lecture
2 CHs areal photo interpretation

Block course
digital image processing

Geostatistics
2 CHs combination lecture and exercises

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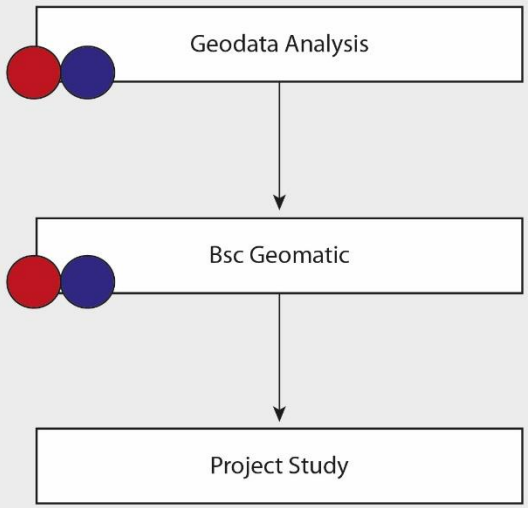
BSc Courses

basic knowledge



lectures exercises

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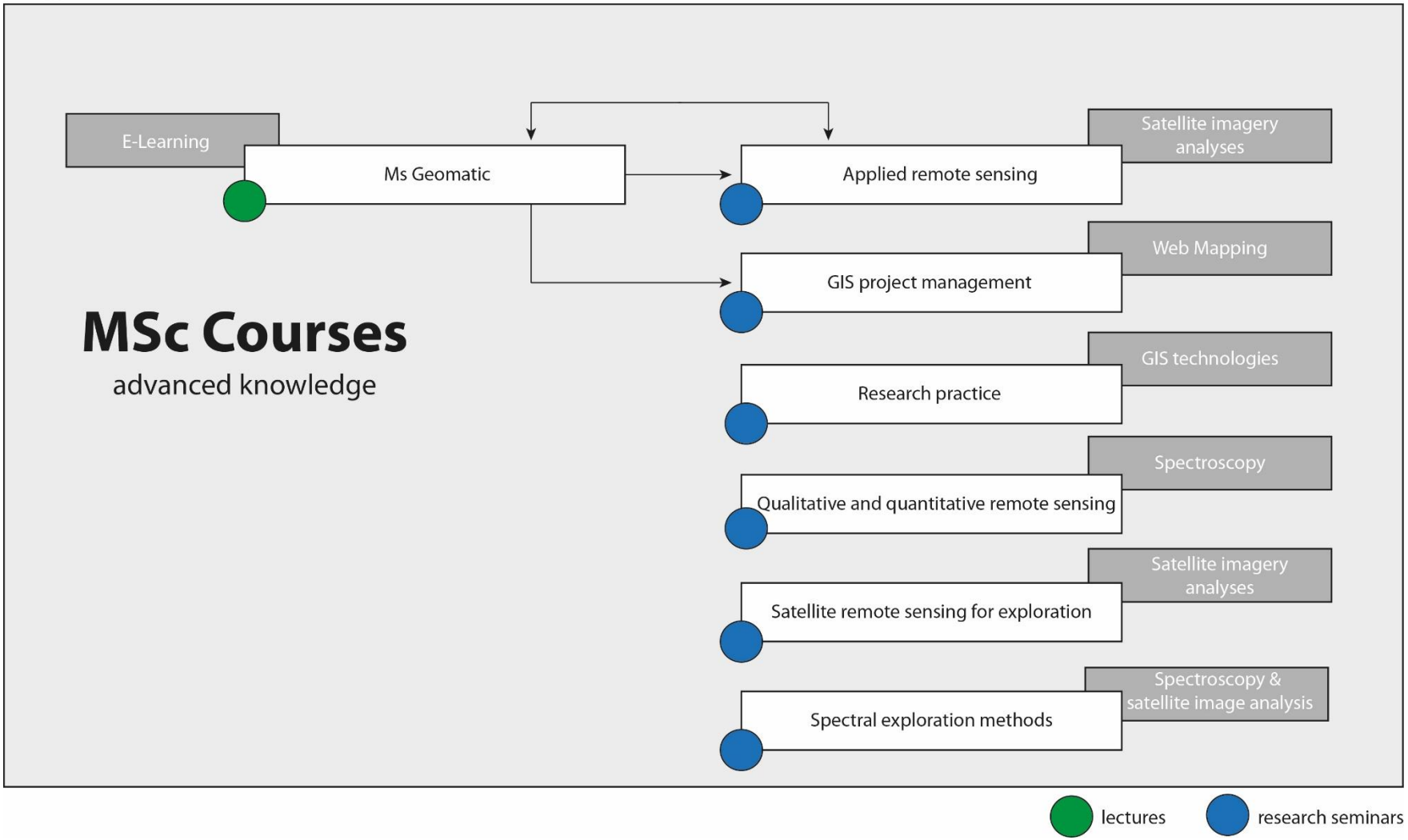

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- Basic understanding of geodata
- Basic knowledge using the data (interpretation,analyses, visualisation)
- Geodata as spatial models of the landscape
- Types of geodata
    - Basic topographic data
    - Thematic data
    - Remote sensing data
    - Digital terrain models
- Scales and generalization

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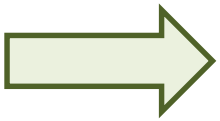
Main Objectives

- Geodetic background
- Geodata infracstructure
- Basic GIS
- Basic cartography



- Combination of theoretical and practical knowlegde
- Fulfil the requirements of the job market
- Fundamentals for the MSc

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Organization of lectures

- Some basic topics like map projection are mot the favorites of students
  - Introduction with some impressive examples
  - Changing of 0° median
  - View to the world though type of projection
  - Webased moduls to map projection and coordinate systems – with exercices

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Greenwich – fixed °Meridian?

Name	Längengrad	Verwendungsbeispiel
Ferro	-17° 39’ 46“	Nullmeridian deutscher Karten bis 1884
Paris	2° 20‘ 44“	Nullmeridian Französischer Karten bis 1911
Rom	12° 27‘ 08“	Früherer Nullmeridian italienischer Karten
Berlin	13° 23‘ 44“	Nullmeridian Preußischer Karten bis circa 1850
Pulkovo	30° 19‘ 39“	Nullmeridian Russischer Karten bis circa 1920

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Greenwich

Heutiger Nullmeridian:
Greenwich

Abbildung generiert mit ArcGlobe.

Gläßer, 2013

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Ferro

Meridian von Ferro
-17° 39‘ 46“

Abbildung generiert mit ArcGlobe. Daten: Wilhelmy 1996, S. 44

Co-funded by the
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Paris

Meridian von Paris
2° 20‘ 14“

Abbildung generiert mit ArcGlobe. Daten: Wilhelmy 1996, S. 44

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Rome

Meridian von Rom
12° 27‘ 08“

Abbildung generiert mit ArcGlobe. Daten: Wilhelmy 1996, S. 44

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Berlin

Meridian von Berlin
13° 23‘ 44“

Abbildung generiert mit ArcGlobe. Daten: Wilhelmy 1996, S. 44

Martin-L
Institut fi
Fachgeb

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Pulkowo

Meridian von Pulkovo
30° 19‘ 39“

Abbildung generiert mit ArcGlobe. Daten: Wilhelmy 1996, S. 44

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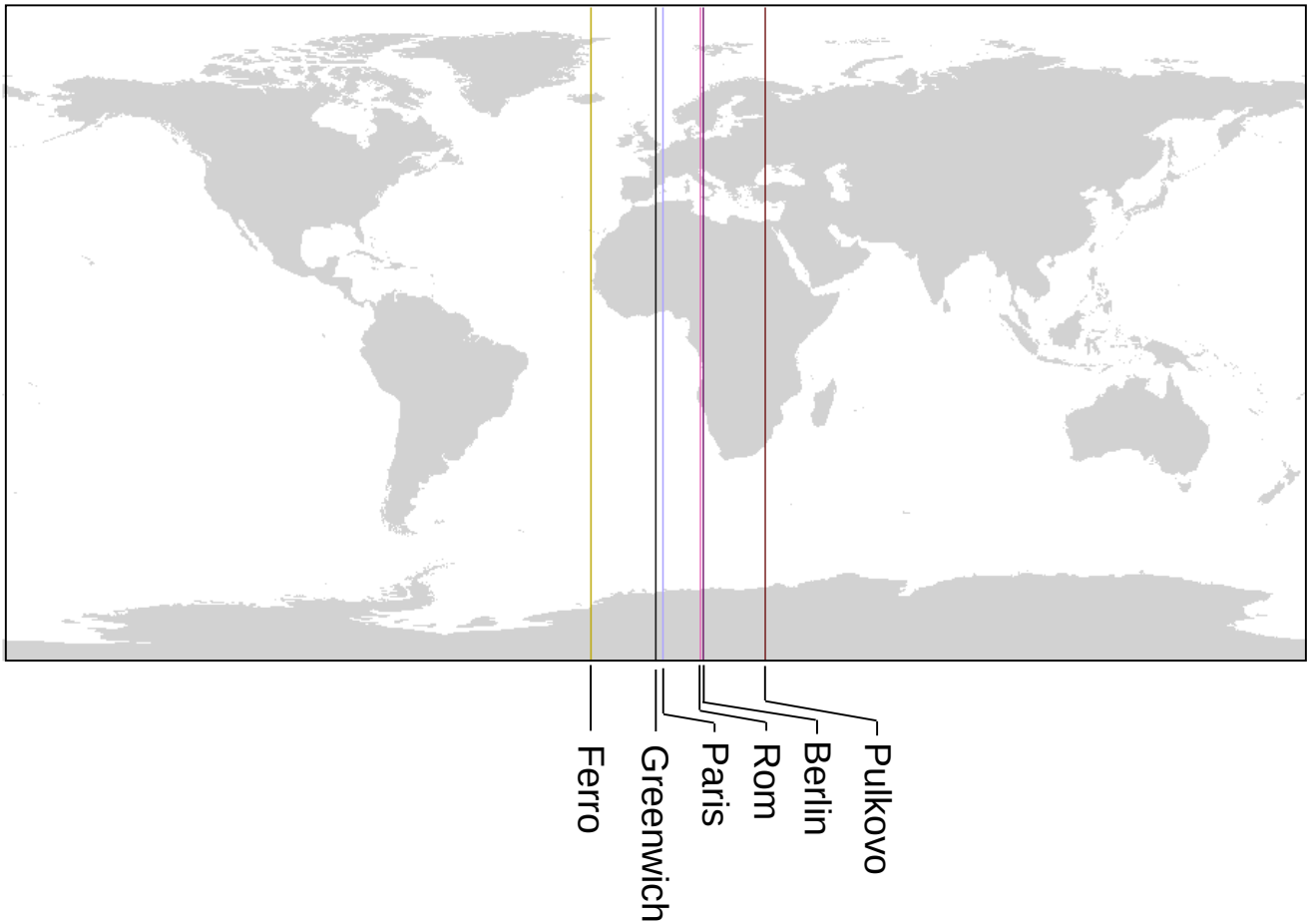

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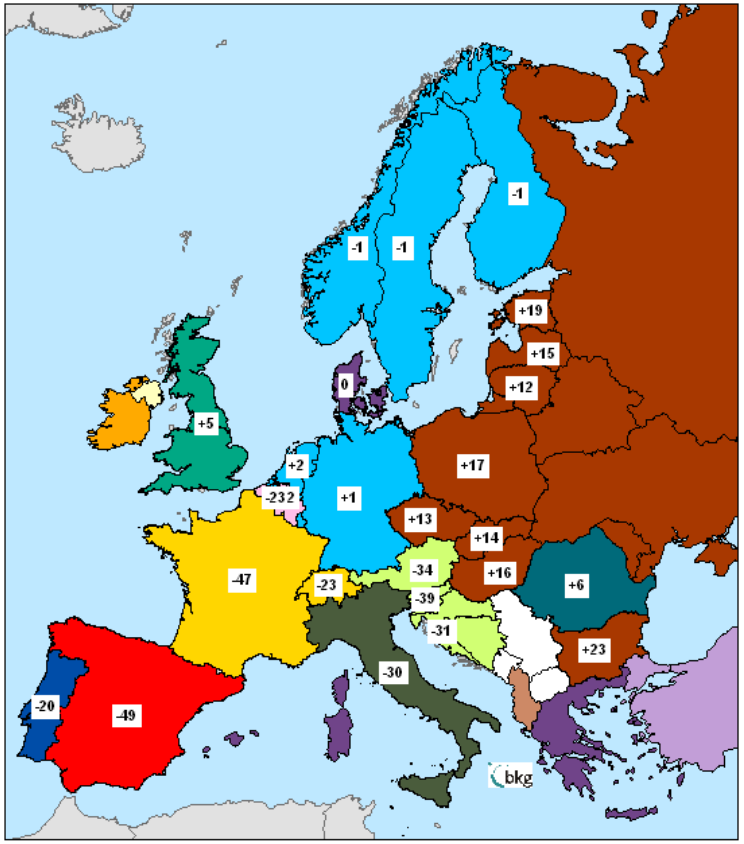
Gauges

- Amsterdam Gauge,
- Measurments in the 17 century flood gate of Haarlem
- Since 1818 for the Netherlands
- Seit 1877 for Prussia
- Reference for Germany
- Planung: EU- weit?

Other Gauges:

