Community of Practice (CoP)-Meeting

Basel, April 25, 2012

GEOURBAN

The potential of EO to support urban planning in Basel

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EO Data for Urban/Regional Planning Authorities – a useful option !?!

RESEARCH

- EO Data and know-ledge for/from state-of-the-art research
- Individual scientific expertise
- Advanced numerical modelling
- Satellite data ana-lysis and digital image analysis
- GIS-technologies

Need for a „data-information conversion module“

APPLICATION

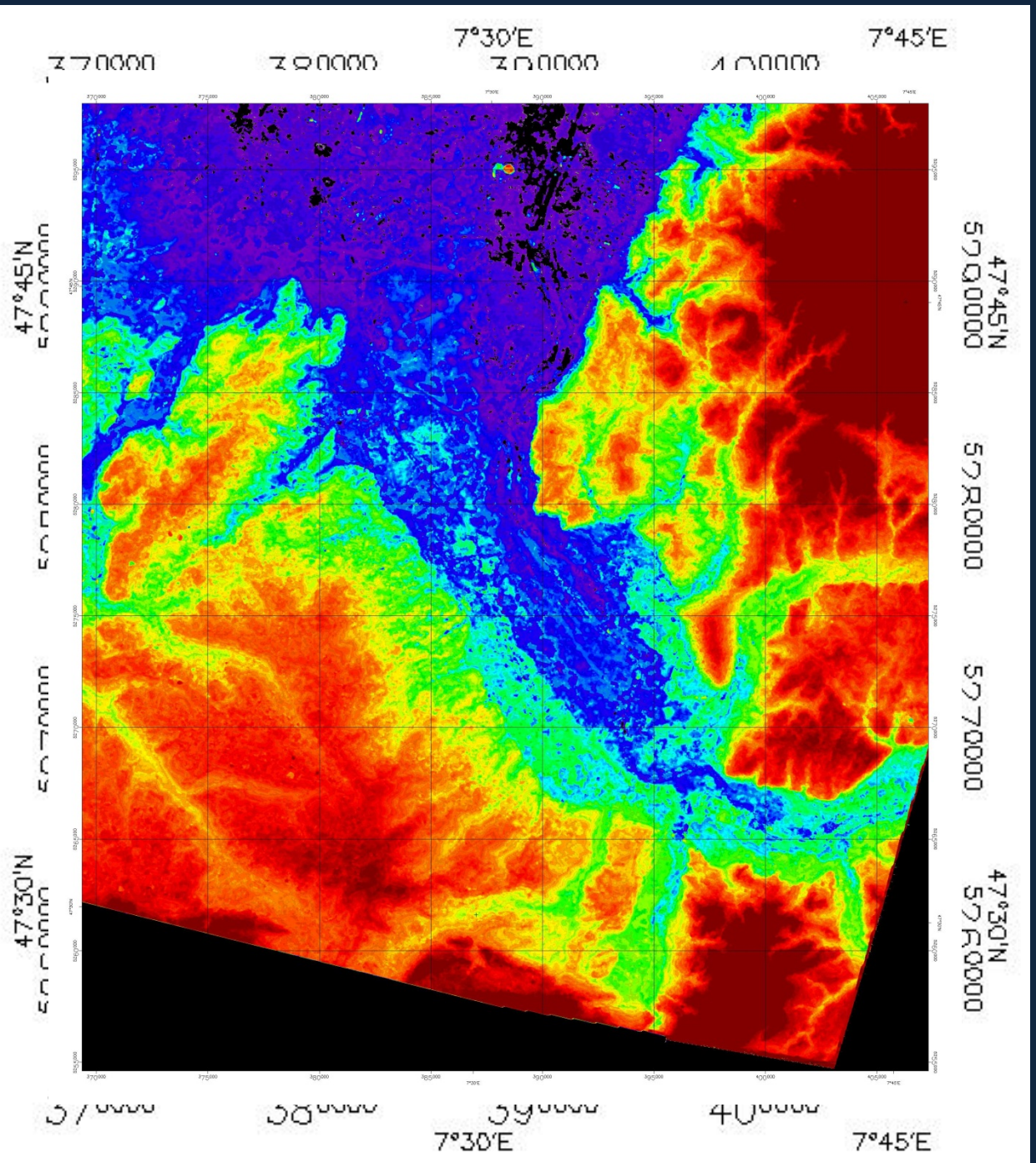
- Information for planners/end-users/politicians
- Data translated into end-user‘s language
- Aggregated in-formation for end-user‘s needs
- Compatability to user‘s computer environment

Special Requirements for the Basel Test Area

- Location at the borders to France and Germany
- Cross-border planning activities
- Different statistical basis data within three countries
- Different geodetic systems in CH, F, FRG
- Two cantonal governments
- Need for data which are
  - homogeneous in the spatial domain
  - homogeneous in the temporal domain
  - available in high/very high resolution
  - spatially distributed
  - easy to be updated
  - compatible with end-users IT infrastructure and software
  - …. to be extended

Which EO data can be of interest

- Digital terrain data
- 3D surface models of building structures from LIDAR data
- VHR resolution data
  - Problem: the better the pixel resolution the smaller is the area covered by remotely sensed data
  - Spatial homogeneity is not guaranteed
- Data integration is dependent from regional or local scale of interest
- Change detection of land cover/land use
- Weather dependency for optical data might be problematic
- Radar data offer data availability at any weather conditions
- Availability of data in the future



