NSGI

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Topology preservation when visualising geo-data in ETRS89

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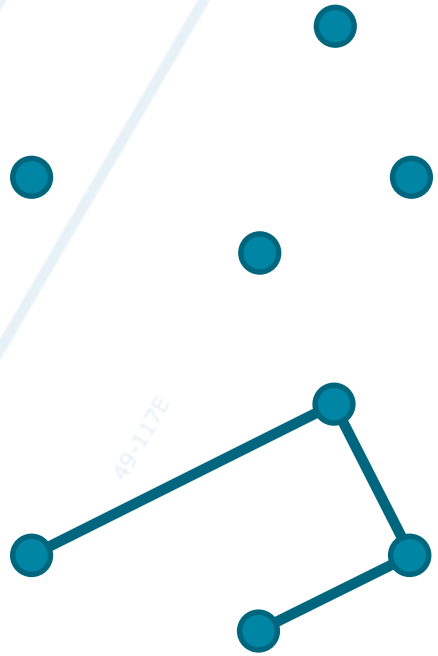
Introduction

EUREF topics

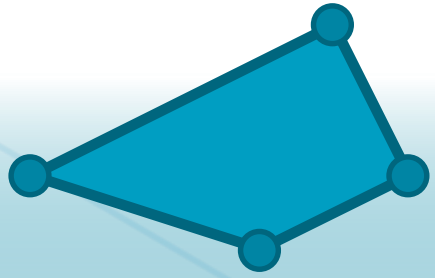
- EPN stations and GNSS data
- ITRS – ETRS89 transformation

with sub-centimetre accuracy for **points**



Side topic

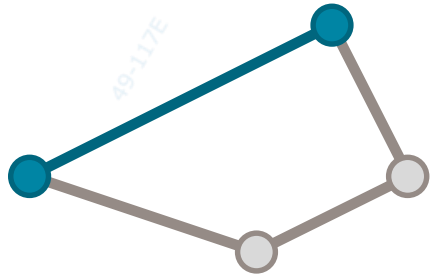
- How about **line strings & polygons** in geo-data?



