REAL TIME MANAGEMENT OF MASSIVE 2D DATASETS

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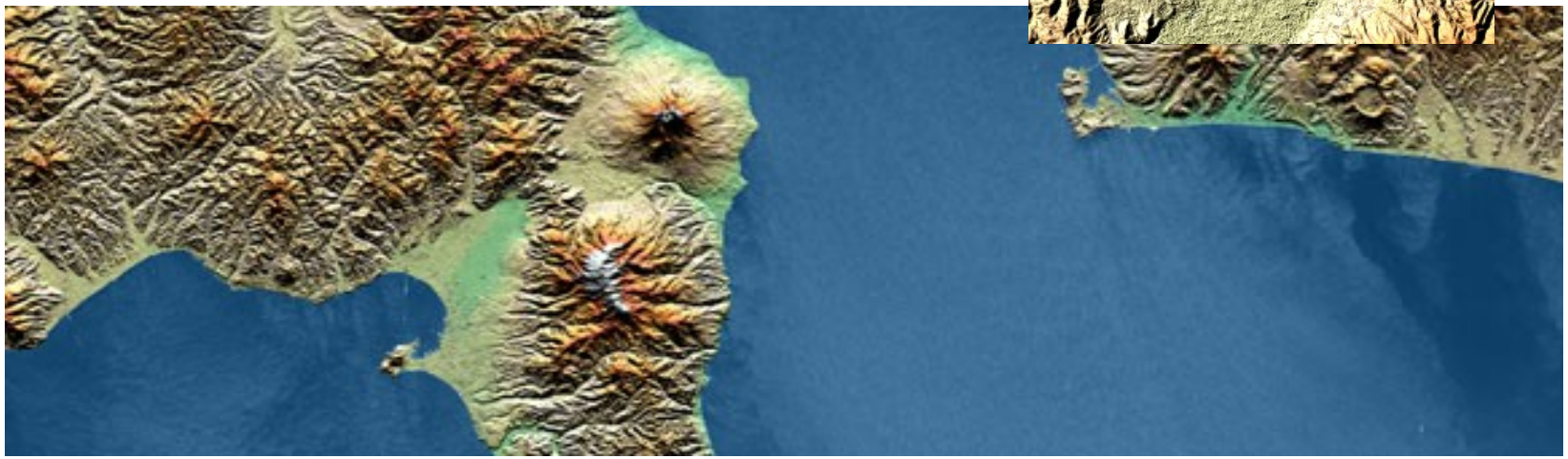
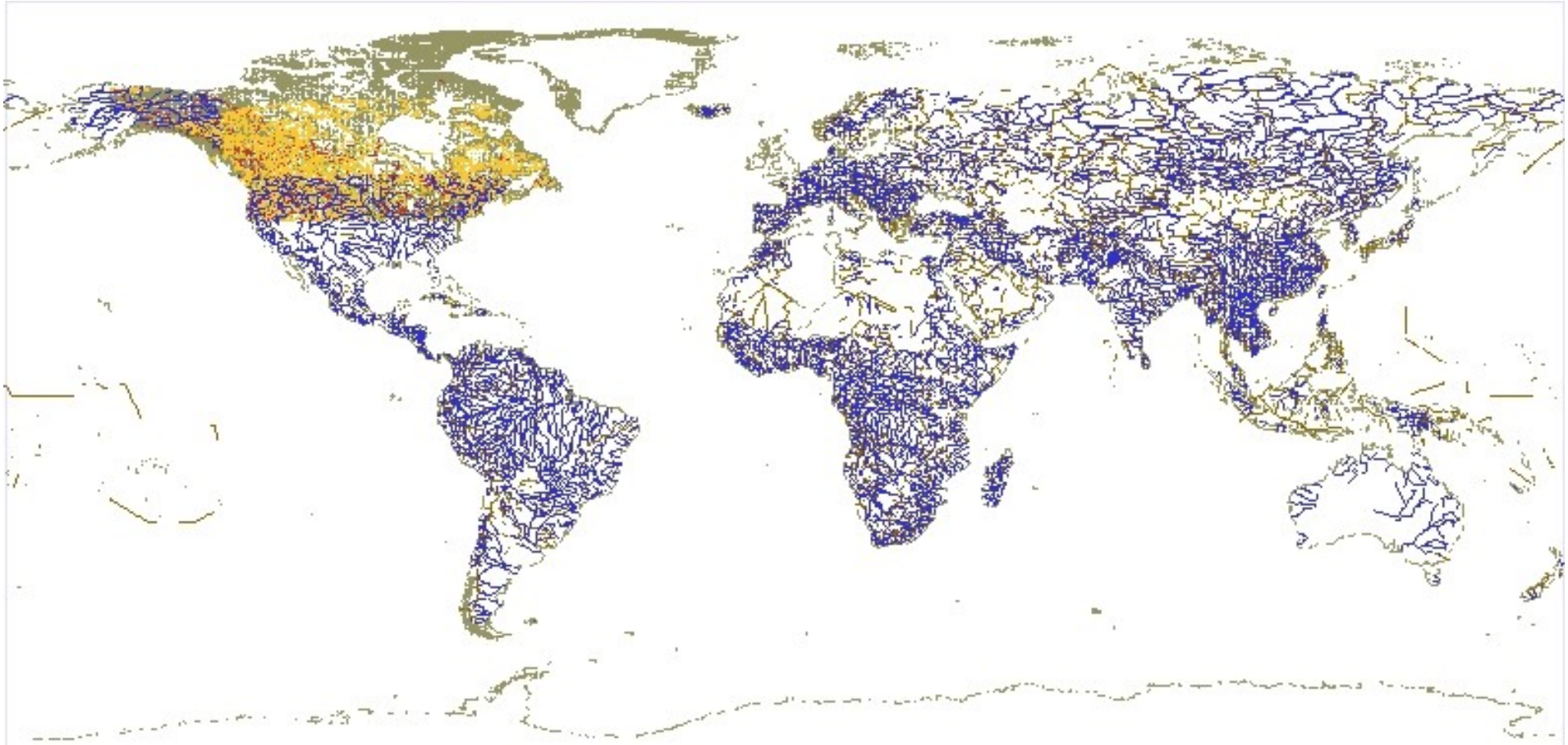
Shuttle Radar Topography Mission (Mission to Earth)