Triest	Austria, Croatia
Genua	Italy, Switzerland
Marseille	France
Tregde	Norway

Gauges



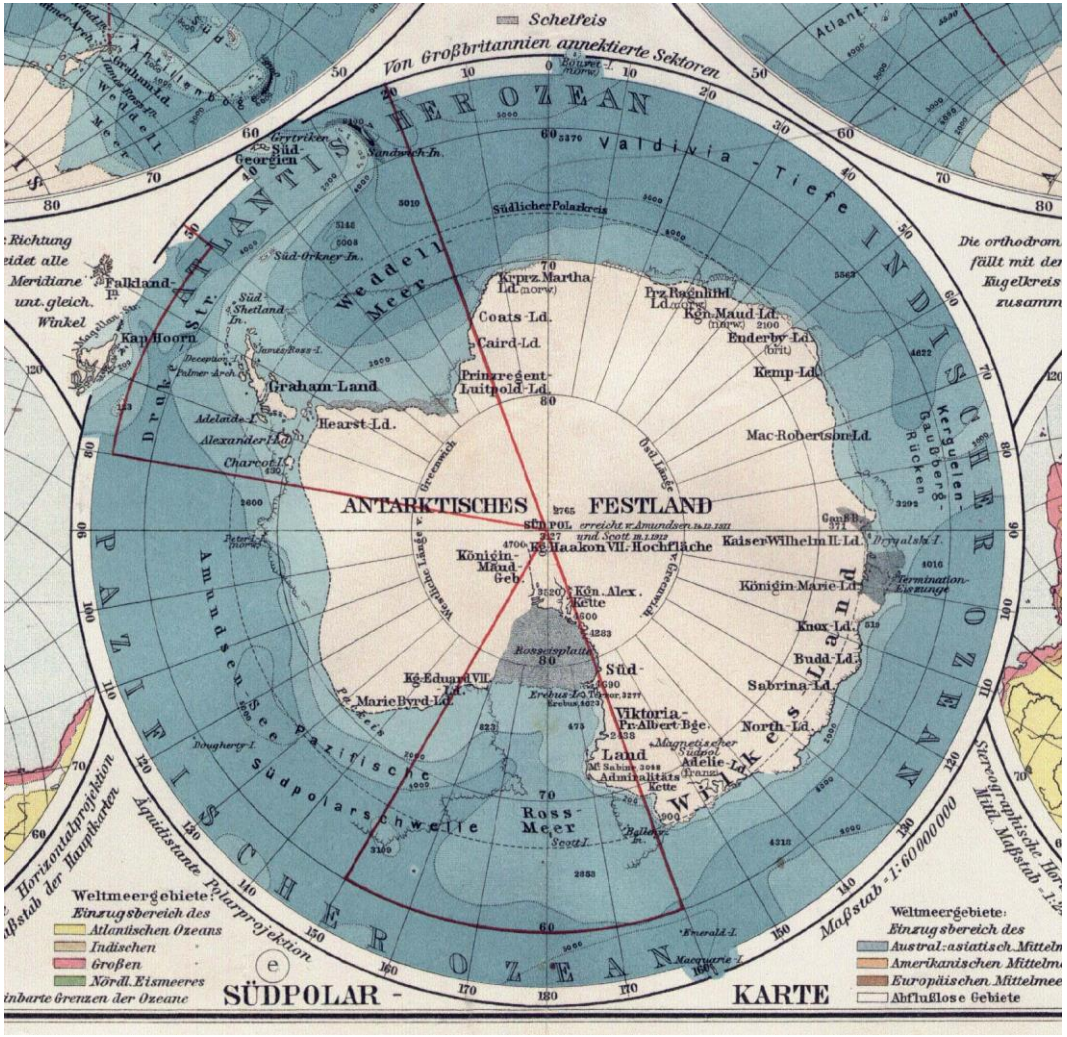
Reference tide gauges

Alicante	Cascais	Kronstadt	Ostend
Amsterdam	Constanta	Malin Head	Trieste
Antalya	Durres	Marseilles	other
Belfast	Genoa	Newlyn	no information

www.bkg.bund.de

Kronstadt Gauge
Former UdSSR
Used GDR and
All countries
Warsaw act
Russia

Our view on the world in maps



Quelle: Sydow-Wagners Meth. Schul-Atlas. Justus Perthes, Gotha 1932, Karte Nr. 5

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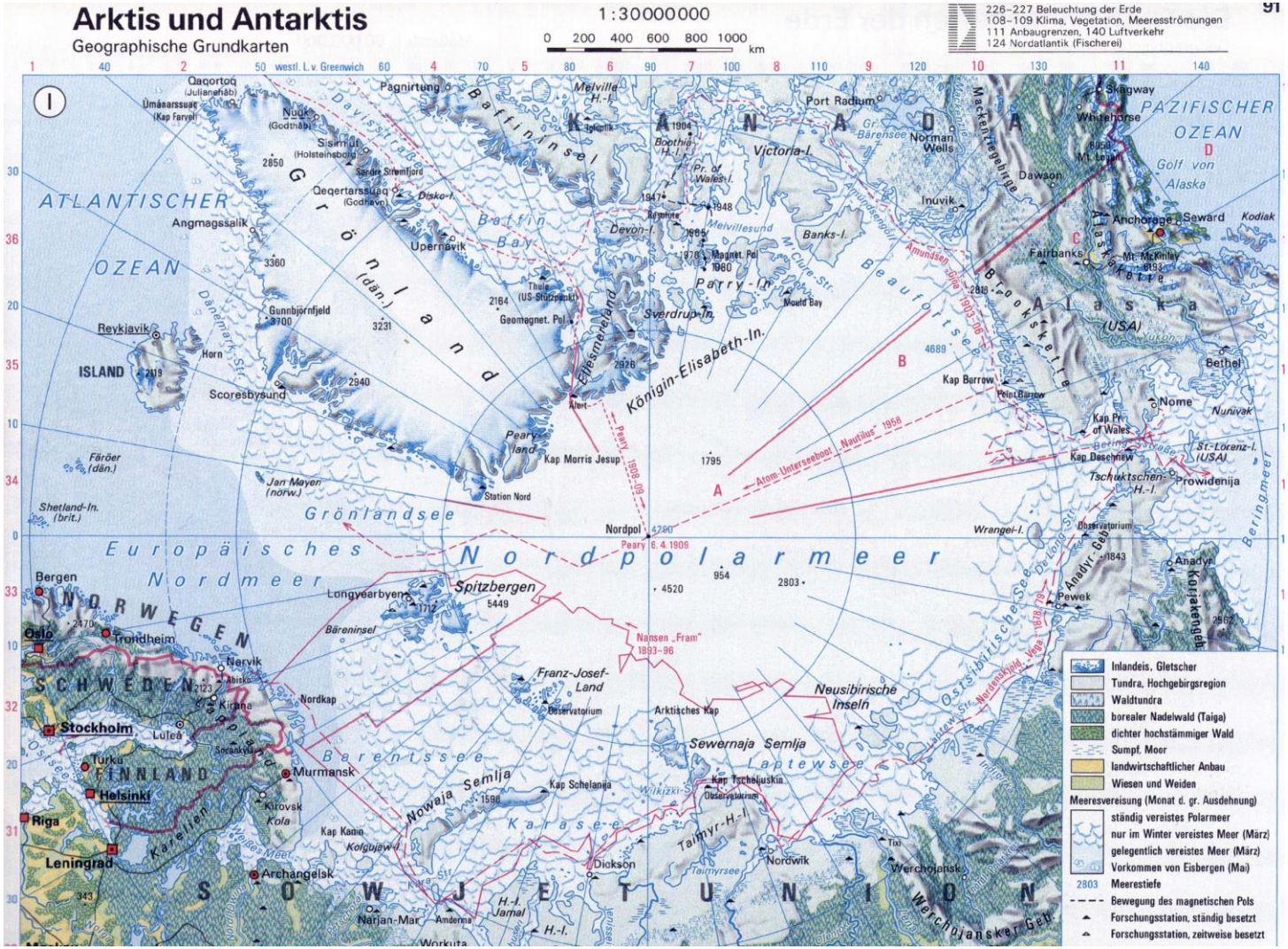
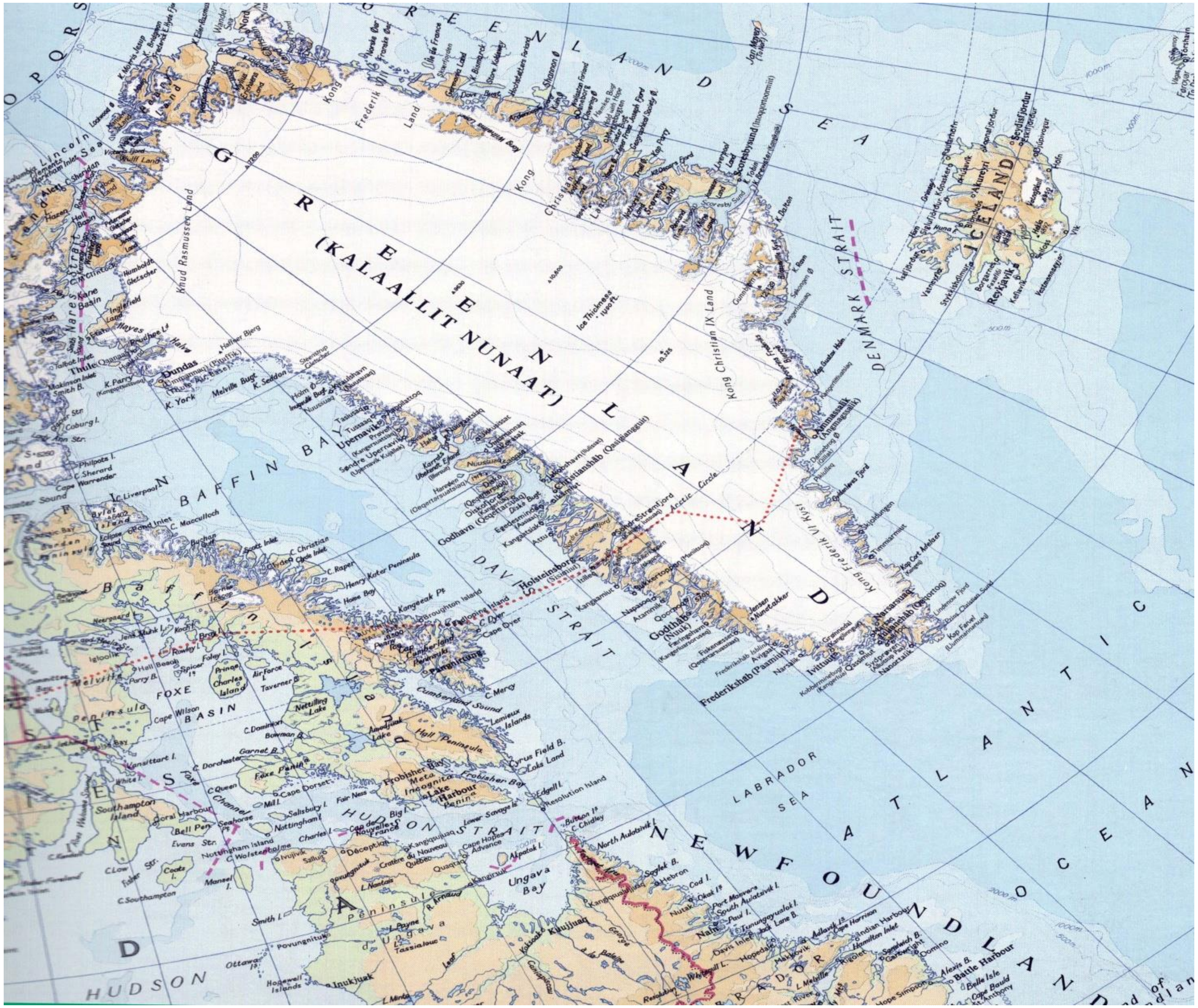
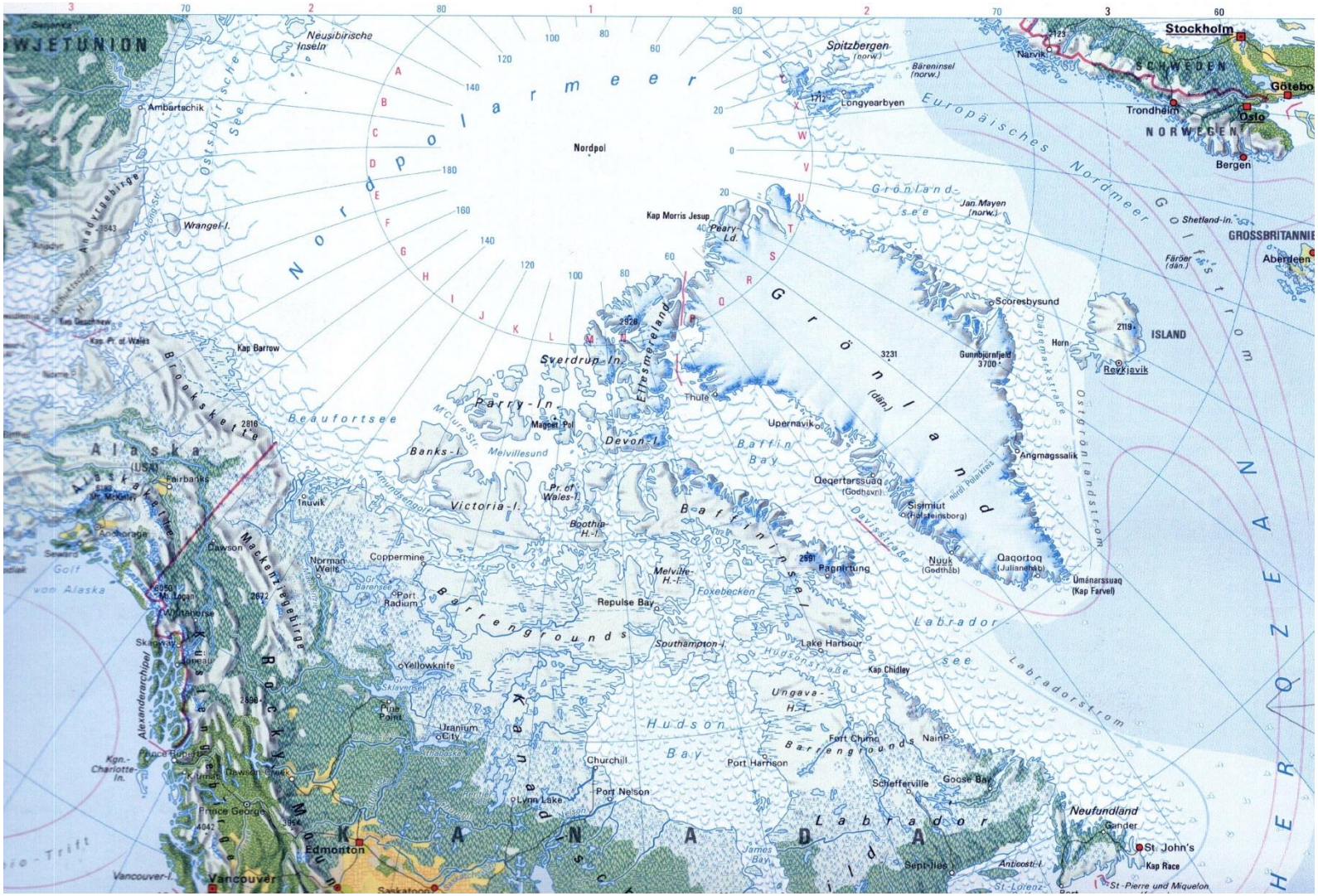


Quelle: Alexander Weltatlas. Klett Schulbuchverlag Stuttgart, 1982, S. 91



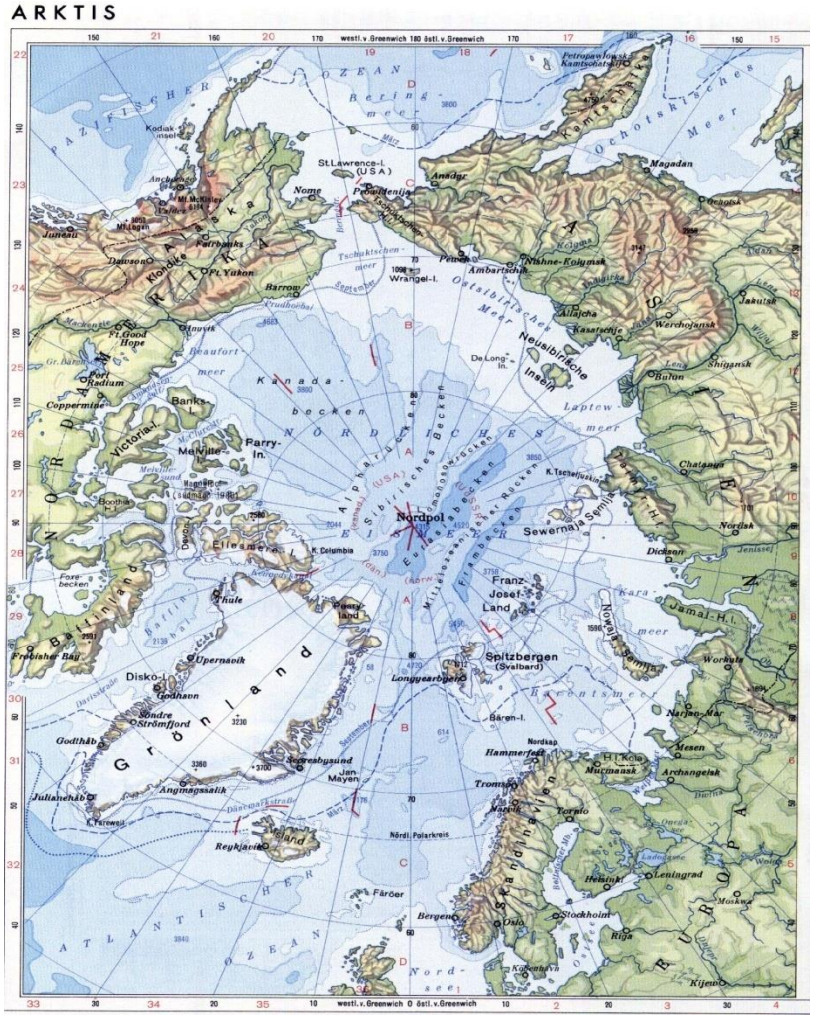
Quelle: The Times Atlas of the World. Times Books, London, 1990, Karte 97