DTM computed from SRTM Radar data with 90 m resolution

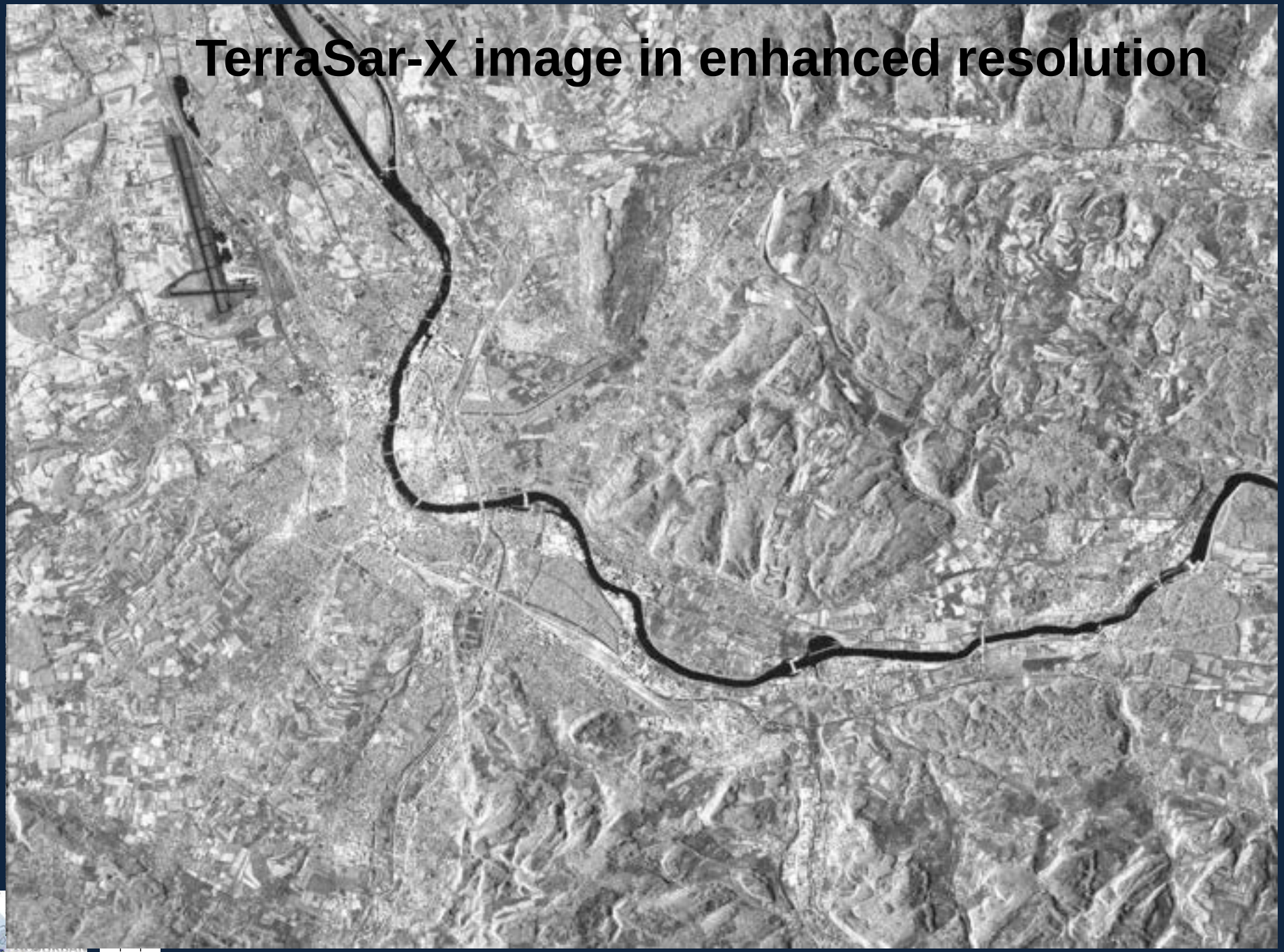
DTM computed from ASTER Stereo data with 15 m resolution