Visualising line strings & polygons in geo-data

Line segments are mapped as **straight lines**

Always requires a map projection*

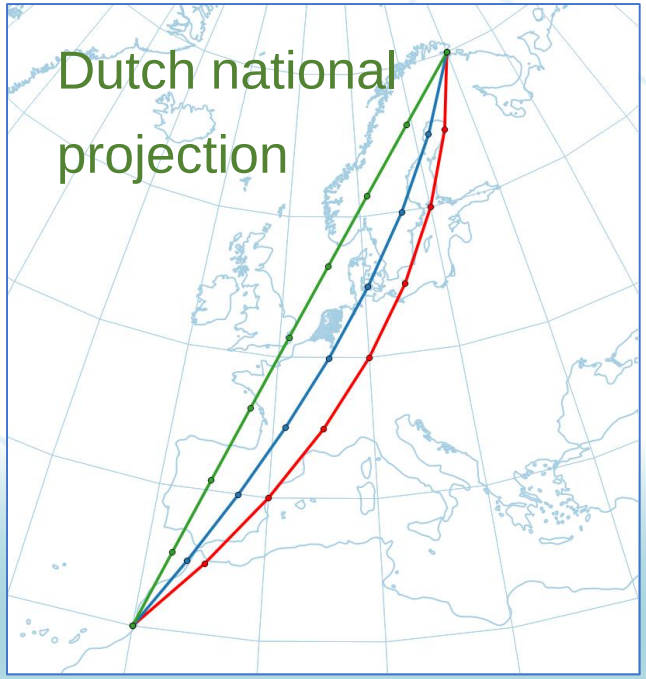


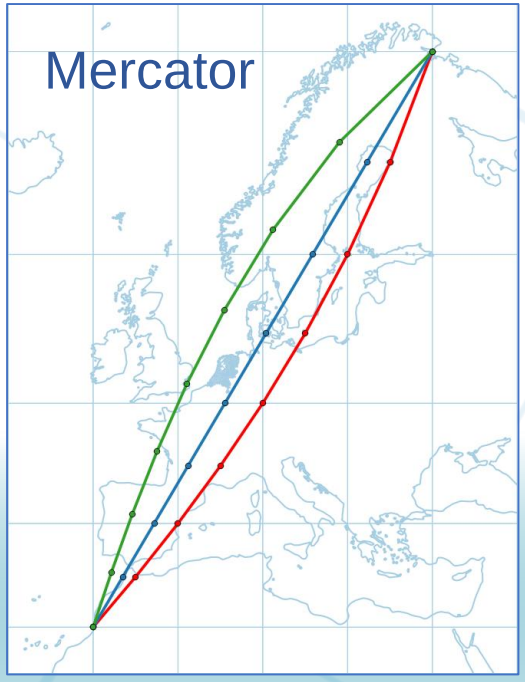
** unless visualised as globe, i.e. an POV adaptive projection*

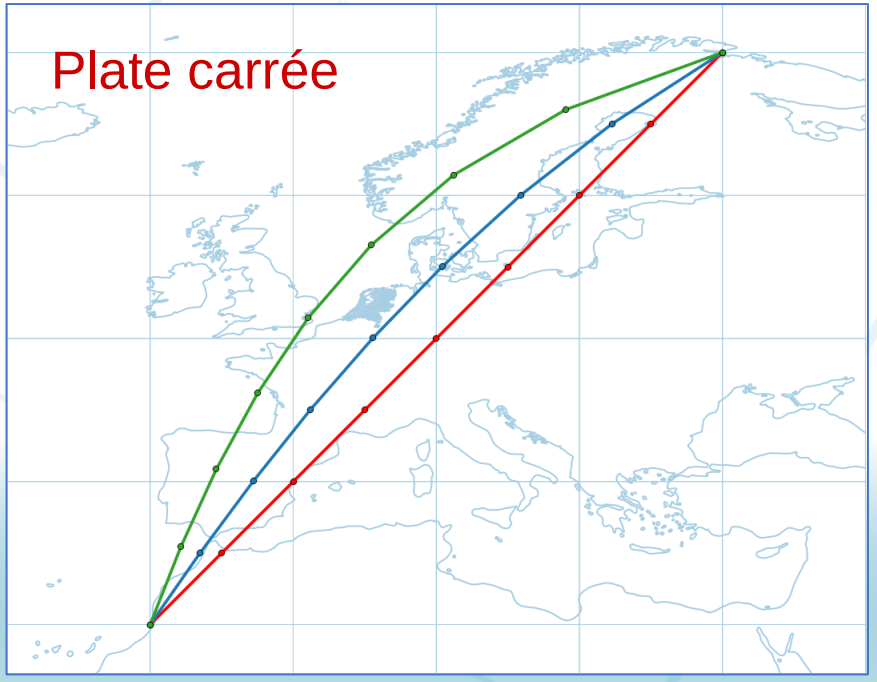
What are straight lines?

Straight lines in a **map projection**

- curved lines in other map projections
- not straight lines in reality (geodesics)