Quelle: Sydow-Wagners Meth. Schul-Atlas. Justus Perthes, Gotha 1932, Karte Nr. 60



Quelle: Alexander Weltatlas. Klett Schulbuchverlag, Stuttgart 1982, S. 78

Quelle: The Times Atlas of the World. Times Books, London 1990, Karte 38



Quelle: Österreichischer Unterstufen-Atlas. Wien, Ed. Hölzel, 1978, S. 121

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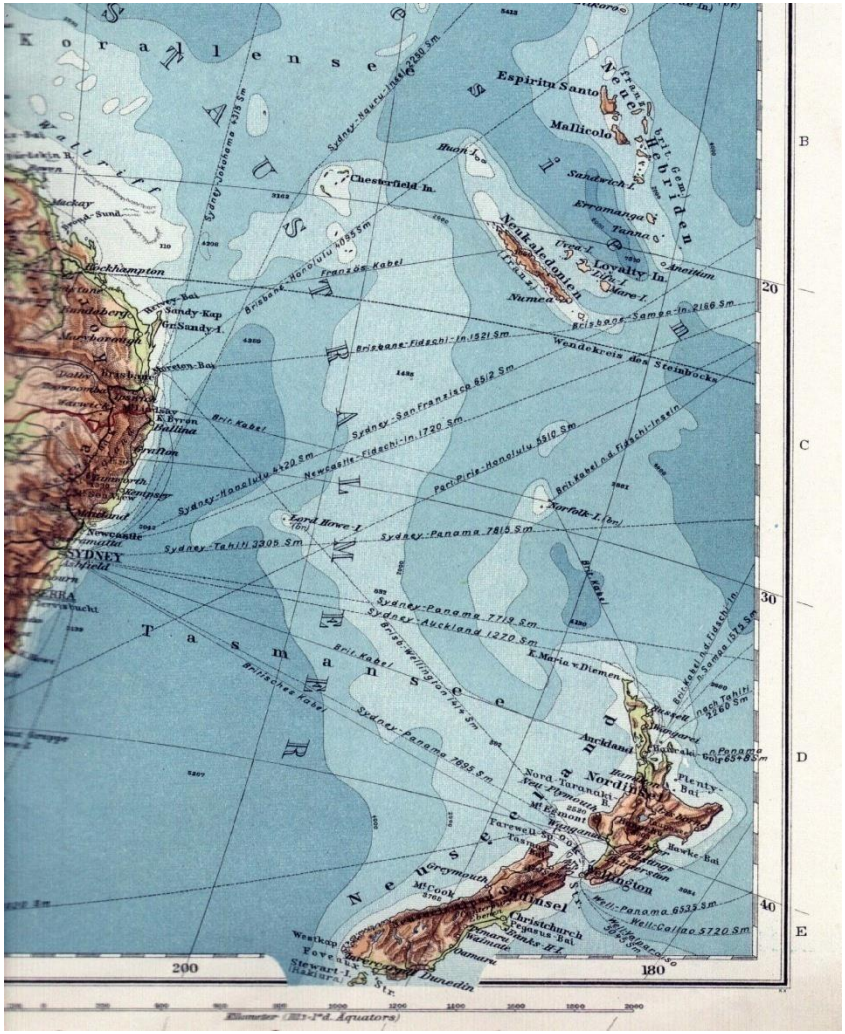
Quelle: Seydlitz Weltatlas. Cornelsen & Schroedel & Geogr. Verlagsgesellschaft, Hannover, Bielefeld, Berlin 1986, S. 132-133

Quelle: The Times Atlas of the World. Times Books, London 1990, Karte 49



Quelle: Sydow-Wagners Meth. Schul-Atlas. Justus Perthes, Gotha 1932, Karte Nr. 53

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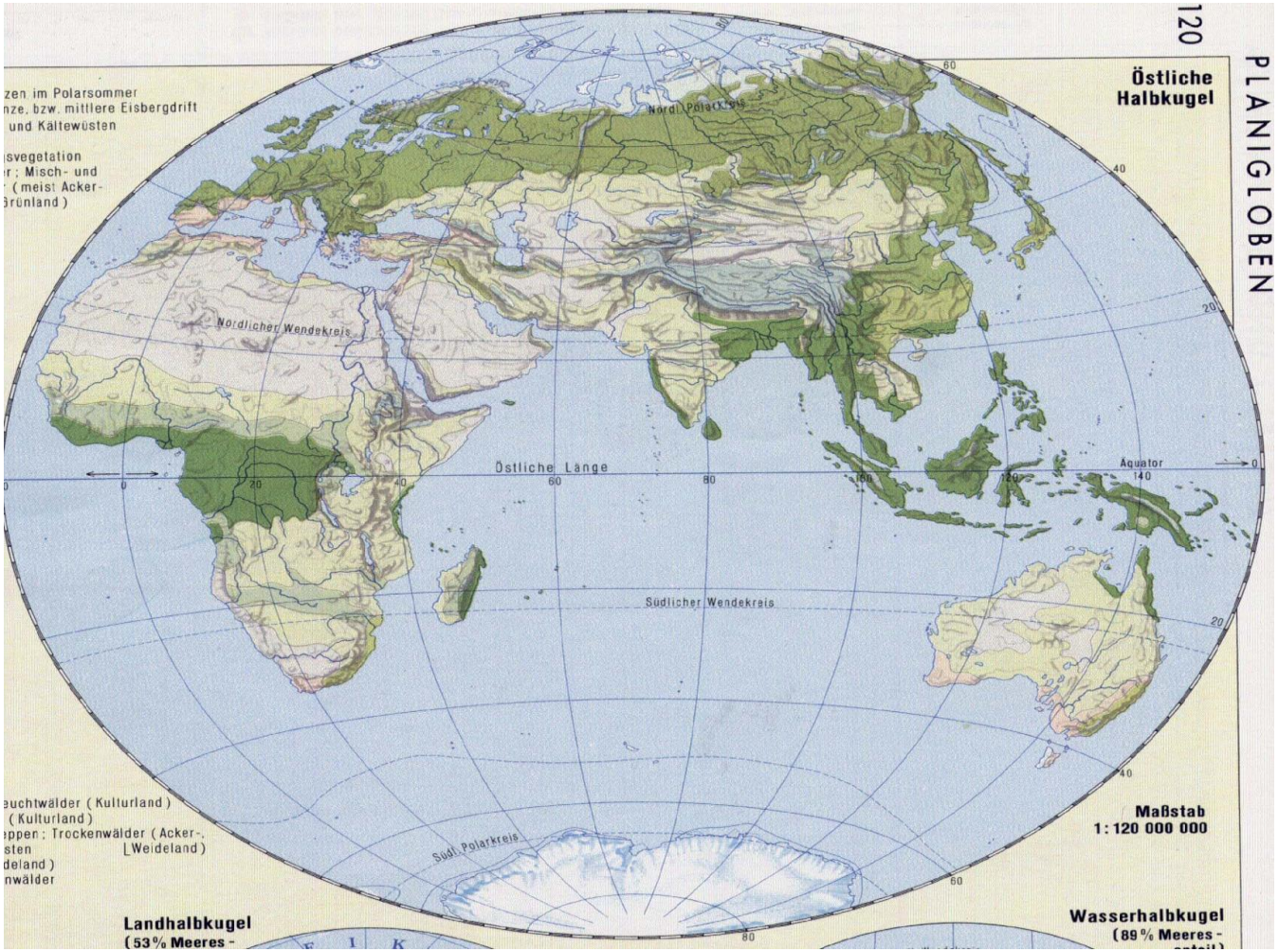

Quelle: Österreischischer Unterstufen-Atlas. Wien, Ed. Hölzel, 1978, S. 120

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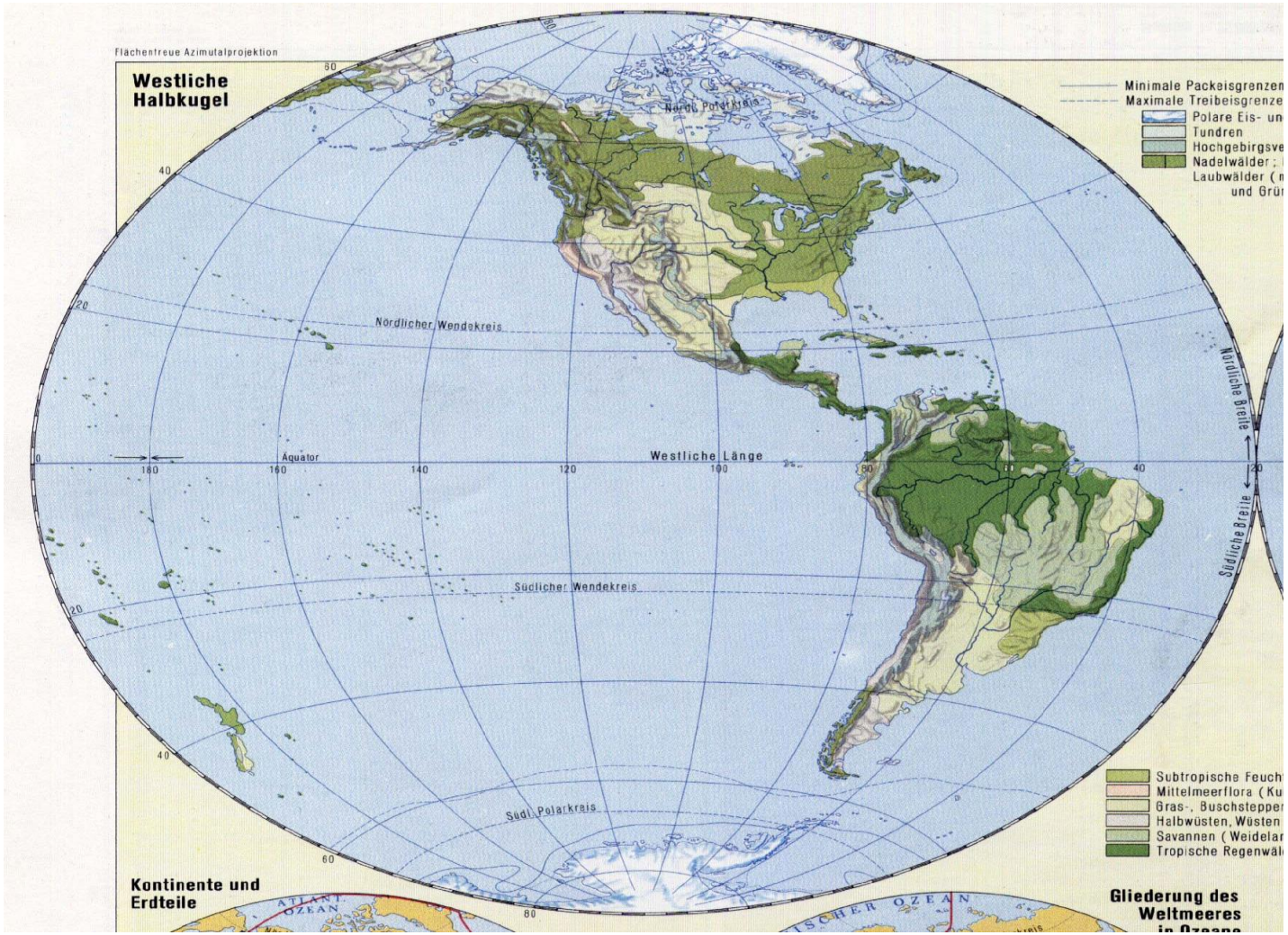

Quelle: Österreischischer Unterstufen-Atlas. Wien, Ed. Hölzel, 1978, S. 120

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Fachgebiet Geofernerkundung und Kartographie

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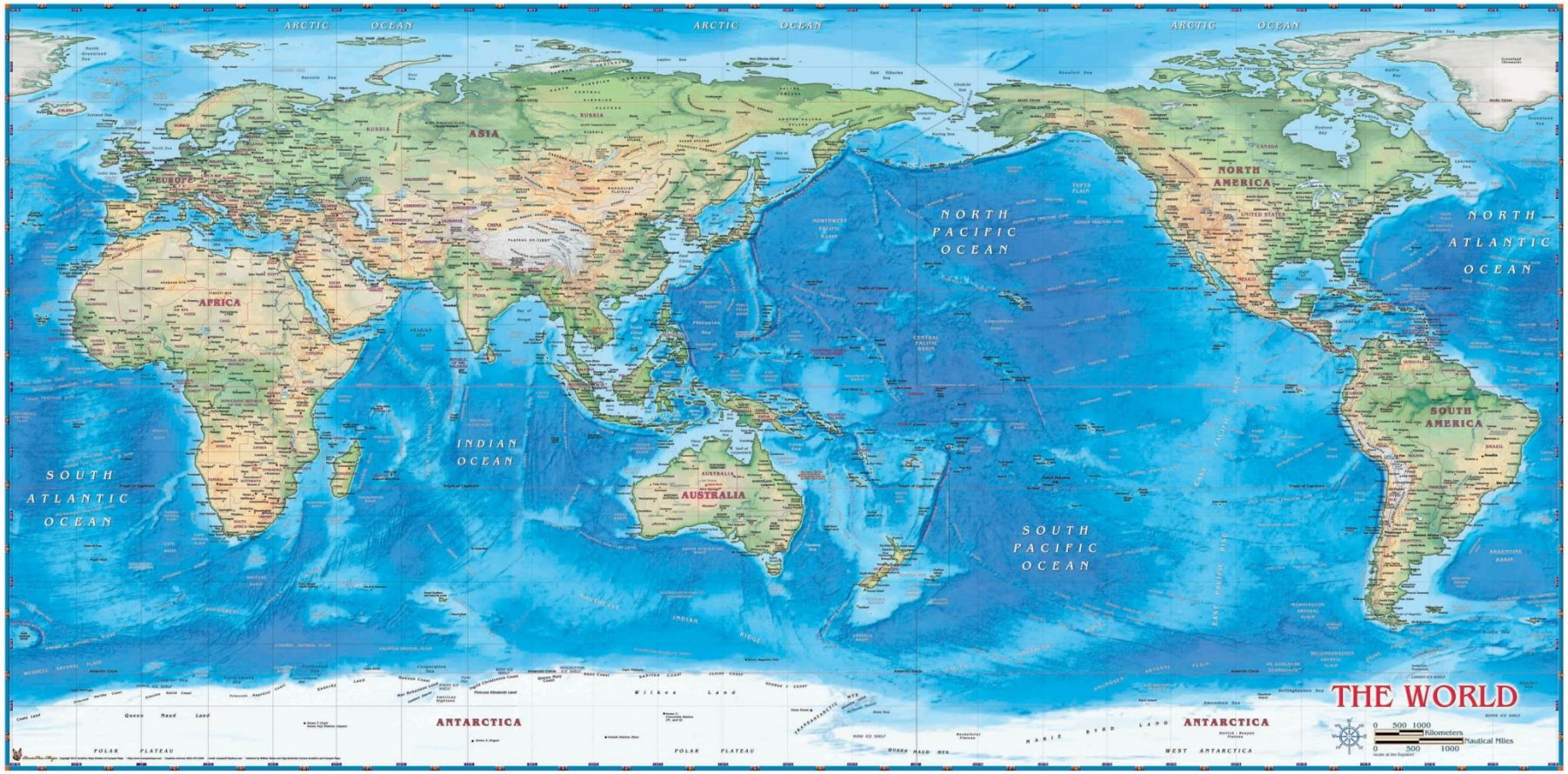