- Landing - May 2000
- 18 terabytes of raw data
- 2 years of post processing
- Virtual Earth: 3D model of 80% of the continental area, 30m mesh
- 20m horizontal resolution, 4m vertical

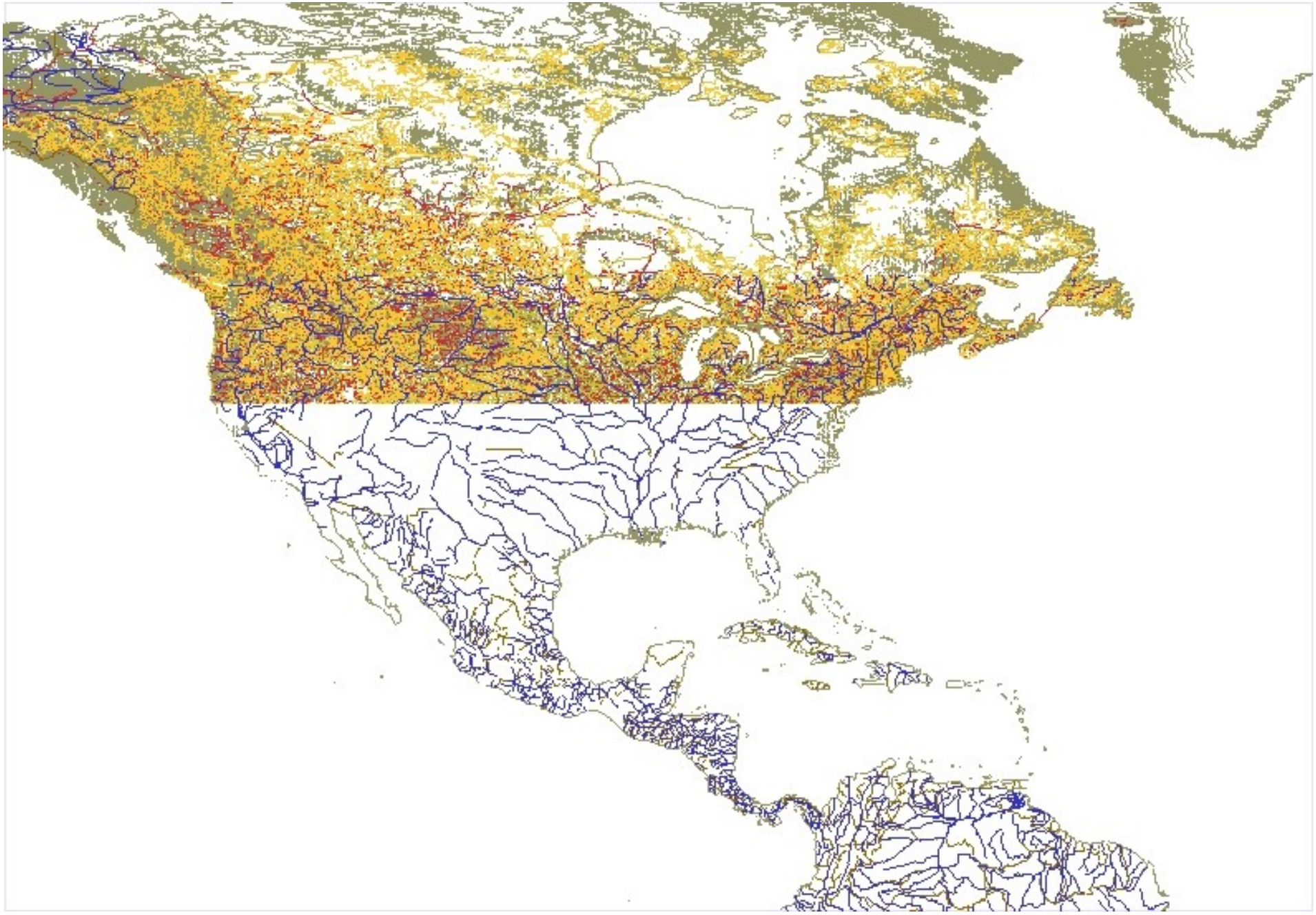


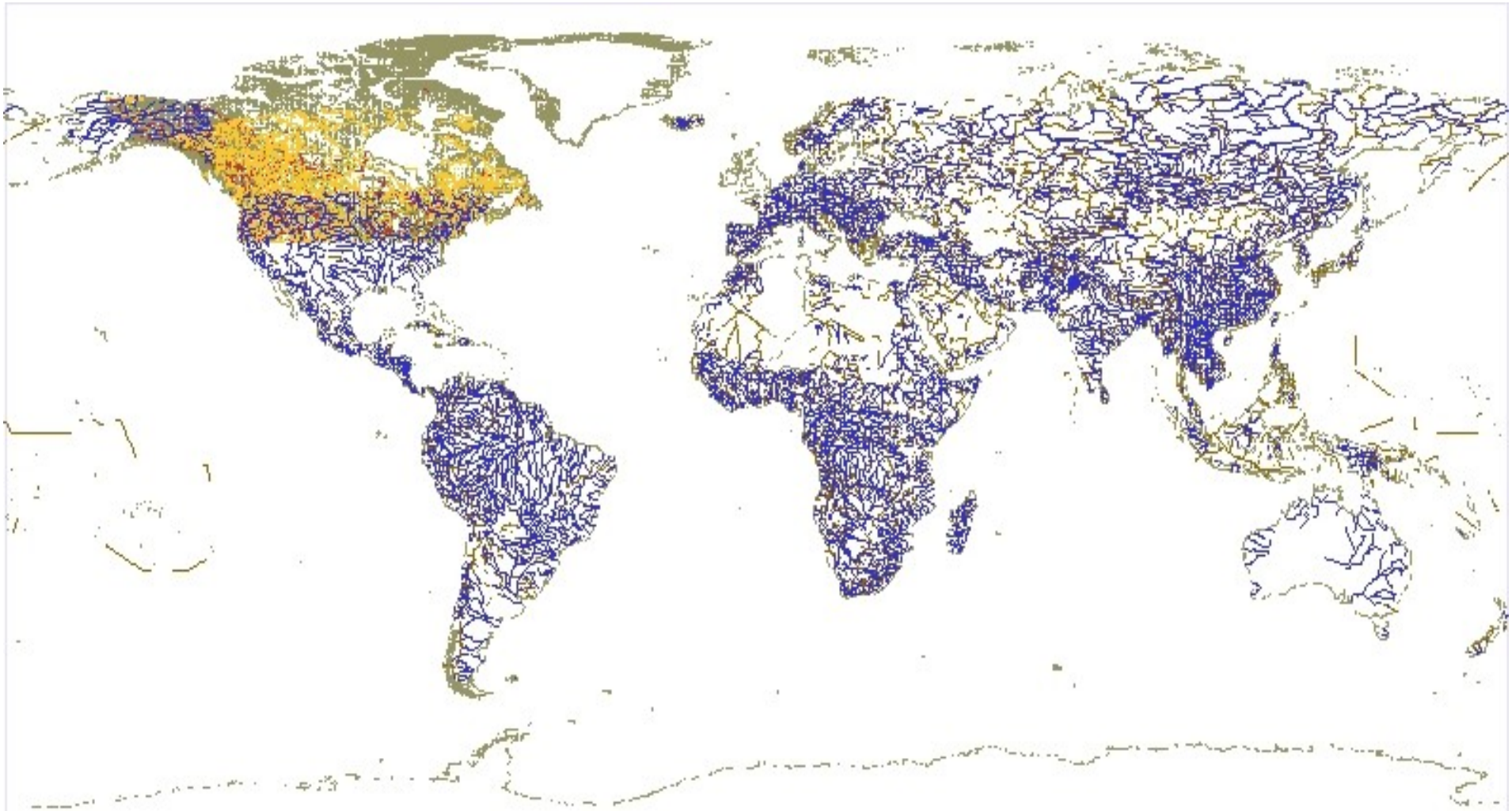
ONE WORLD – ONE MAP