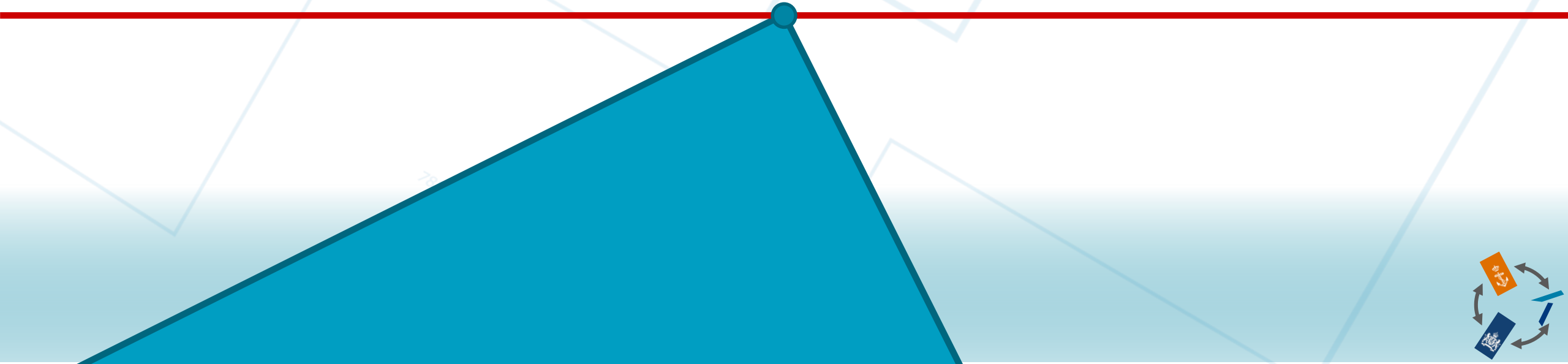




Topology problems

Example 1: Building seemingly intruding neighbours' parcel

viewer using national projection

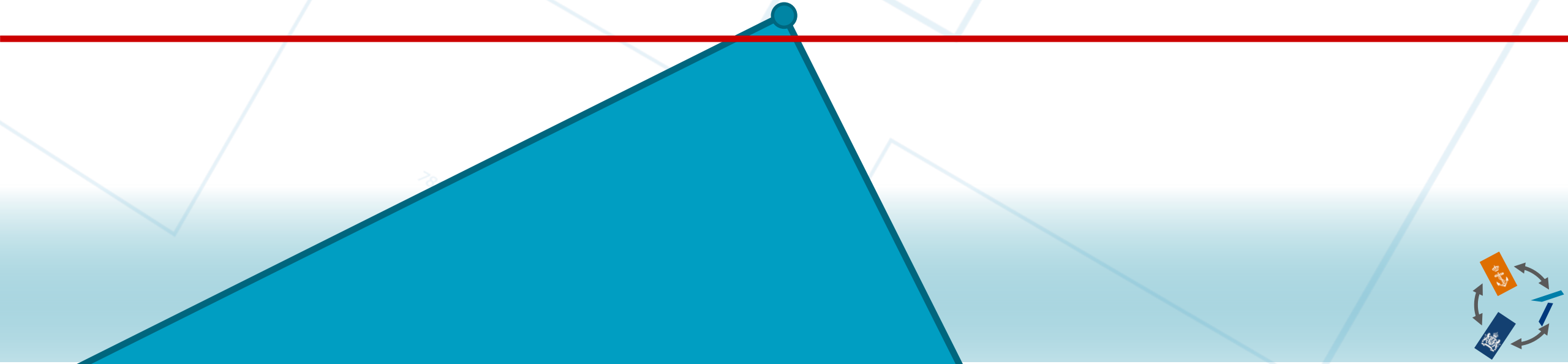


Topology problems

Example 1: Building seemingly intruding neighbours' parcel

viewer using Web Mercator

up to 2 cm deviation for 750 m line segment at latitude of Helsinki



Topology problems grow quadratically

Example 2: Ship seemingly at wrong side of maritime border

viewer using national projection

Topology problems grow quadratically

Example 2: Ship seemingly at wrong side of maritime border

viewer using Mercator

up to 200 m deviation for 85 km line segment in the North Sea

Topology problems also in computations

Example 3: Administrative division API

Coordinates in national CRS: EEZ Netherlands

Coordinates of same point in ETRS89: Germany

Solution: No long line segments

To conserve topology and prevent misinterpretation regardless of used software

Max. segment length depends on:

- Map projection
- Latitude
- Required accuracy

Dependance on map projection

Map projections:

- National: *Dutch stereographic*
- INSPIRE: *UTM, LCC*
- Navigation: *Mercator*
- Web mapping: *pseudo-Mercator*
- QGIS default for lonlat: *plate carrée*