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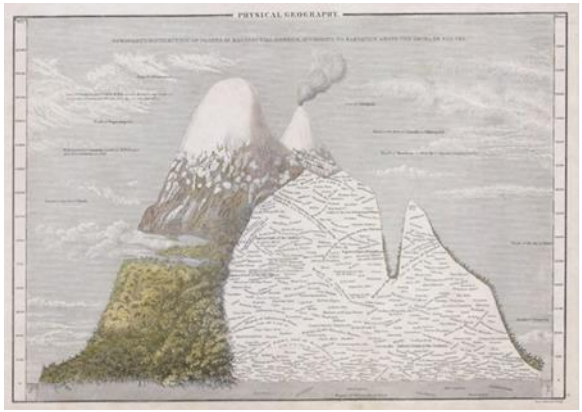
Past – Present - Future

- Limited time
- Digital natives
- „Ready for the job“
- Highly dynamic topics
- Increasing of types of data, models
- Scenarios …

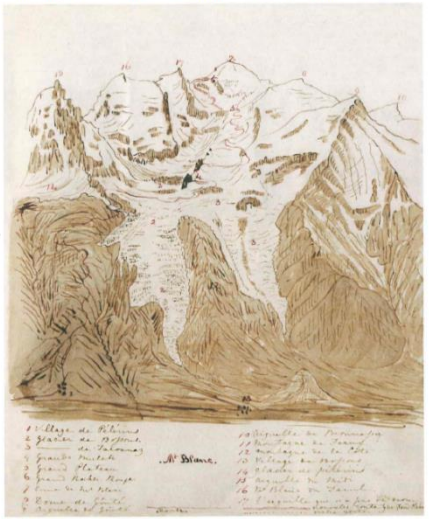
- Landscape development needs knowledges about past,present and future
- Historic maps and old aerial photos as well as time series of satellite data

- History of Science is important

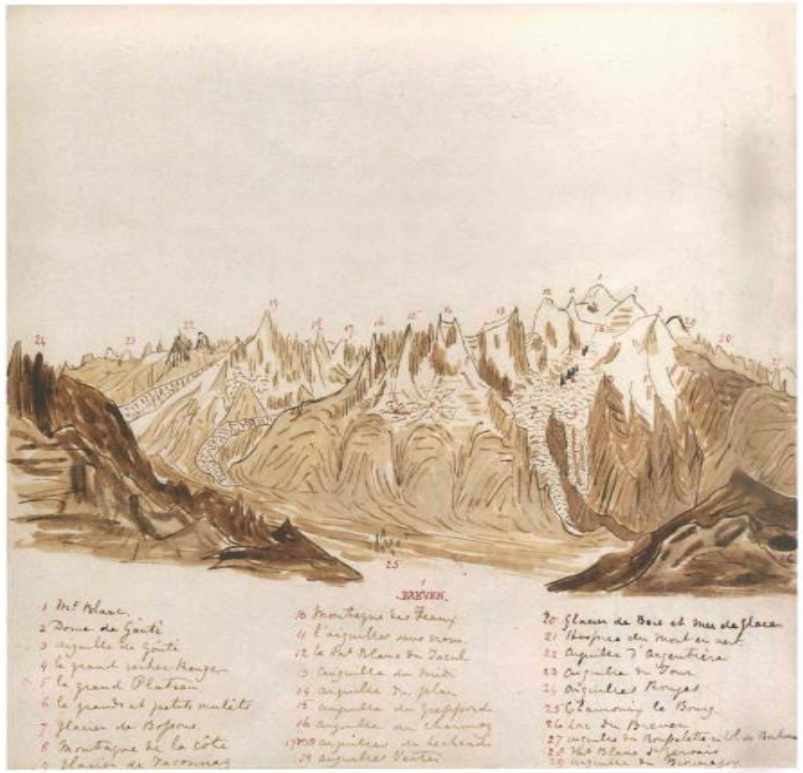


Visualisation

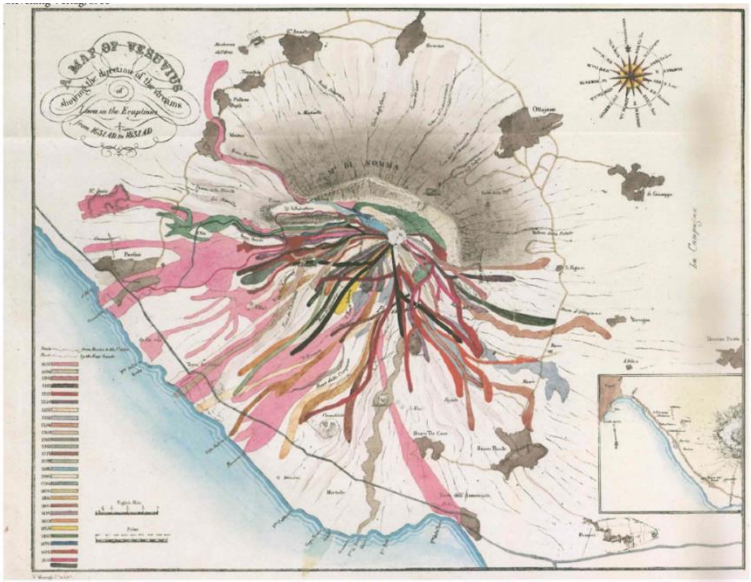
John Auldjo 1805-1886, in: Lewis-Jones, Huw; Herbert Karl; Vorwort von Robert Macfalane, Kosmos grosser Entdecker: Leben, Skizzen und Notizen. Sieveking Verlag, S. 30



Auldjos Zeichnung der Besteigung des Montblanc, bei der er »bestrebt war, so genau wie es eine Skizze eben erlaubte, die Route einzuzeichnen, der ich bei dem Aufstieg folgte«



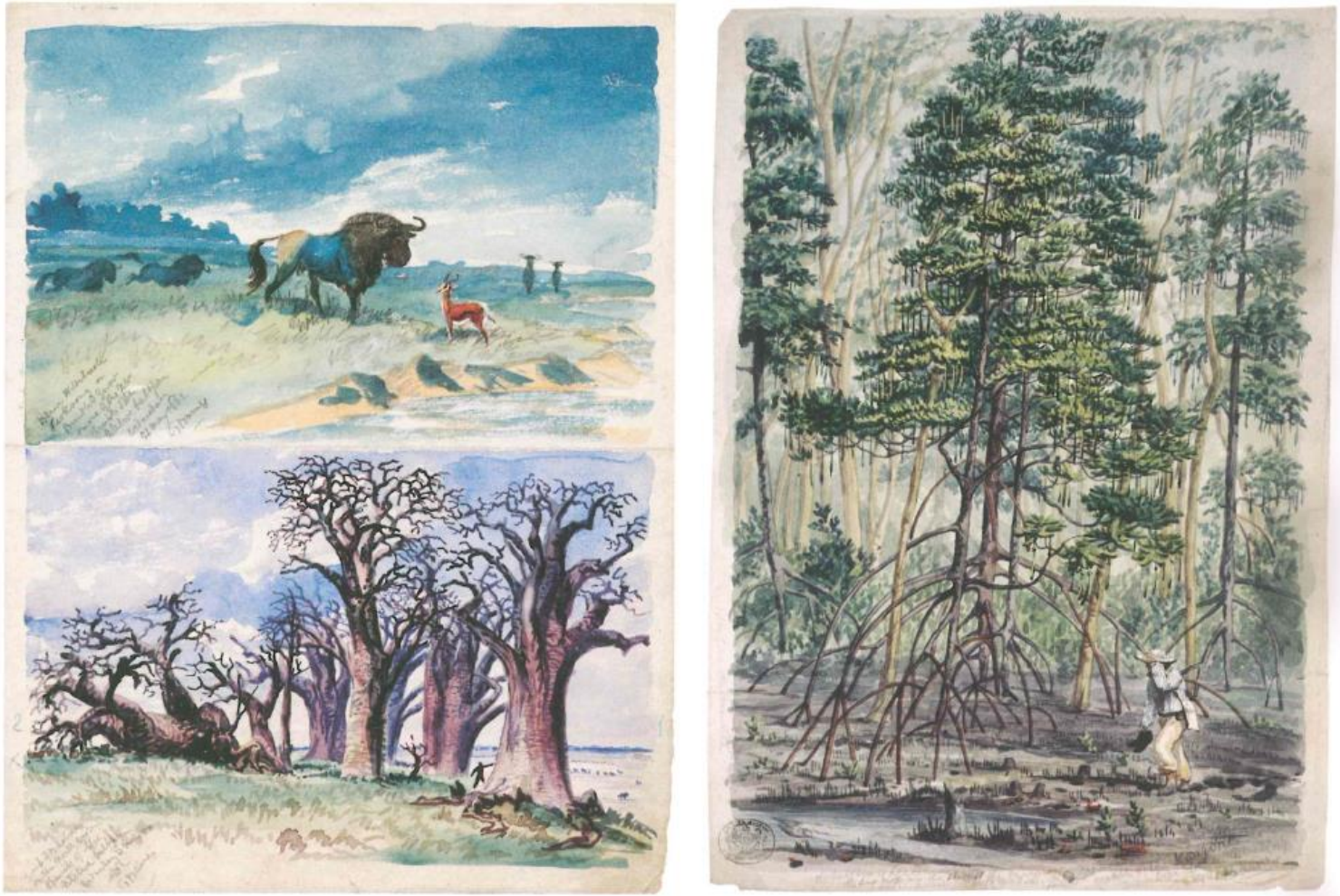
30 JOHN AULDJO



Eine Karte des Vesuv, auf der historisch verbriefte Lavaströme von Ausbrüchen verzeichnet wurden - eine bahnbrechend neue Art, geografische Informationen und Naturphänomene zu visualisieren. Auldjos illustrierte Berichte verlockten Reisende, den Vesuv selbst zu besuchen.

Oberserving – Analysing - Documentation

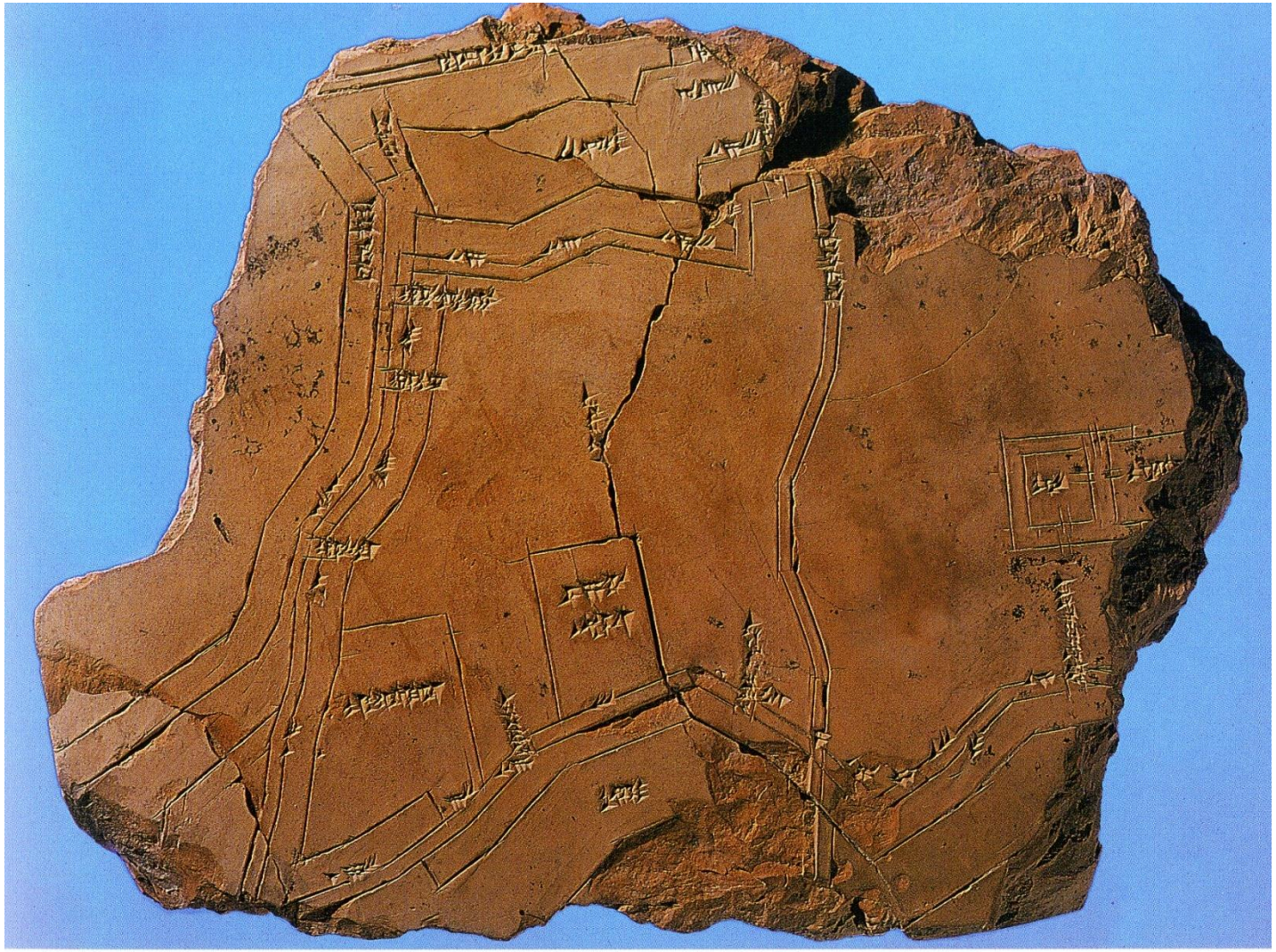
Thomas Baines 1820-1875, Lewis-Jones, Huw; Herbert Kari; Vorwort von Robert Macfalane, Kosmos grosser Entdecker: Leben, Skizzen und Notizen. Sieveking Verlag, S. 35



Baines' Aquarellzeichnungen von Streifengnus und Baobabbäumen in der Nähe der Ntwetwe-Salzpfanne (1862). Daneben ein Mangrovensumpf bei Niedrigwasser (22. November 1859): "Der schlanke Baum ist eine Doacenna. Die langen Tropfen sind die Samen der Mangrove, die beim Herabfallen in den weichen Schlamm dringen".