IRS Basel : pan-sharpened image with lots of artefacts due to data resampling

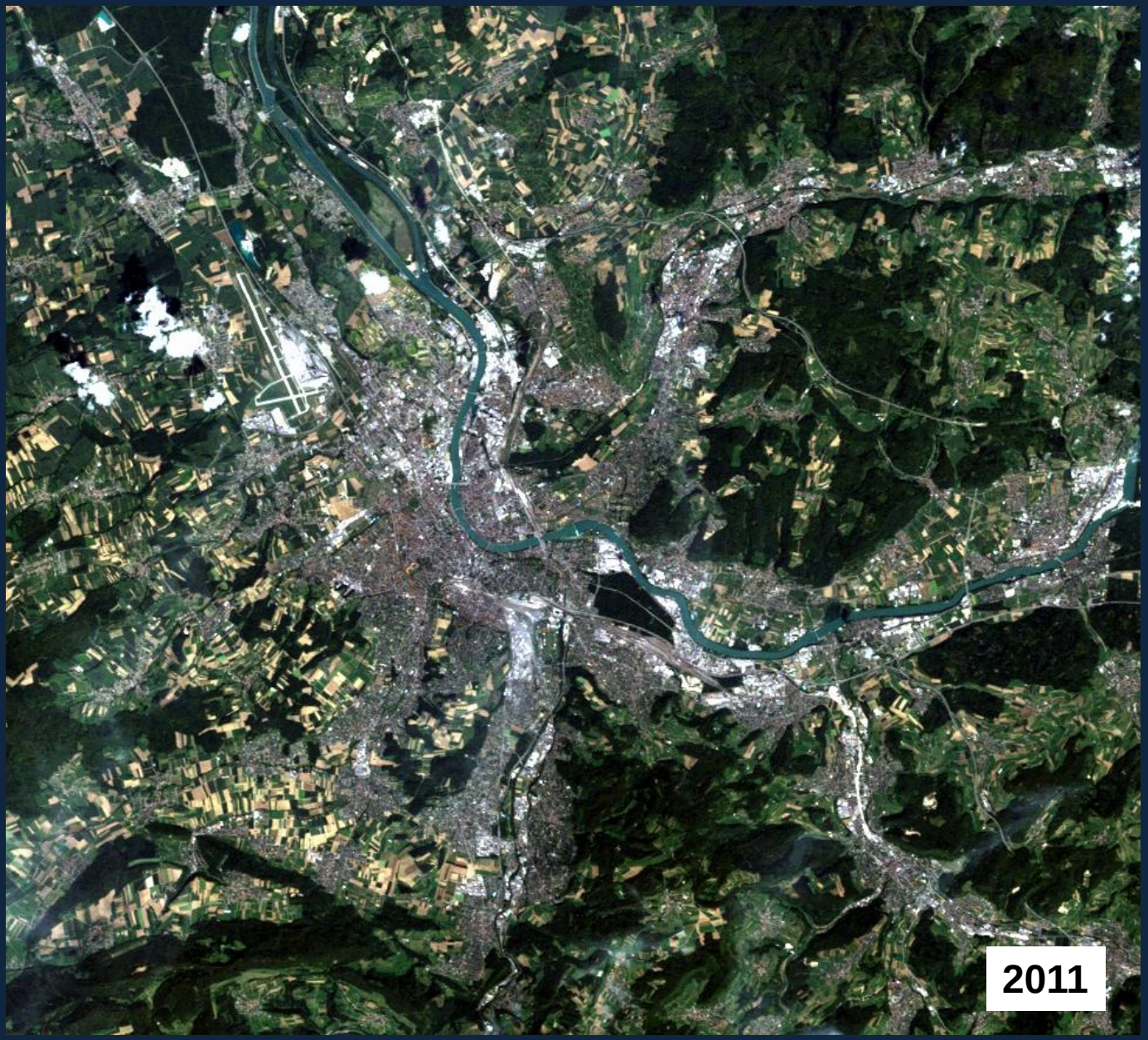

Basel Quickbird : 2.4 m pixel resolution

QUICKBIRD – the same scene in 60 cm full resolution

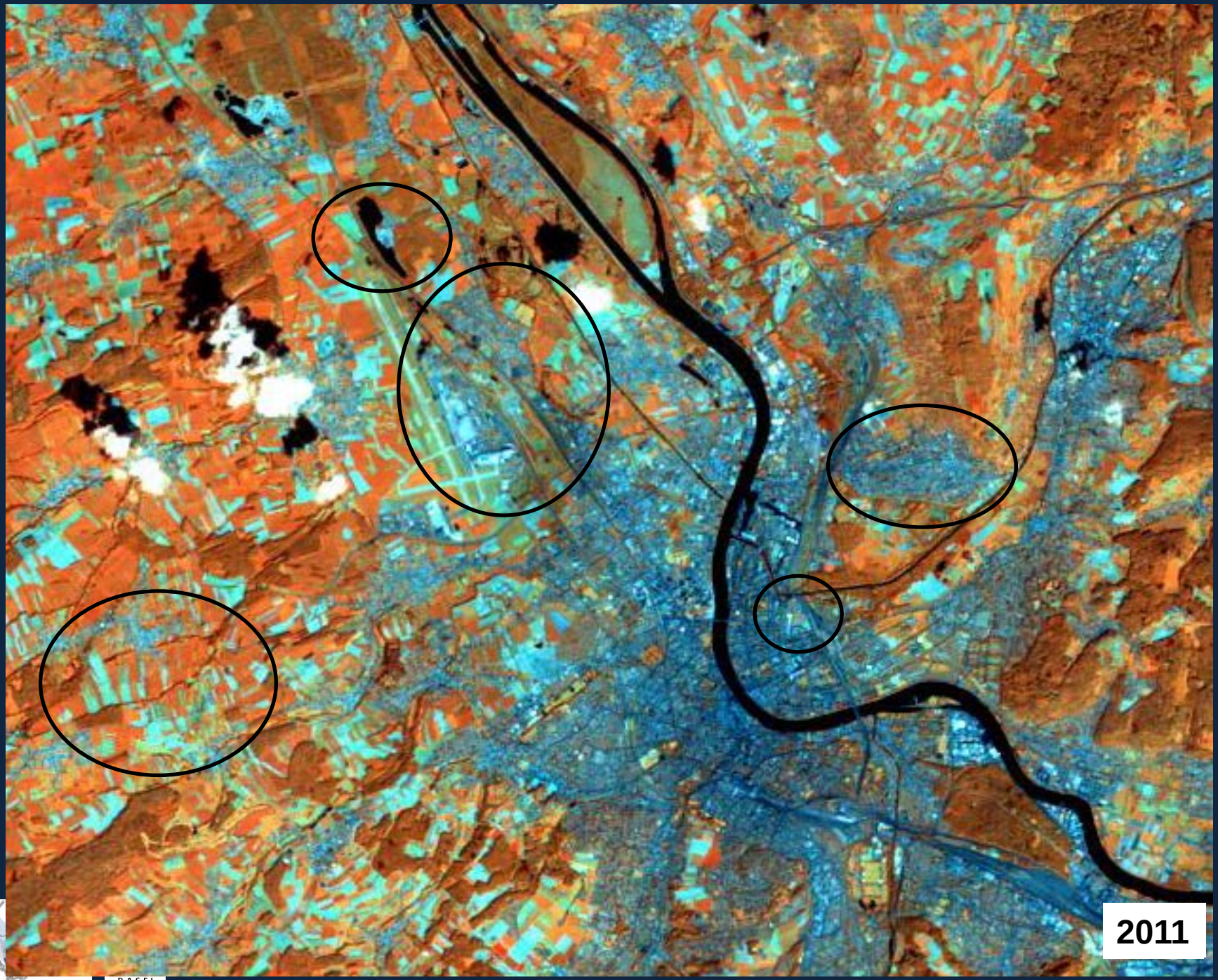
TerraSar-X image in enhanced resolution



UNI BASEL



Changes of land cover between 1984 and 2011 seen from Landsat imagery (True color image, ch 3-2-1)


2011

APEX (Airborne Prism Experiment) hyperspectral sensor – technical specifications

Type
- pushbroom (along track) scanner

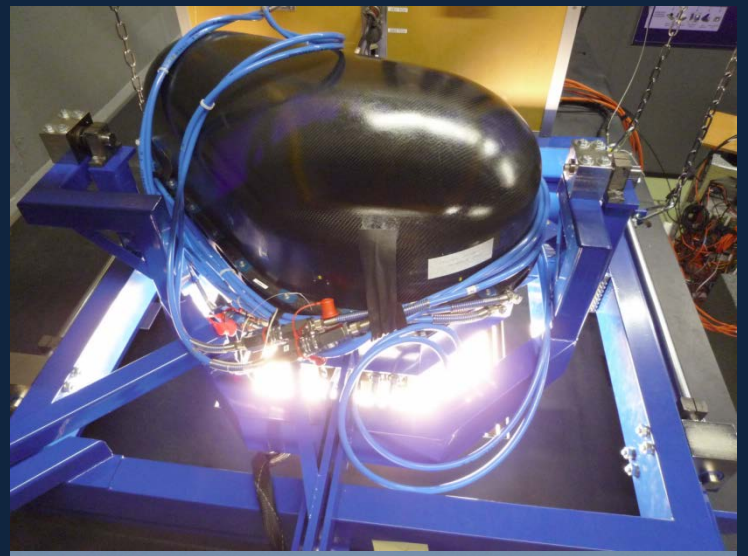
Spectral Range
- VNIR 380 – 970 nm
- SWIR 940 – 2500 nm