- On-the-fly generation of user defined maps in real time, typically via Internet servers
- Any combination of layers
- Any selection, from global to street level views
- Any resolution, from large graphical desktop displays to small PDA/cellular screens
- Frequently updated in formation
- Such servers already present, e.g. http://tiger.census.gov/cgibin/mapsurfer
- ...BUT: Still more to do ☺

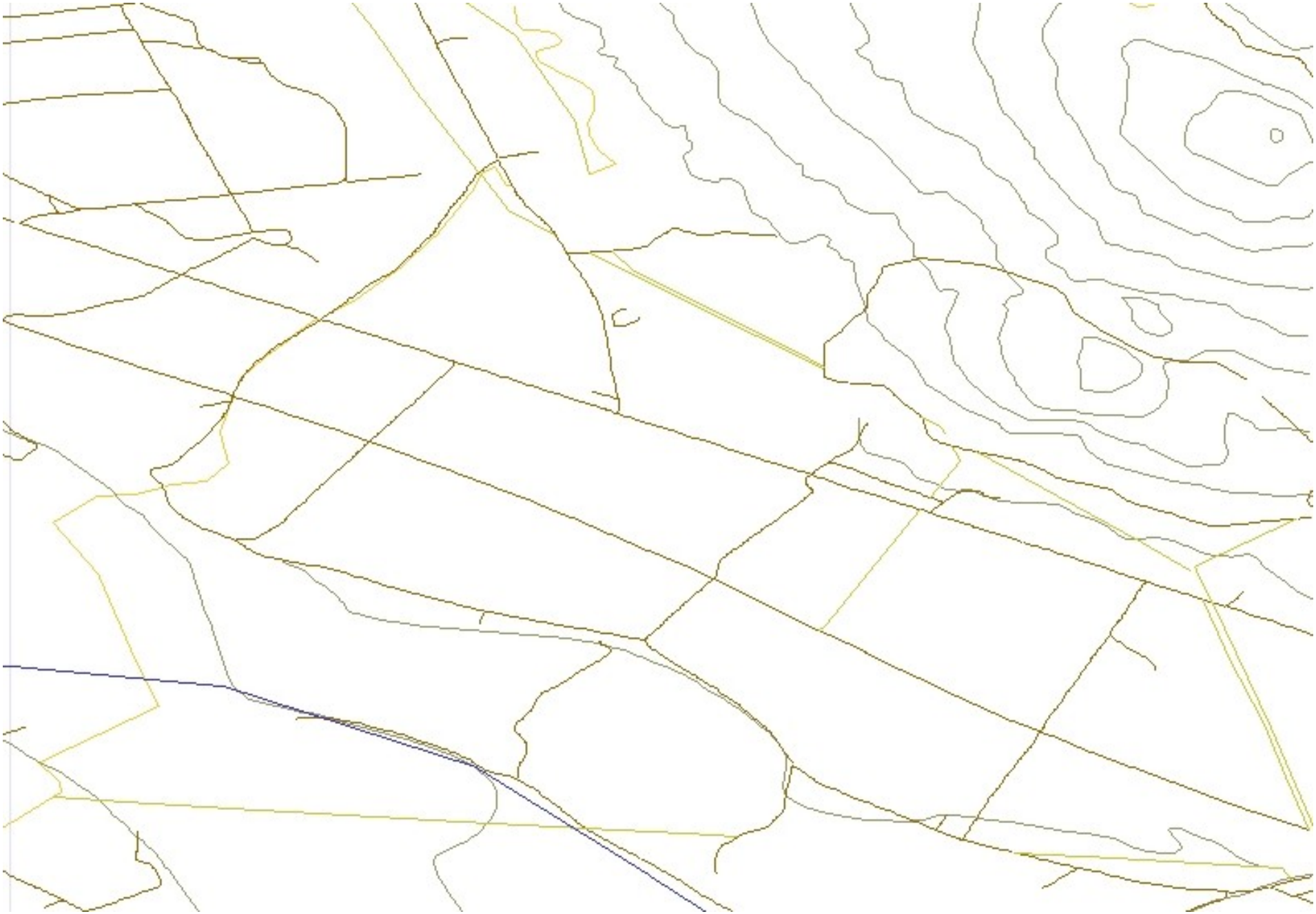


Mostly DCW data: coasts, rivers, political boundaries
Canada: Elevation contours, roads, utilities etc. (”upgraded” DCW)
US coast: 1:70.000
Total ca 30.000.000 points