ALEXANDER v. HUMBOLDT 1769 – 1859
Central and South America

3500 Year old town map, Nippur, Babylonia in einer Tontafel



Sammet (1990): 53

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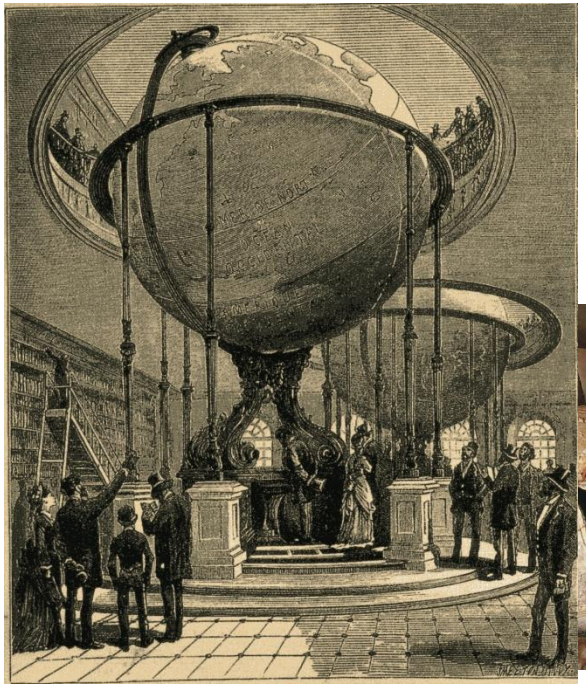
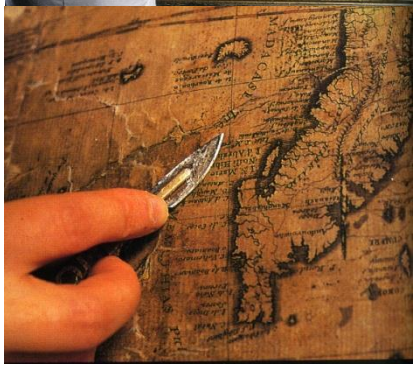
Historic globes and globe collection



Erd- und Himmels-globus von Coronelli 1683 – Anfertigung für Ludwig XIV

Globensegmente von Gerard Mercator 1541



Rekonstruktion historischer Globen

Sammet (1990): 116

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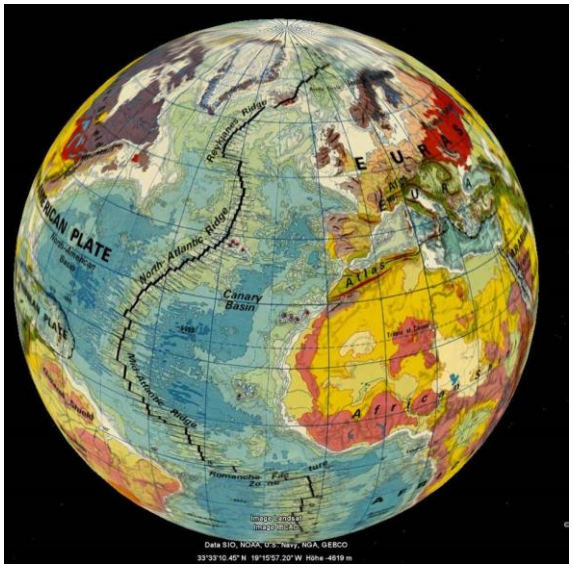
Globen und Atlanten

Globus von Willem Janszon Blaeu 1645, Niederlande

Physikalischer Globus von 1987, Ungarn

Globus von Vincenzo M. Coronelli 1700, Italien



Tektonischer Globus von 1988, Ungarn

Virtual Globes Museum
http://terkeptar.elte.hu/vgm/2/

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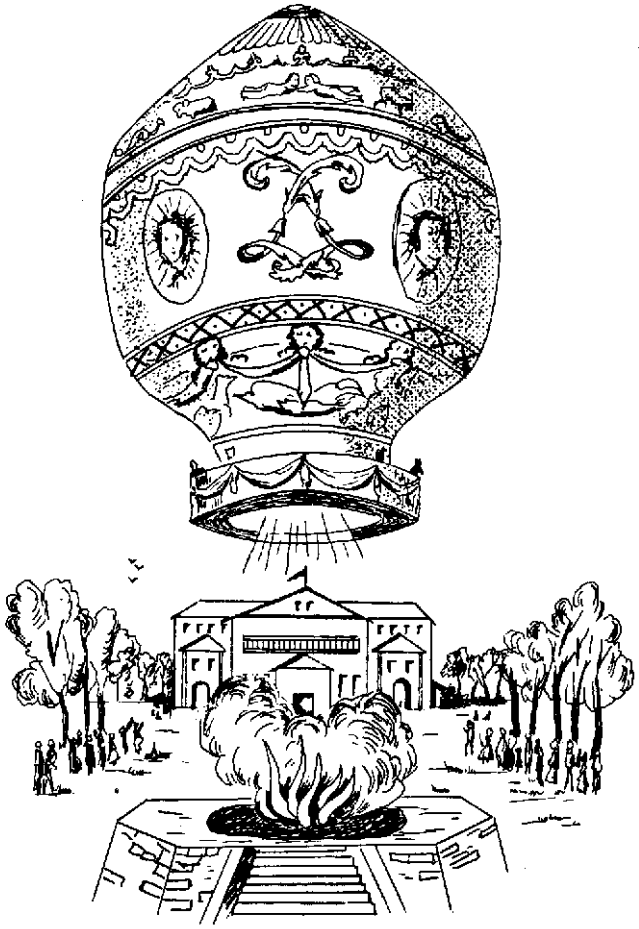
First Ballon

Paris, 21.11.1783

Pilatre de Rozier und Marquis d' Arlandre



- 23m above ground
- 5m Diameter
- Strohfeuer

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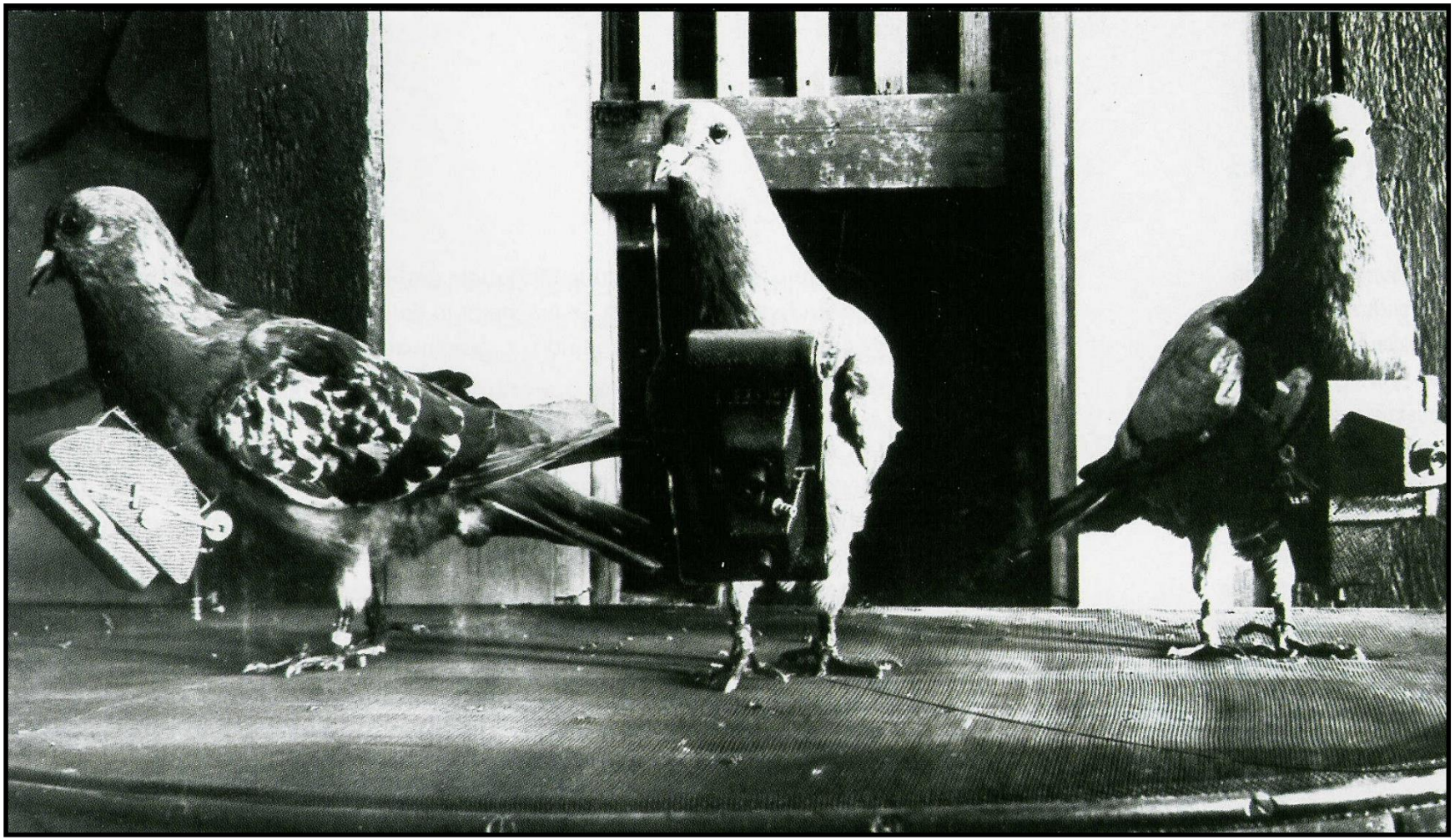
„Aerial photographer on the way to the job“



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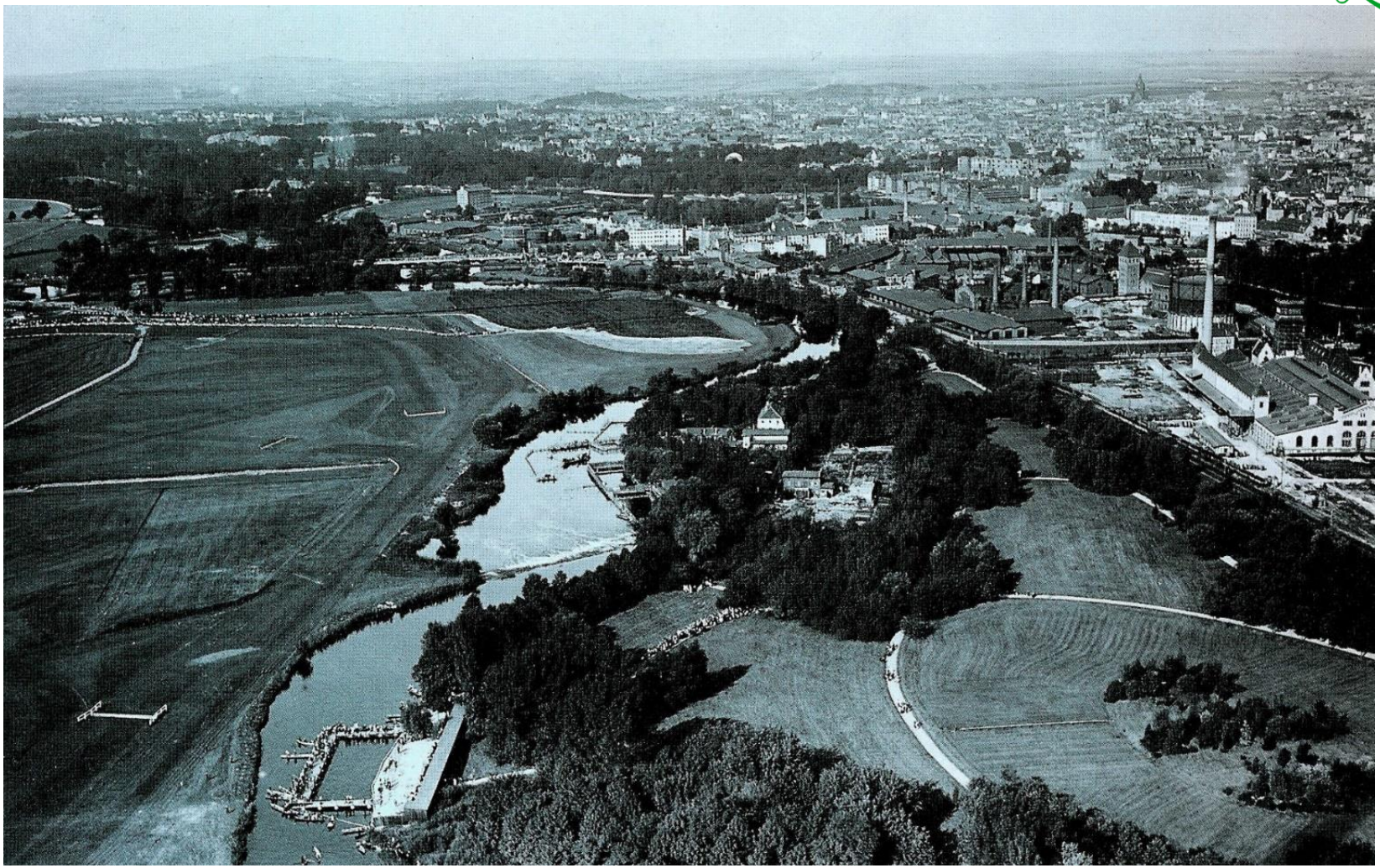
Zeppelin above Halle



Jacob, R. [Hrsg.] (2000): Mit dem Luftschiff über Halle und Umgebung, S.61)

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History of aerial photos and remote sensing

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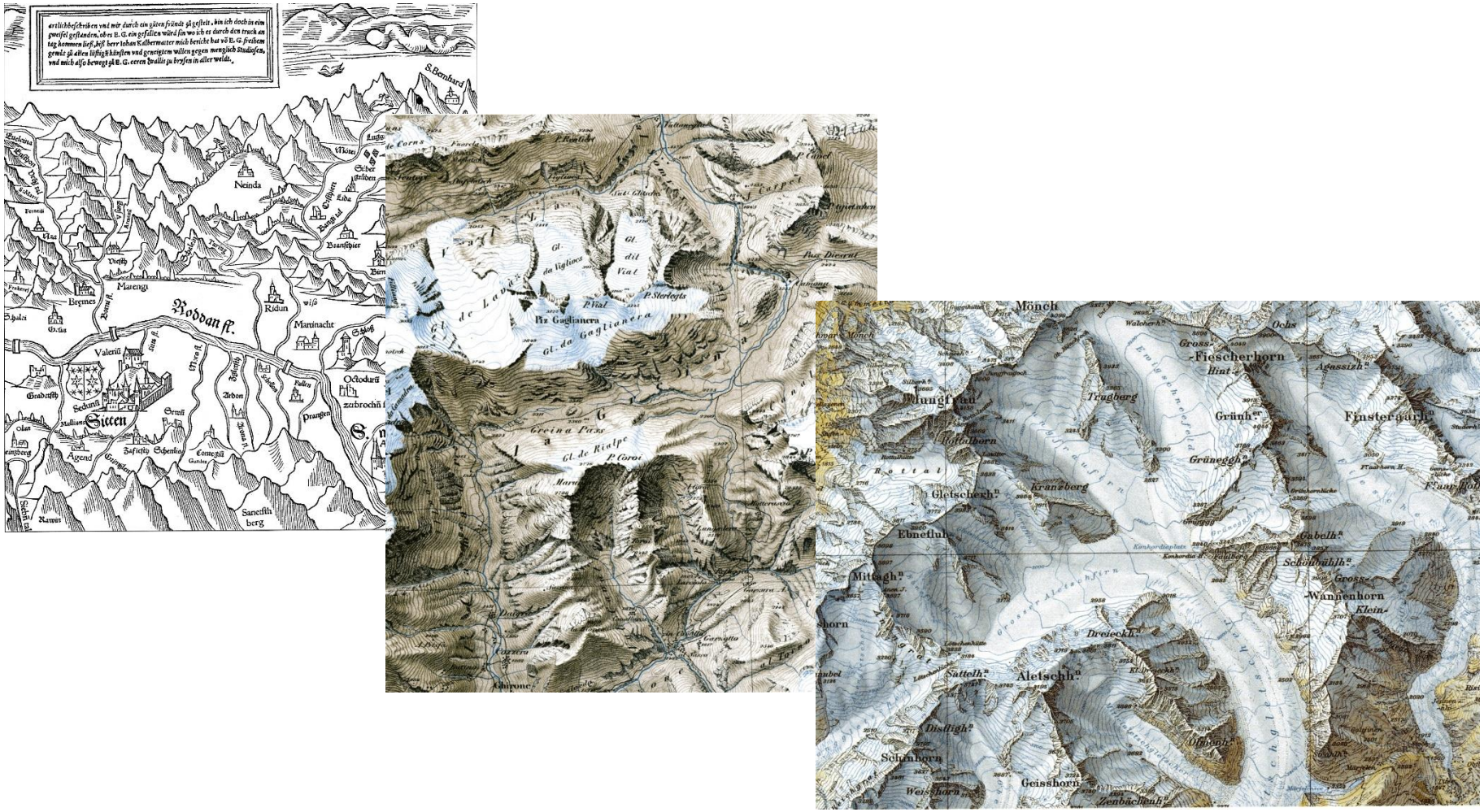
Development of morphology in maps