Spectral Channels
- up to 534 channels (dep. on binning patterns)
- 220 bands in this study

Spatial Pixels
- 1000, IFOV 0.028°
- ~ 1.6 m width in this study

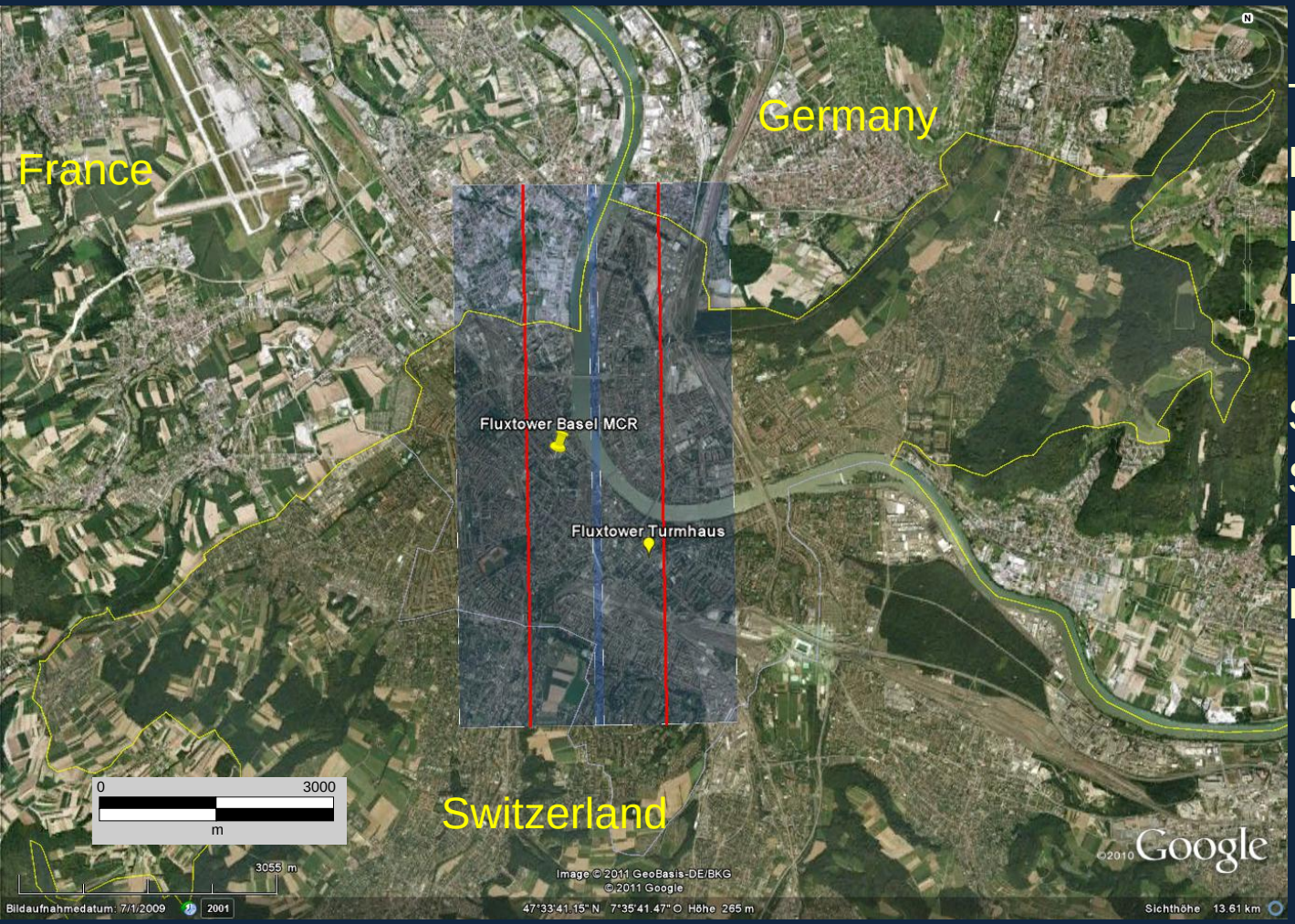
Spectral Sampling Interval
- Between 0.5 nm and 15 nm