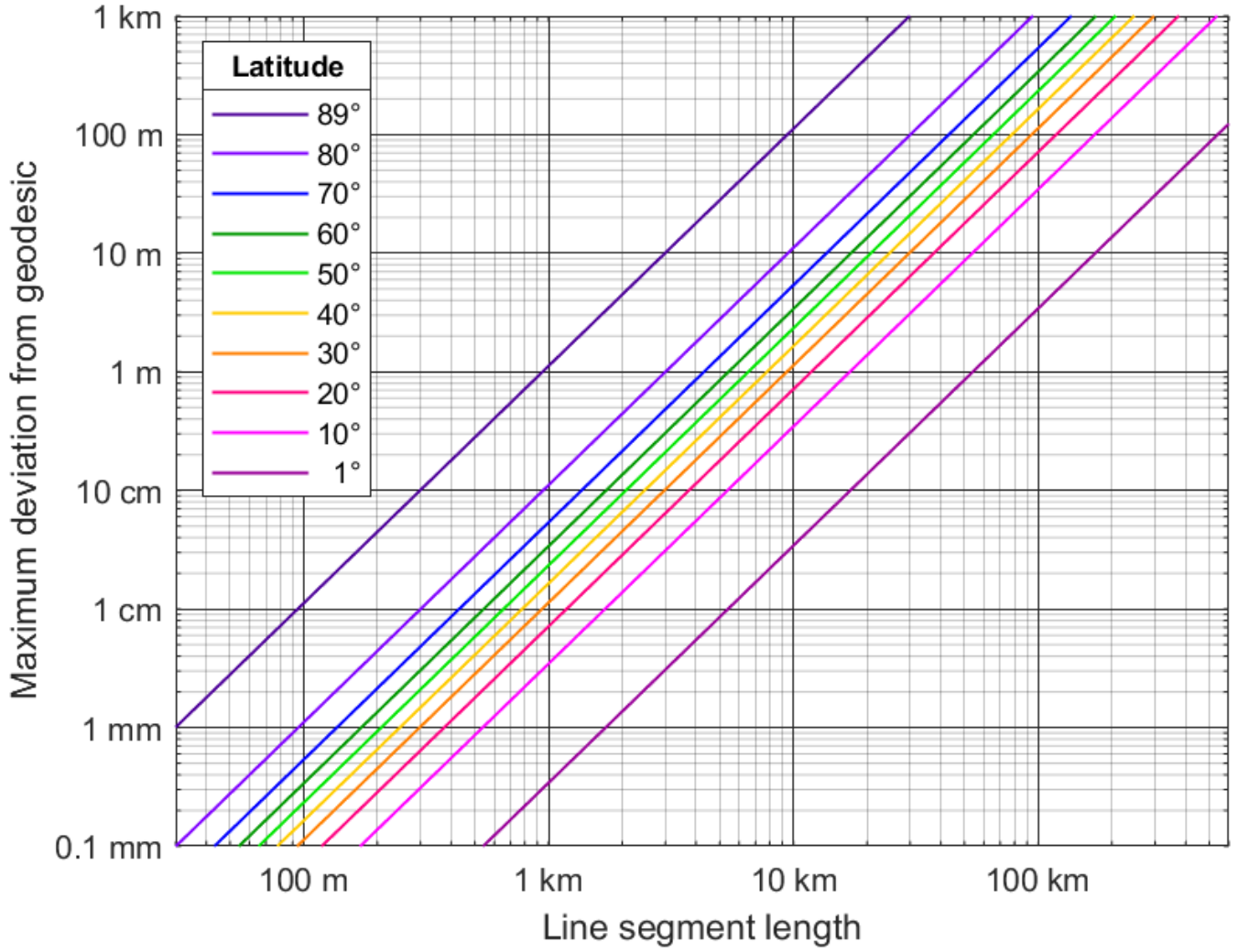
All map projections have limitations for segment length

end users' projection unknown, especially for ETRS89 lonlat data

Worst case: east-west line in plate carrée or (pseudo)-Mercator

What are too long line segments?

For 1 cm accuracy
at European latitudes
max. segment length:
400 – 1000 m

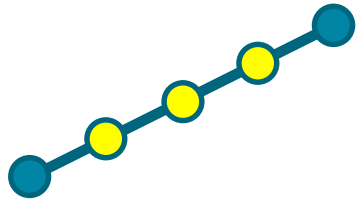


Recommendation for geo-data suppliers

Use max. segment length based on

accuracy of data set or required consistency

- Check datasets (long segments are unexpectedly common)
- Compute intermediate points (along geodesic or other preferred path)



Guidance

- Table
- API

Table

For worst-case projection and max. latitude of Netherlands

Required accuracy	Recommended max. segment length
1 mm	200 m
1 cm	500 m
1 dm	2 km
1 m	5 km
10 m	20 km
100 m	050 km

Coordinate transformation API

https://api.transformation.nsgi.nl/v2/openapi

Line strings and polygons in GeoJSON input

- **Transform:** Refuses too long segments
- **Densify:** Computes intermediate points
  - geodesic in ETRS89
  - straight line in projection of source CRS

With user specified accuracy or

200 m default for 1 mm accuracy in the Netherlands

Questions?

Contact: RD@Kadaster.nl