Sammet, 2010

Organization of the modules

- Lectures and elearning modules

- Exercises
  - 180 students, PC pool with 40 places
  - „ready to use“
  - Standardization
  - Examples for all BSc studies

- Excursion
  - Training site in the surrounding of Halle (public transport, bike)
  - Short field trip and self study
  - Increasing of knowledges landscape – maps-remote sensing data

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Remote Sensing data

- EMS, spectral reflectance in geology, soils and vegetation
- Platforms (UAV, airborne, spaceborne)
- Active and passive systems
- Multitemporal remote sensing
- Multiscale remote sensing
- Examples- global-regional-local
- Basic image interpretation
- Basic digital image processing

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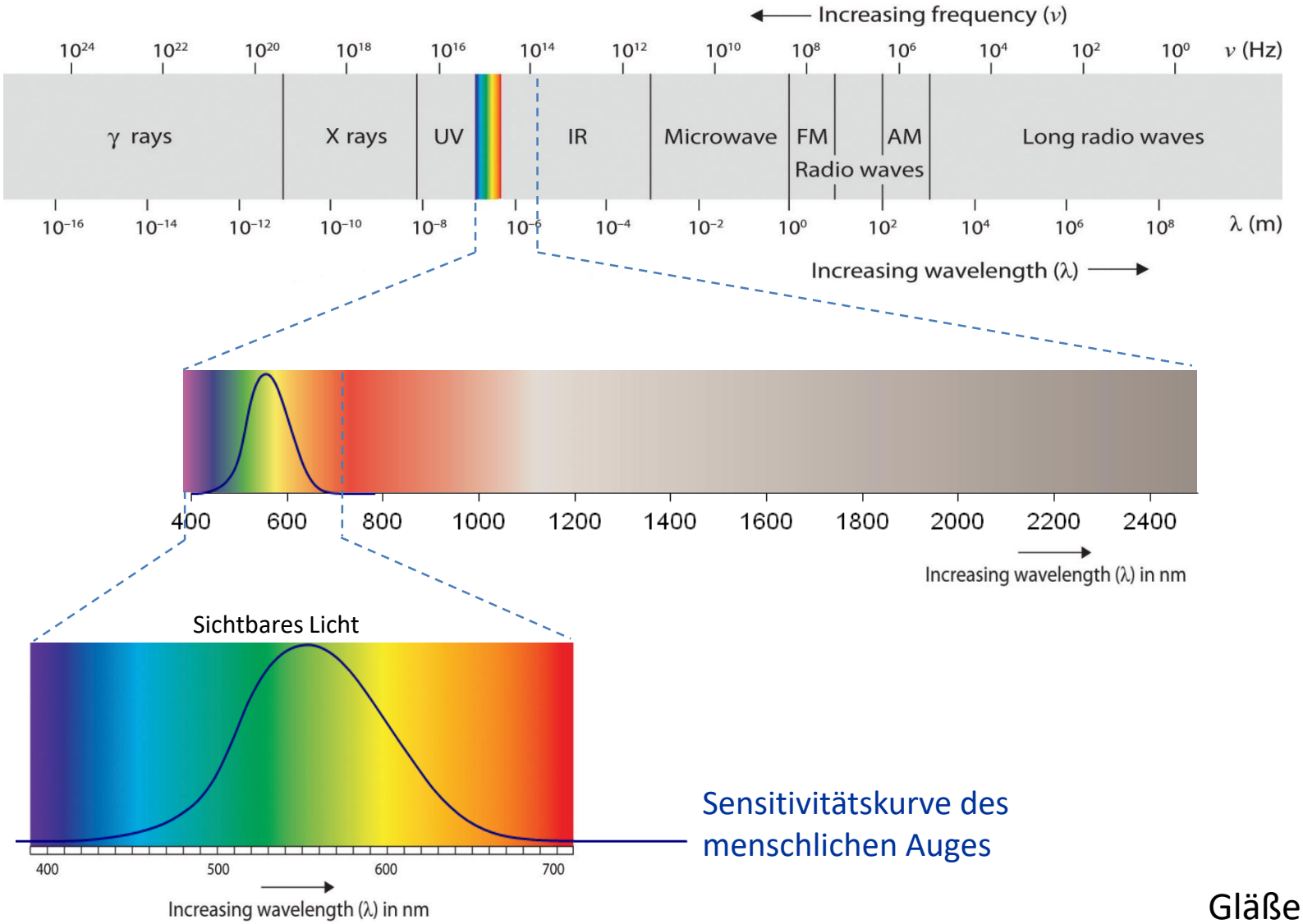
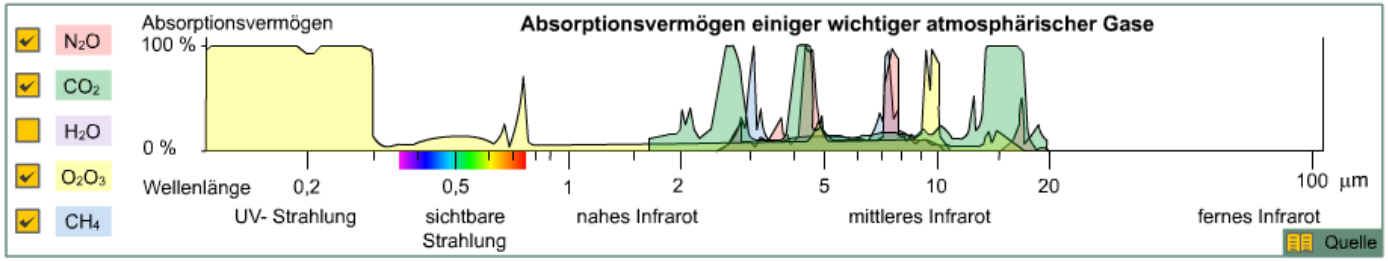
Elektromagnetic Spectrum



Sensitivitätskurve des menschlichen Auges

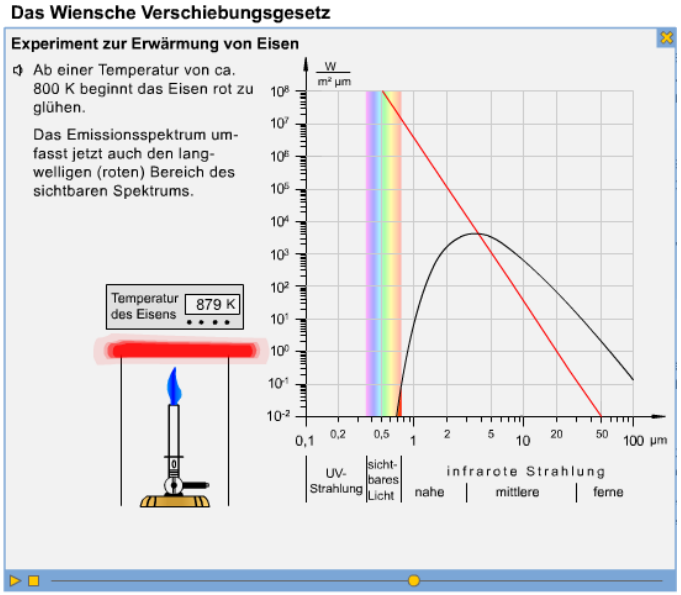
Gläßer, 2015

Atmospheric absorption → http://www.webgeo.de/r_002/



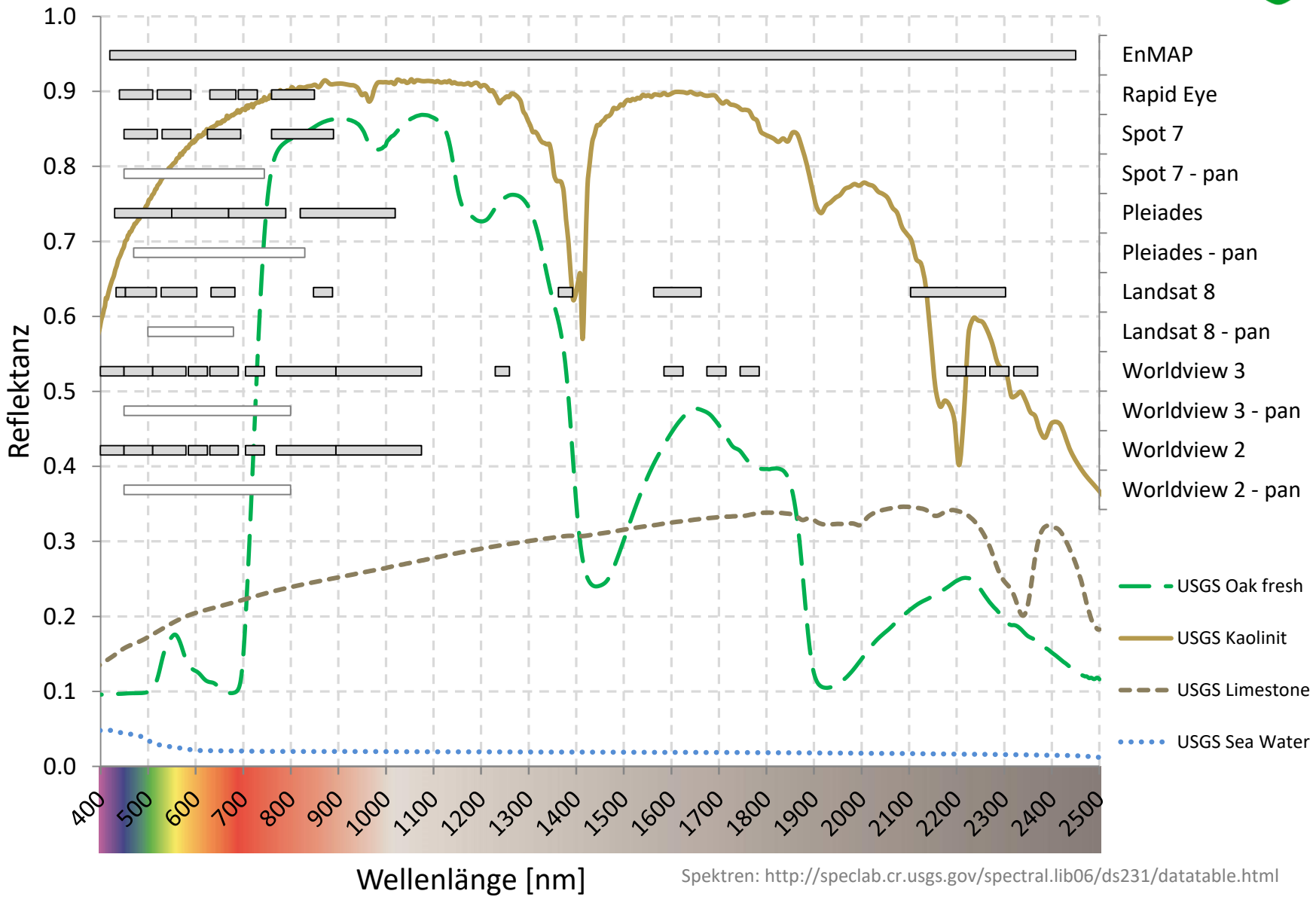
http://www.webgeo.de/r_002/

Wien´s displacement law → http://www.webgeo.de/k_304/



http://www.webgeo.de/k_304/

Remote Sensing Sensors and spectral reflectance



Spektren: http://speclab.cr.usgs.gov/spectral.lib06/ds231/datatable.html

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Ballon

http://kansan.com/media/2013/04/geology_jjakowatz21.jpg

Starrflügler

http://media.defenceindustrydaily.com/images/AIR_UAV_RQ-11_Raven_lg.jpg

Oktokopter

http://www.utas.edu.au/__data/assets/image/0003/276618/IMG_7323.jpg

Flugzeug

http://arsf.nerc.ac.uk/images/g-envr-image2.jpg, http://www.intergraph.com/global/de/assets/images/ILV-Flugzeug-3_Copyright_ILV-Fernerkundung-GmbH.jpg

Helikopter

http://blog.lidarnews.com/nasa-tests-lidar-2, http://radio.aalto.fi/en/research/space_technology/hutscat-mounted.jpg

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Basic knowledge

- Understanding of the technical princips of the sensors

- Understanding of resolution:
  - Spatial
  - Spectral
  - Temporal
  - Radiometric

Many students have problems in understanding relation:

Pixel sizes – landscape parameters- information in the images

Examples from one area in different pixel sizes

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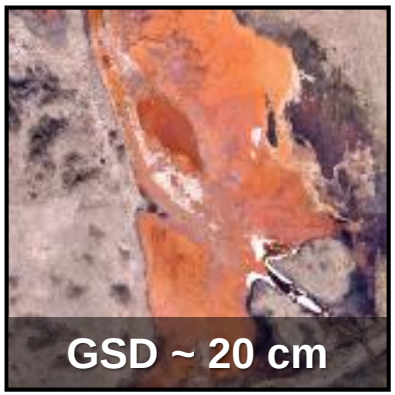
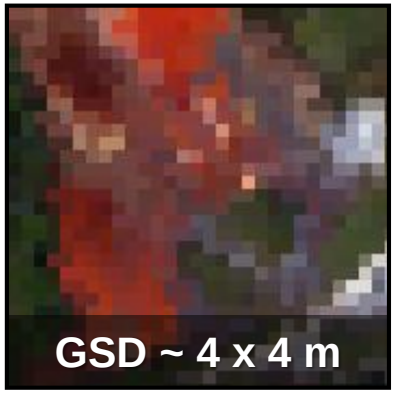
Issues of different geometric/spatial resolutions