Spectral Resolution
- Between 0.6 nm and 18 nm



Mounted on a Dornier Do228
operated by DLR Oberpfaffenhofen

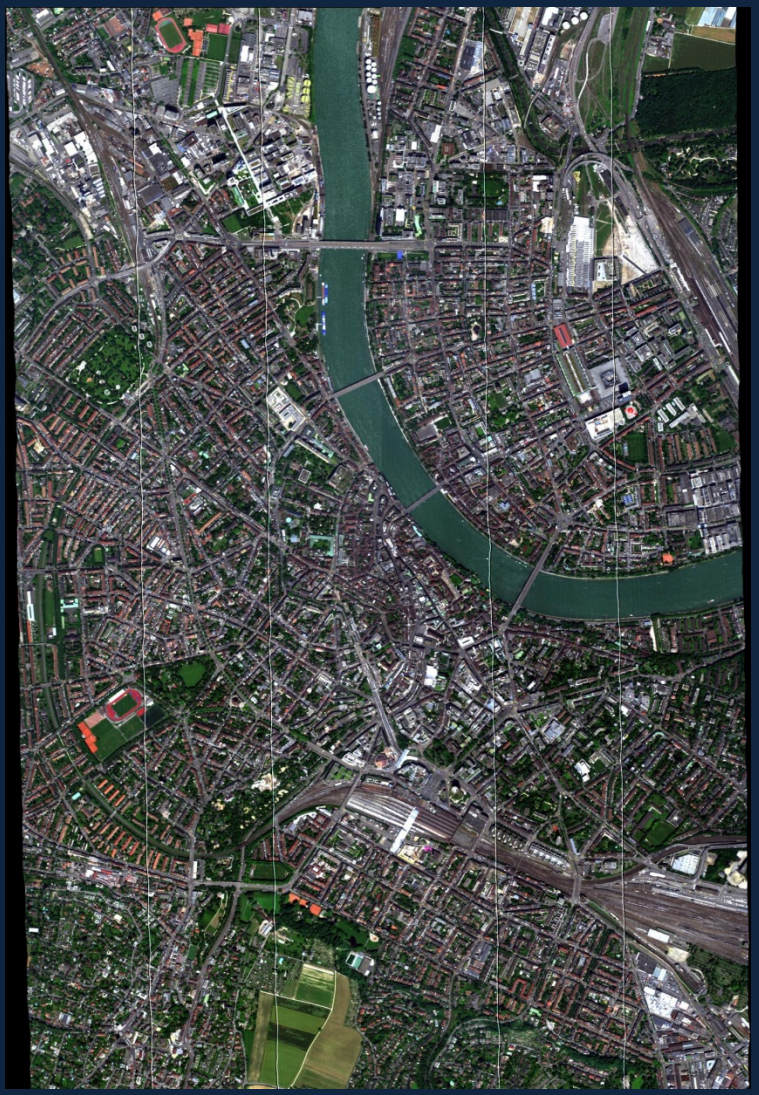
APEX flight campaign 2010 Basel



Two flight lines N-S
Height a.s.l. 3700 m
Height a.g.l. ~ 3430 m
DOY 177 (June 26)
Time UTC 11:15
Solar elevation 66°
Solar azimuth 172°
Pixel size: ~ 1.6 m
FOV = 28°

APEX spectral reflectance images

(atmosphere-corrected, georeferenced, mosaicked and adapted to DEM resolution)



←

true color

R: 641 nm

G: 552 nm

B: 461 nm

spatial resolution:

pixel size: 1x1 m^2

3300 x 5000 m^2

spectral resolution:

220 bands

400 .. 2438 nm

→

CIR

R: 860 nm

G: 650 nm

B: 552 nm

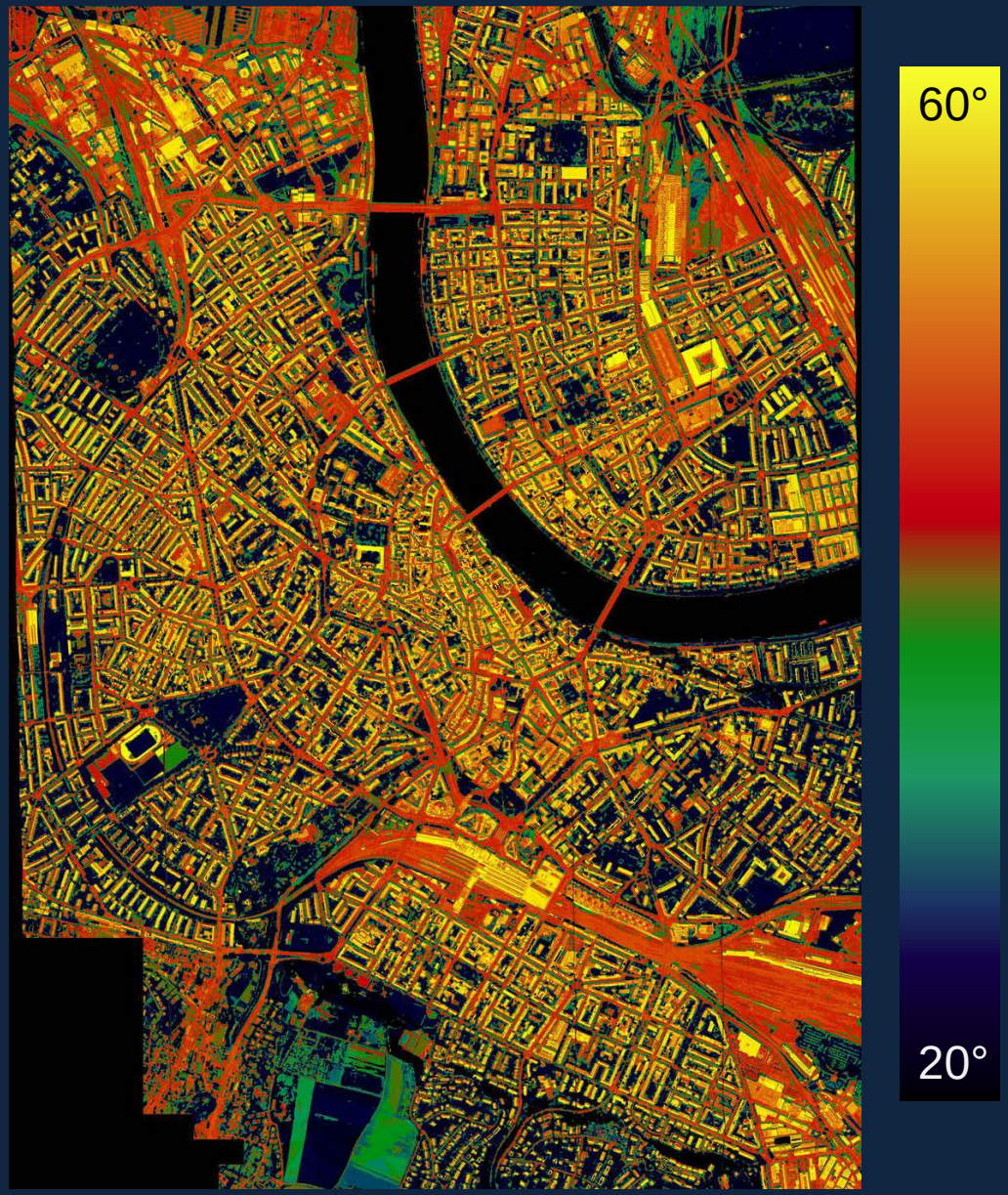
Infratec VarioCam® flight track 2009 (helicopter borne)

12 flight lines N-S
Height a.g.l. ~ 800 m
DOY 182 (July 1st)
Time UTC 12:23
Solar elevation 62.3°
Solar azimuth 208°

1 Hz frequency
~ 3000 pictures
320 x 240 pixels
Pixel size: ~ 1.6 m
spectral range
7.5..14 μm

Infratec VarioCam® derived surface temperatures

(mosaicked, georeferenced, adapted to DEM resolution)



spatial resolution:

1 x 1 m^2

3300 x 5000 m^2

spectral resolution:

1 band

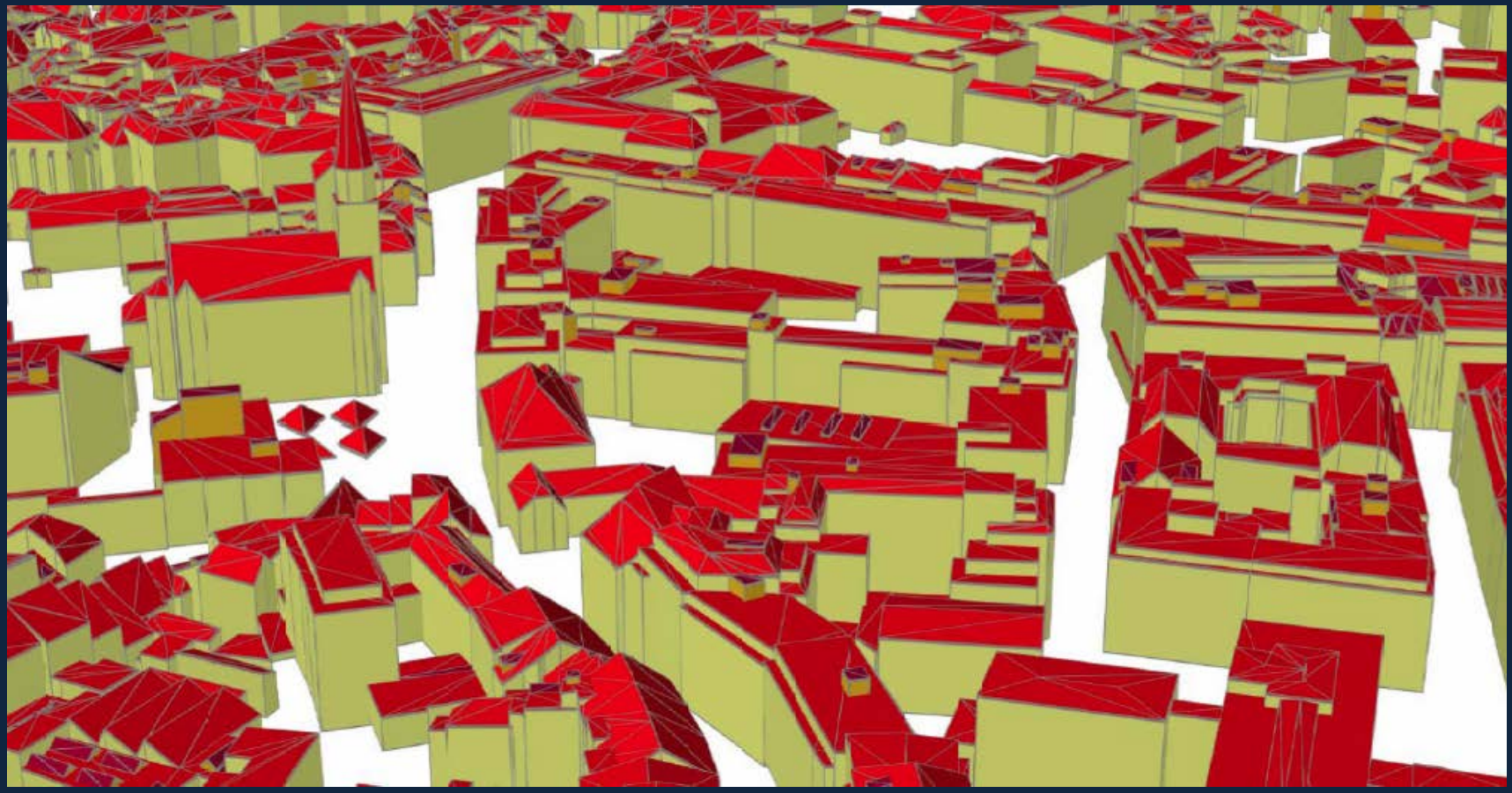
spectral range

7.5..14 μm

3D high resolution building model

(vector model, rasterized to 1 x 1 m^2 resolution)

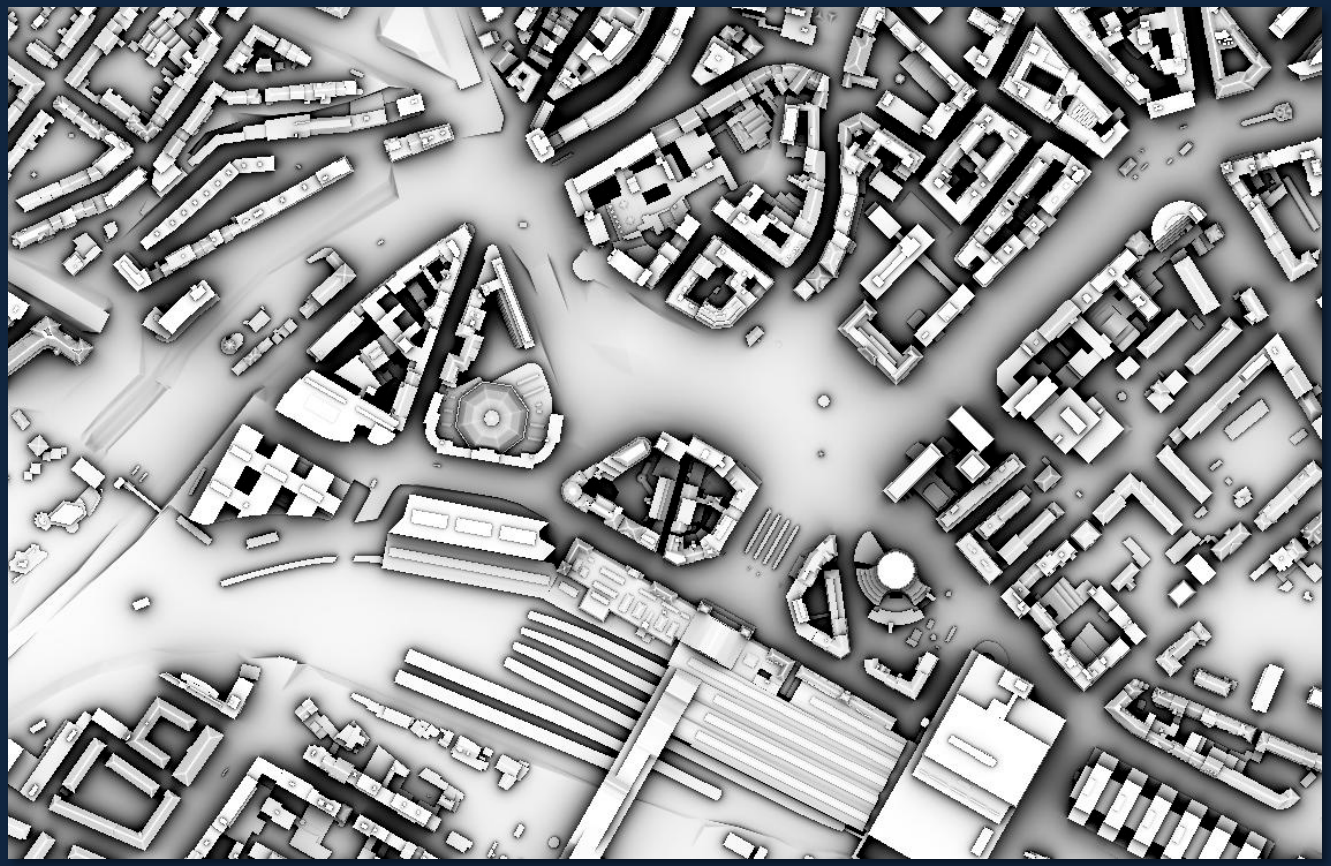
- geometry (height, slope, aspect)
  → horizon, skyview factor, illumination angles