high resolution aerial photograph



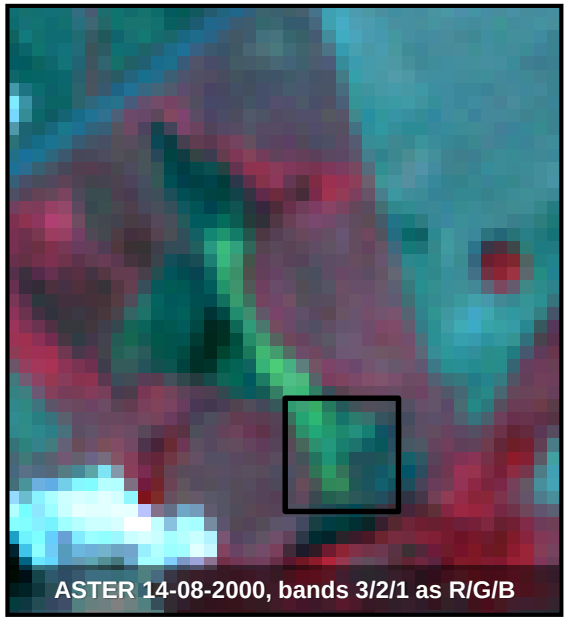
Digital airborne camera

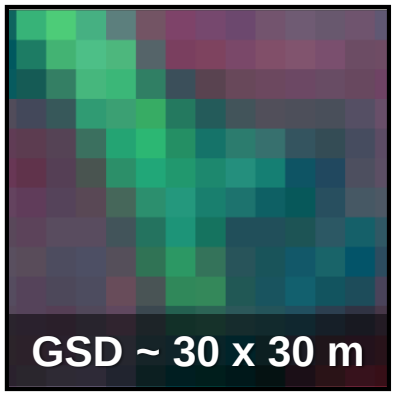
airborne hyperspectral scanner



Airborne HyMap data

spaceborne multispectral sensor





Satellite ASTER data

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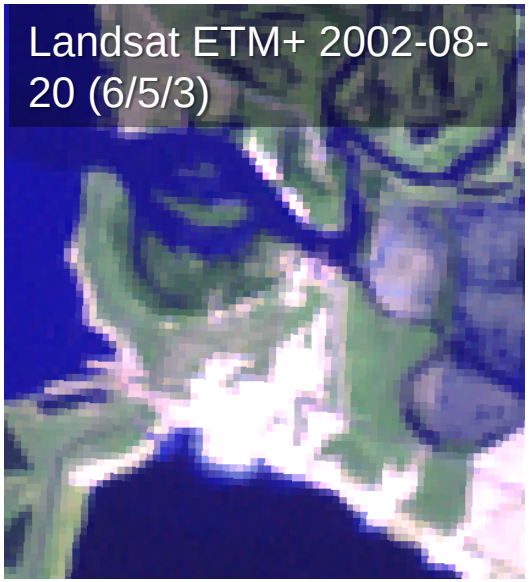
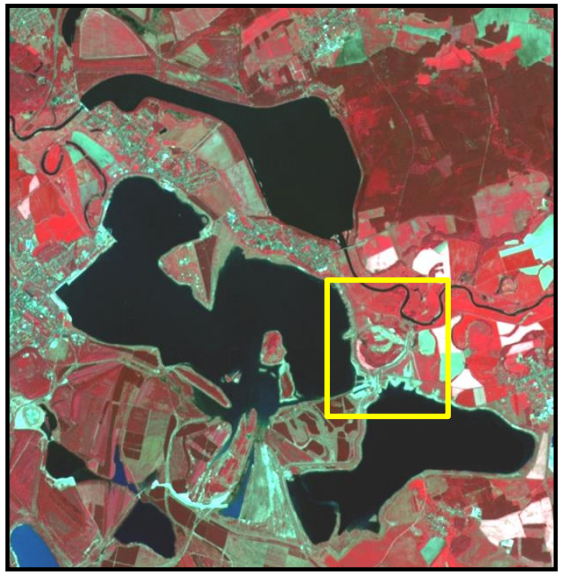
Spatial resolution of spaceborne remote sensing





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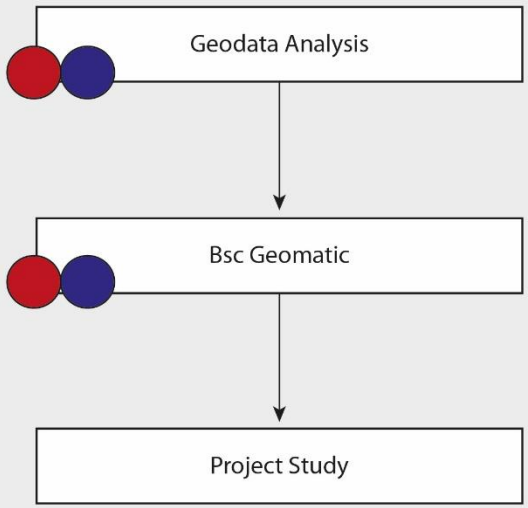
MARTIN-LUTHER-UNIVERSITÄT
HALLE-WITTENBERG

BSc Courses

basic knowledge



lectures exercises

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Geomatic

- Main content similiar to the geodata anayles
- Examples in one area to increase the understanding for:
  - Official geodata
    - Topographic data/ATKIS
    - Orthophotos (RGB, CIR)
    - DTM
    - Soil maps
    - Geological maps
    - CORINE/BTNT
  - Scales
  - Generalization
  - Geodata infrastructure
  - GIS

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Concept of the courses

- For all topics show examples world wide and in addition in **one site**
- The test site is very near to the university
- The small test site shows a large variety in the landscape parameters
- We do have a large varity of official govermental data and remote sensing data in different scales as well as free and commercial data

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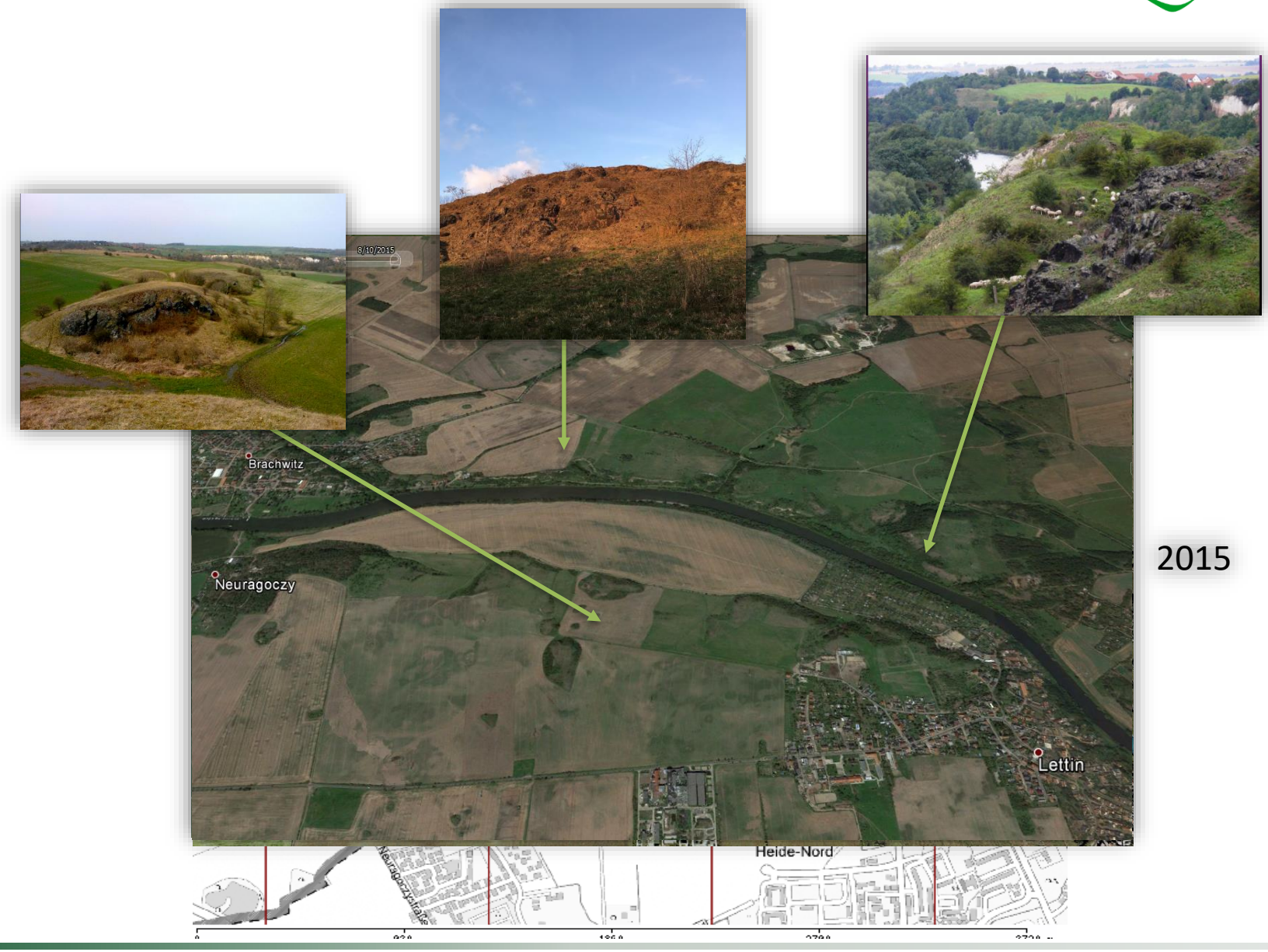
Area of investigation Brachwitz



Landscape impression

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ENVIPRO

Study area Brachwitz-Lettin

(Steinhardt et al. 2012 nach Löffler 2002b)

Geology
Soil
Water
Bios
Terrain
Climate
Land use

Spatial Thematic Data/ Landscape Compartments
[thematic maps]

Satellite imagery

RapidEye
Pleiades
Sentinel-2
SPOT-6

analog:
TK 10
TK 50

Spatial Base Data
[topographic maps]

digital:
AAA (AFIS, ATKIS, ALKIS)
INSPIRE
Open Street

Orthophotos

DOP 20 cm

Digital Elevation Model

DGM 1 m

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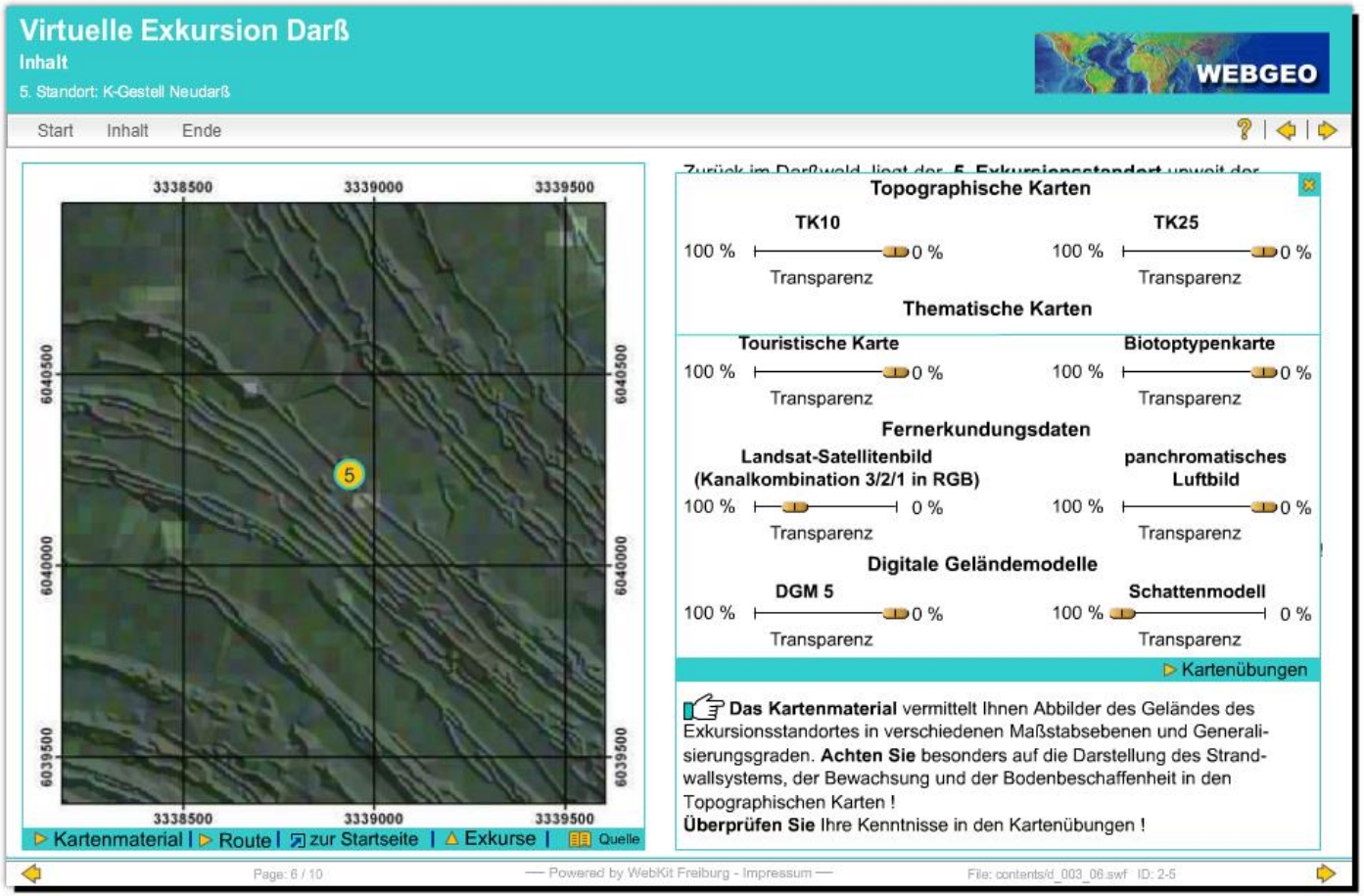
Virtual excoursion – Darß Peninsular (Germany)

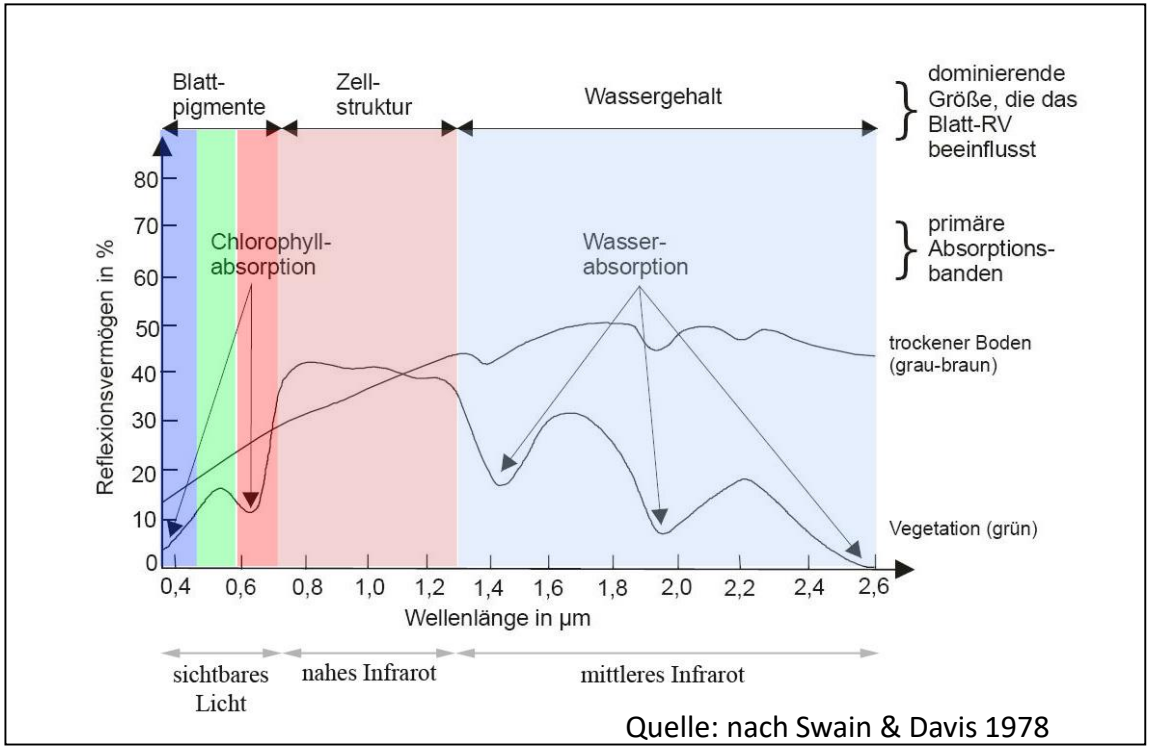
http://www.webgeo.de/d_003/



displaying a wide variety of geodata

Spectral Signature Vegetation Geodata Analyses

Das spektrale Verhalten grüner und vitaler Blattorgane kann in drei typische Bereiche differenziert werden:

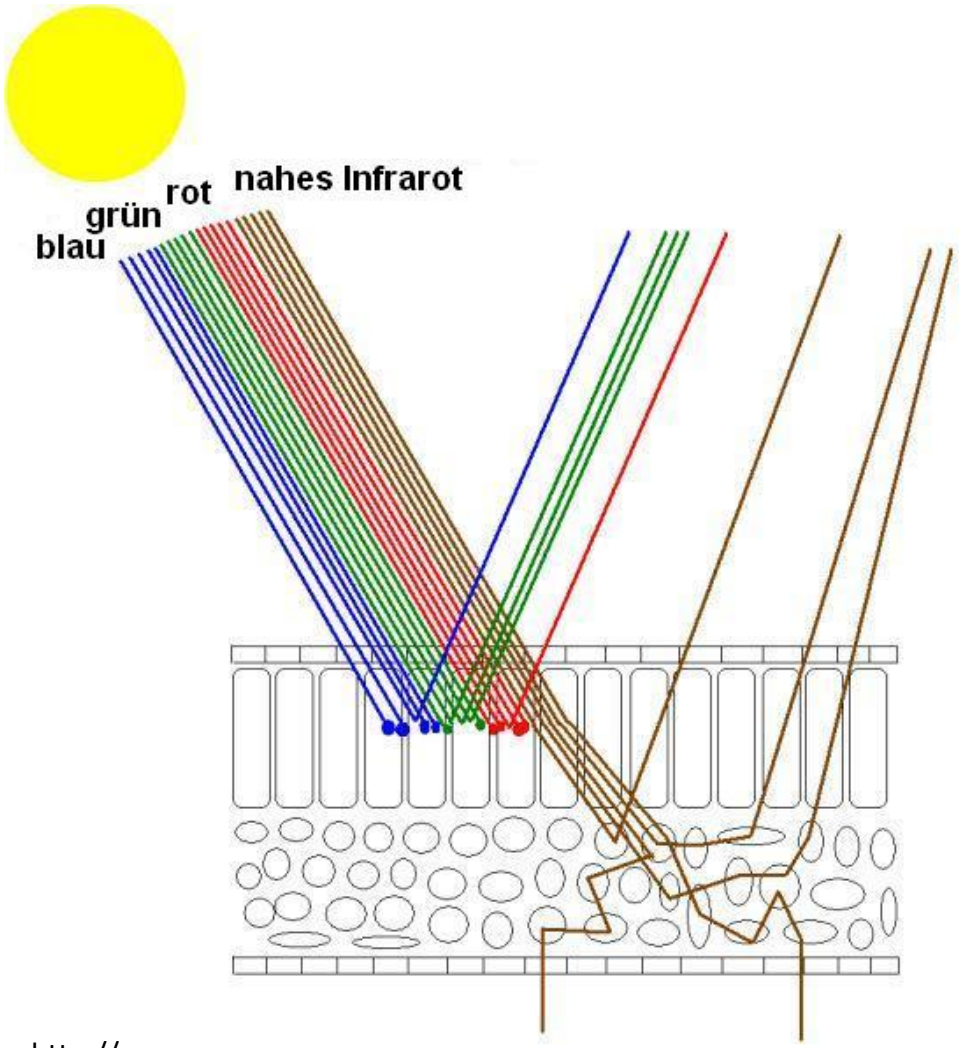


Quelle: nach Swain & Davis 1978

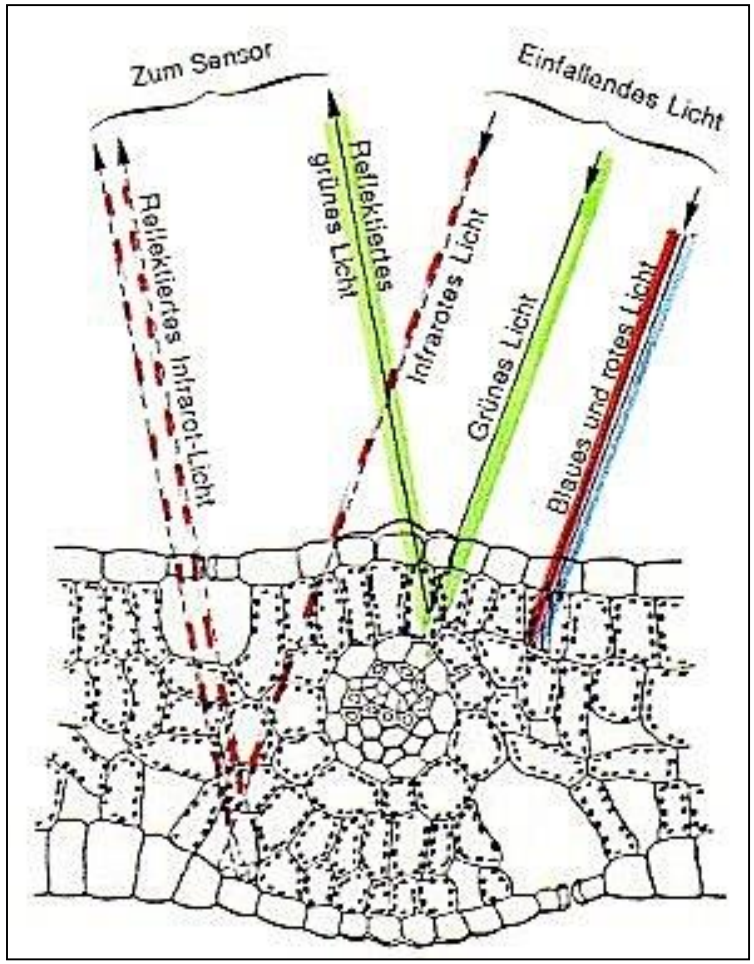
- 0,4-0,7 µm (Absorption der Blattpigmente im Bereich des sichtbaren Lichtes)
- 0,7-1,3 µm (interne Streuung und Brechung der Zell- und Gewebestrukturen)
- 1,3-2,5 µm (Absorption von Wasser im Blattgewebe)

Spectral Signature Vegetation Geodata Analyses

Strahlungsweg durch das Blatt



http://www.seos-project.eu/modules/agriculture/images/leaf_structure_large-de.jpg



Schematische Darstellung vom einfallenden Licht durch das Blatt nach Wellenlängenbereichen
Quelle: satgeo.zum.de

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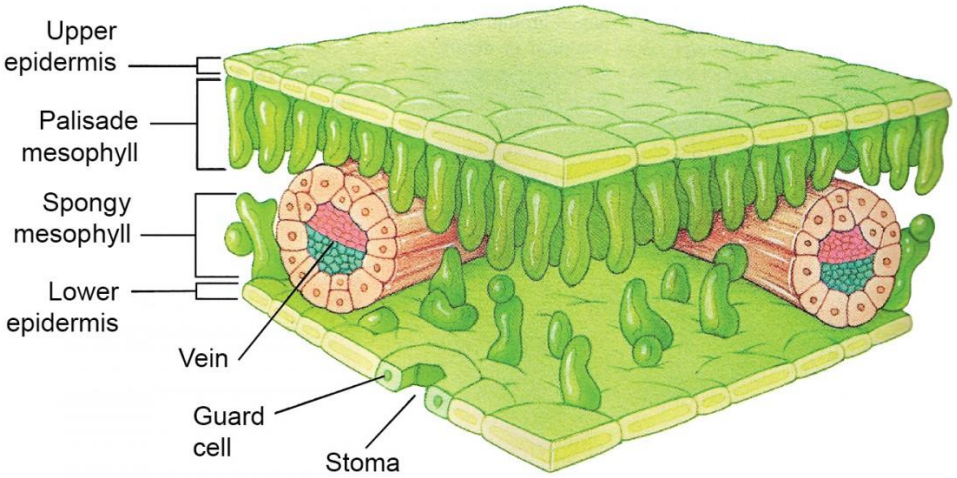
Spectral Signature Vegetation Geomatic

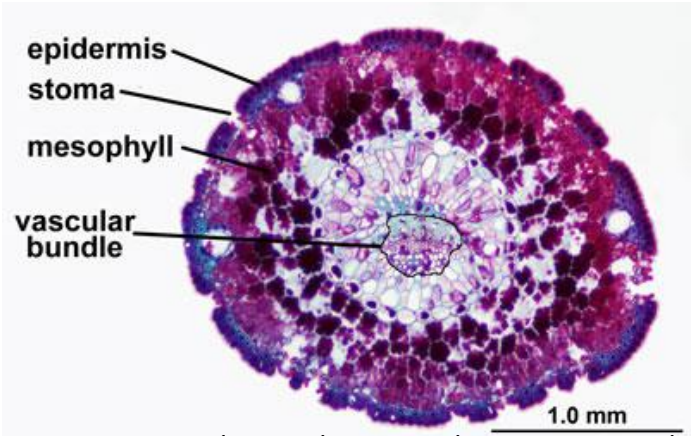
Blattstruktur

Dorsiventrale Struktur (meist zweikeimblättrige P.)
- bifazial (eine Symmetrieachse) aufgebaut
- Schwamm- und Pallisadenparenchym sind getrennt



https://online.science.psu.edu/sites/default/files/biol011/Fig-9-15-Leaf-Strucutre.jpg

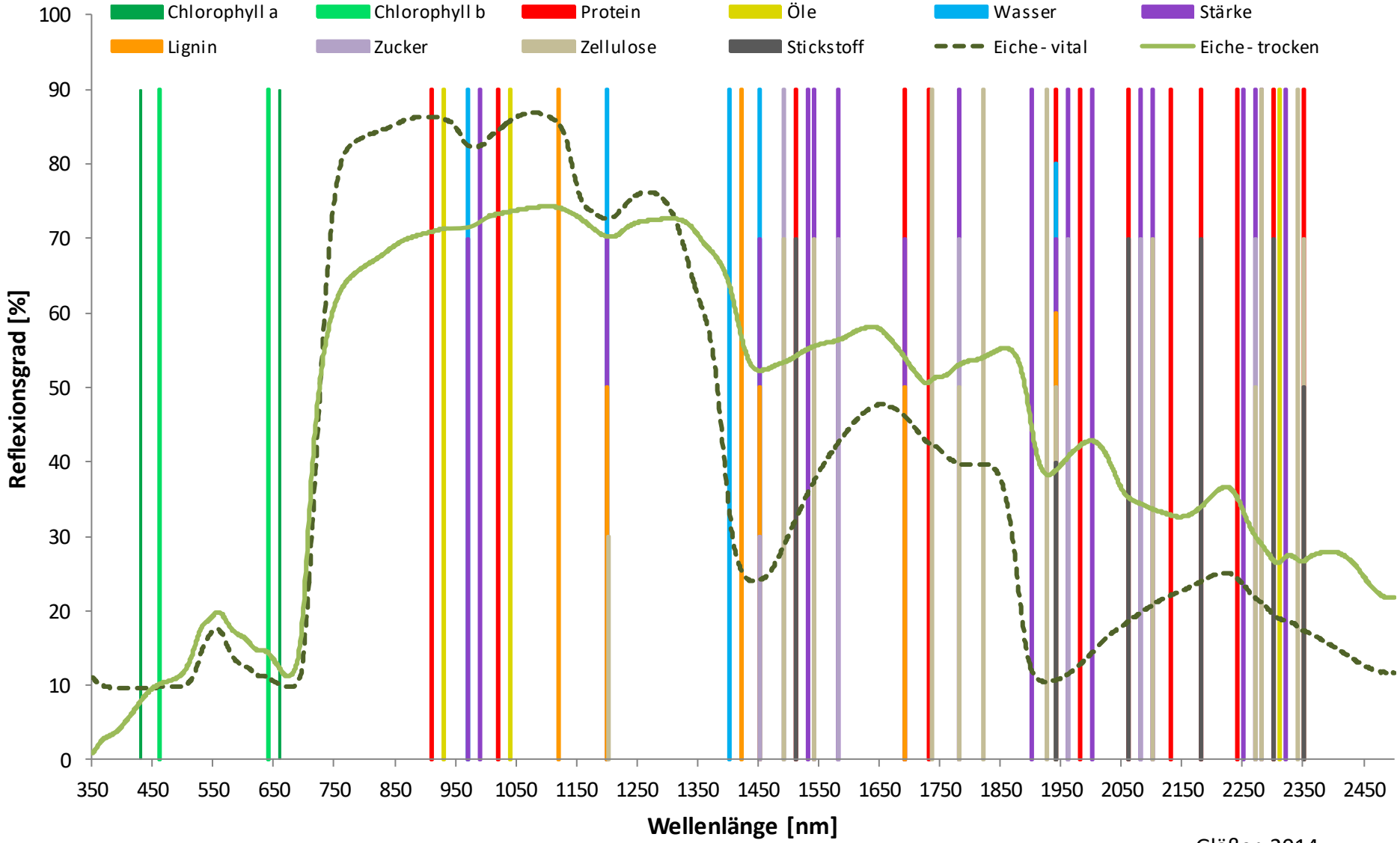
Kompakte Struktur (meist einkeimblättrige P.)
- Äquifazial („gleiche“ Ober- und Unterseite) aufgebaut
- Schwamm- und Pallisadenparenchym sind nicht deutlich getrennt
- Nadelblätter, Mais



Blattaufbau vom Laub- und Nadelblatt
Quelle: www.storm.uni.edu

http://www.deanza.edu/faculty/mccauley/6a_site_images/plants-images/pinus-1needle-b-400.jpg

Advanced information in Master: detailed spectral features, related to hyperspectral data



Gläßer, 2014

Digital data and education versus basic understanding

Increasing understanding landsacpe - statial models

- Seeing
- Discovering
- Observing
- Analysing
- Interpreation

Practical exercices:

- Pixelsizes - Landscape components
- Orientation with different coordinate systems
- Morphology
- Landuse types
- Estimation and measering, like horizontal distances, inclination, curvatore

- Example: Isohypses from maps - profile versus DTM, Lasersannerdata
- Demonstration of field equipement for gound measurements
  - GNSS
  - LAI
  - Spectrometer

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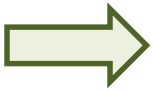
- Teamwork, 10 – 15 students, 2 semester
- Thematic Topic with enhanced application in RS and GIS

Examples from the last years:

- Shrinking Dead Sea, Isarel
- Extrem Flood Events at Elbe Riover: 2002, 2006,2010, 2013
- Water tourism concept at the Saale river
- Invasive Species in the Town Forest DölauerHeide
- Salty Cotton - Buchara Oases, Usbekistan



„ Geography in the trust sense of the science“

E- Assessement

Why?

- 200 students, very limited staff
- New technical approachs
- Long term experiences in E-learning
- In the beginning time consuming, later on time saving
- Pool of questions

How?

- Up to 5 PC Pools in two houses parrallel
- Support by LLZ
- Electronic test must be named in the examination rules

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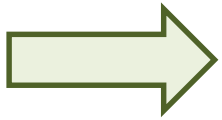
Bsc in Geography

- Students from Halle University
- Students with knowledges on cartography and GIS and very few remote sensing
- Students with enhanced knowledegs in RS and GIS

Students from other Bsc

- Forestry
- Agriculture
- Spatial Planning
- Geology
- Regional sciences
- Social and Economical Sciences



- Large variety and amount in education in GIS and RS
- Variation from „only statistics“ upt to advanced GIS and digital image processing

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- all students in MSc Geography have to start with 4 basic courses
- one course in each department
- no staff capacity to integrate students n Bsc courses – „ Bridging Courses“

In relation to the large variety of the students we developed a new integrated teaching approach between lectures and self study concept

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