3D high resolution building model

(vector model, rasterized to 1 x 1 m^2 resolution)

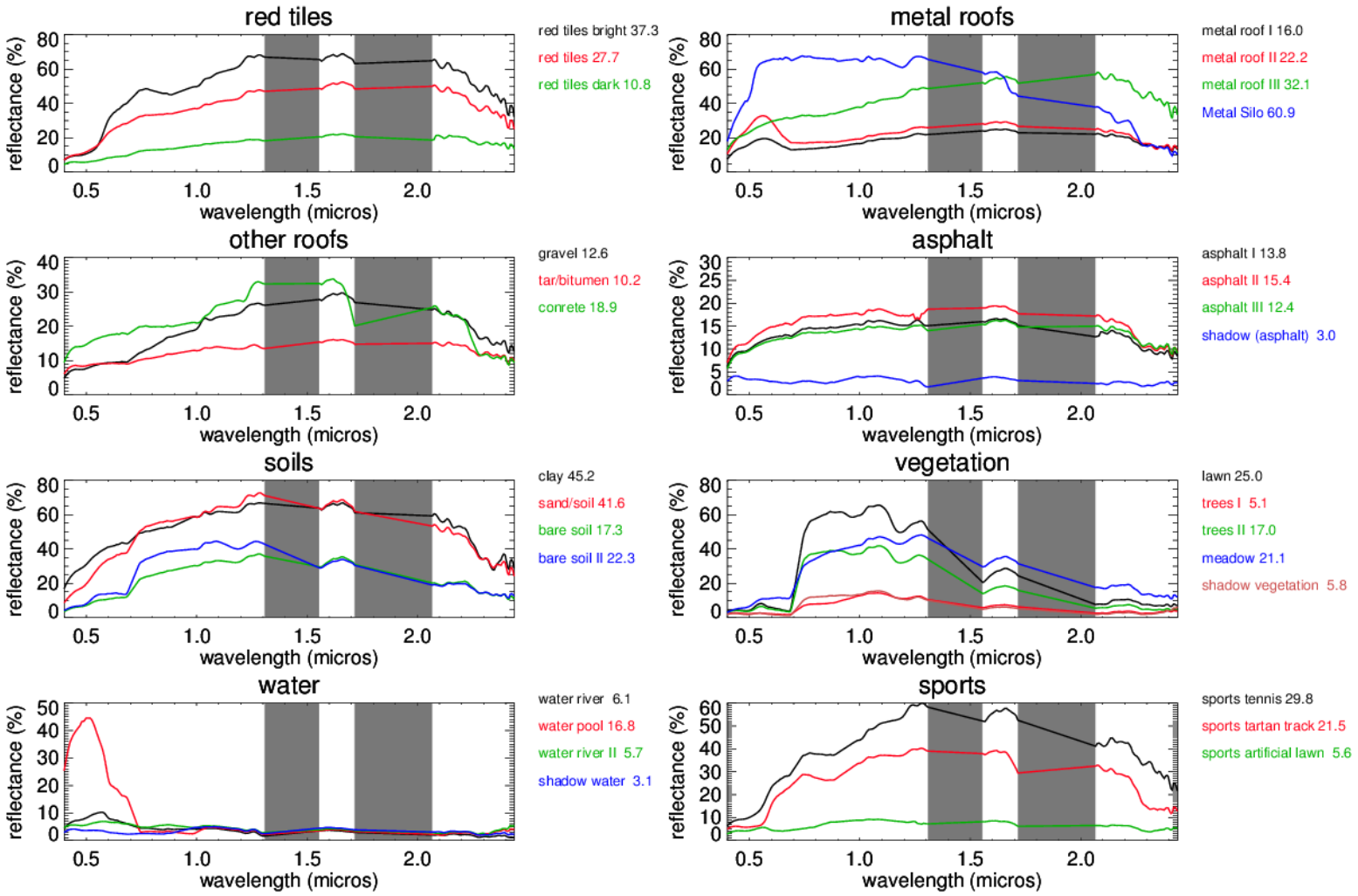
- geometry (height, slope, aspect)
  → horizon, skyview factor, illumination angles for overflights



Imaging spectroscopy in urban environments

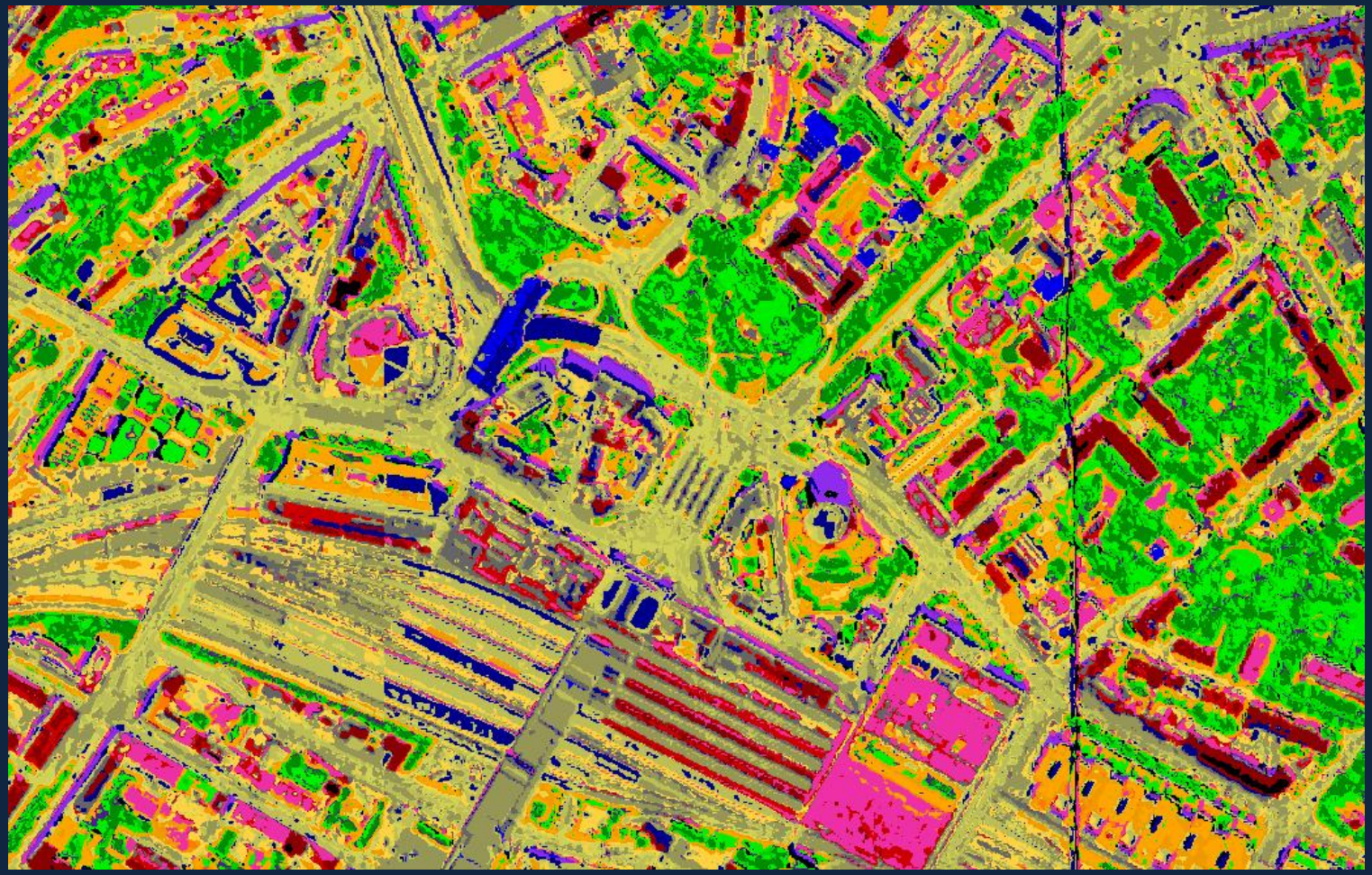
- algorithm development (APEX)
  - algorithm for urban material classification
    SAM (spectral angle mapper) implied in ENVI
  - algorithm for broadband albedo
- products (APEX)
  - High resolution urban albedo map
  - High resolution urban surface materials map
  - LUT urban surface materials/material properties
    (albedo, emissivity, heat conductivity/capacity)
- not directly APEX related
  - Derivation of net radiation and heat fluxes

Surface material classification
spectral curves of urban surface material



result of surface material classification

(spectral angle mapper (SAM) and spectral endmembers)



bright tiles	metal I	asphalt I	lawn/meadow	clay	gravel
red tiles	metal II	asphalt II	trees I	sandy soil	tar
dark red tiles	metal III	asphalt III	trees II	bare soil	concrete

broadband albedo

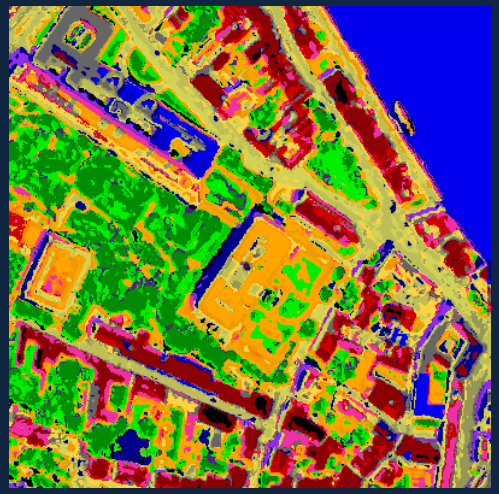
0..70 %

0..70 %

Products from hyperspectral data, IR camera overflight and 3D surface/building model

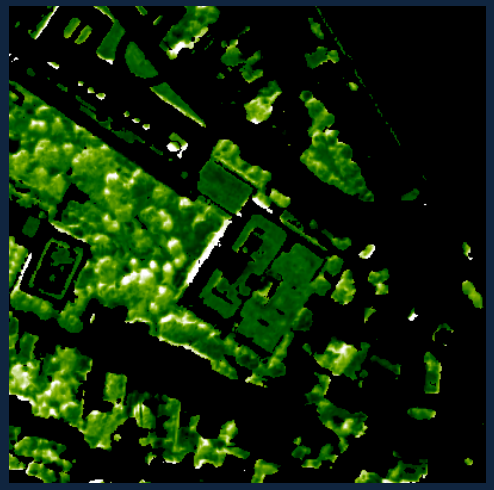
(spatial subsets, resolution 1x1 m^2)

surface material classification



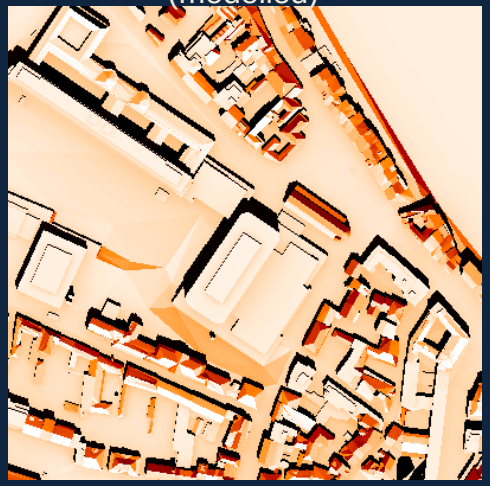
broadband albedo

vegetation indices



skyview factor

shortwave downward radiation (modelled)



Surface brightness temperatures