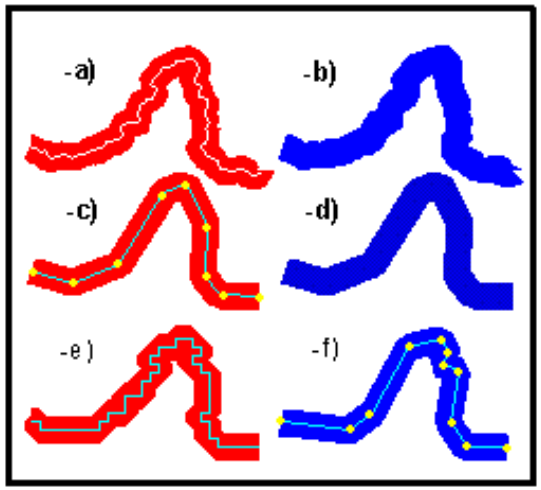


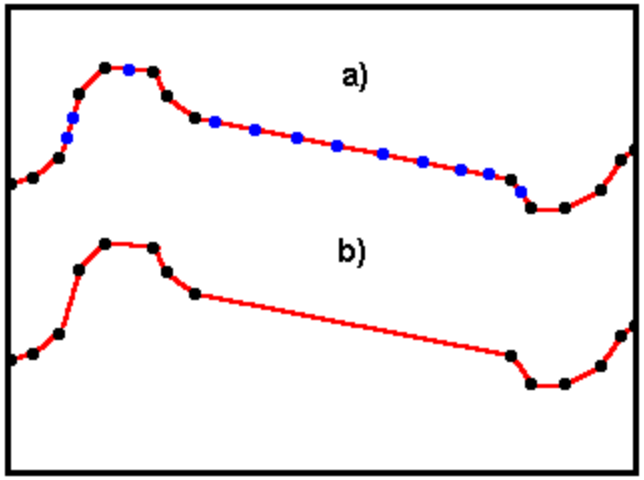



N50 1:50.000 map sheet
Ca 180.000 points



Approximation: Simplification vs. Data Reduction





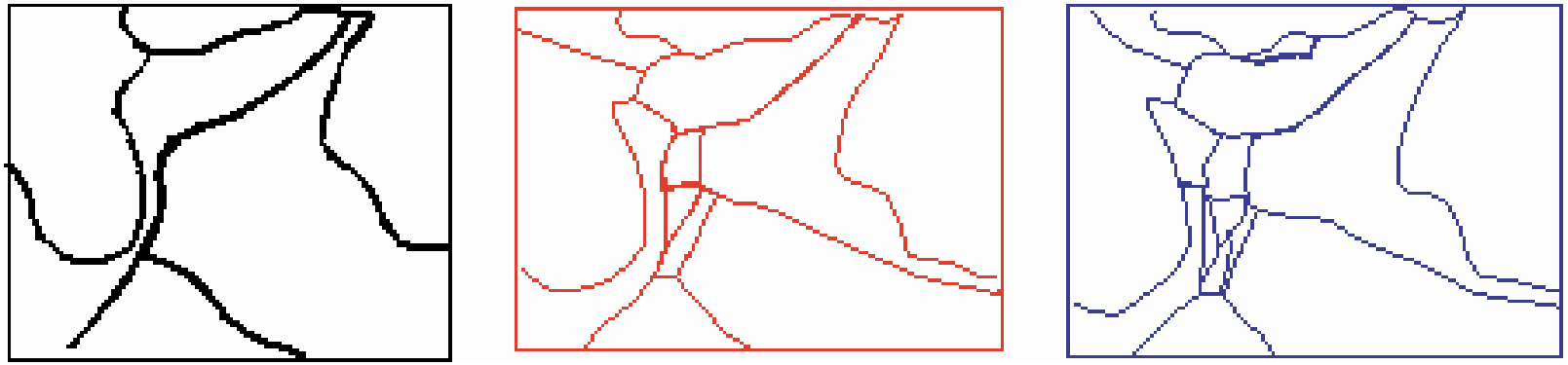
Simplification (smoothing):
Reducing the (visual) complexity
of a geometric object

Data reduction (thinning):
Reducing the amount of data
(often 2D/3D) needed to represent
a geometric object within a given tolerance

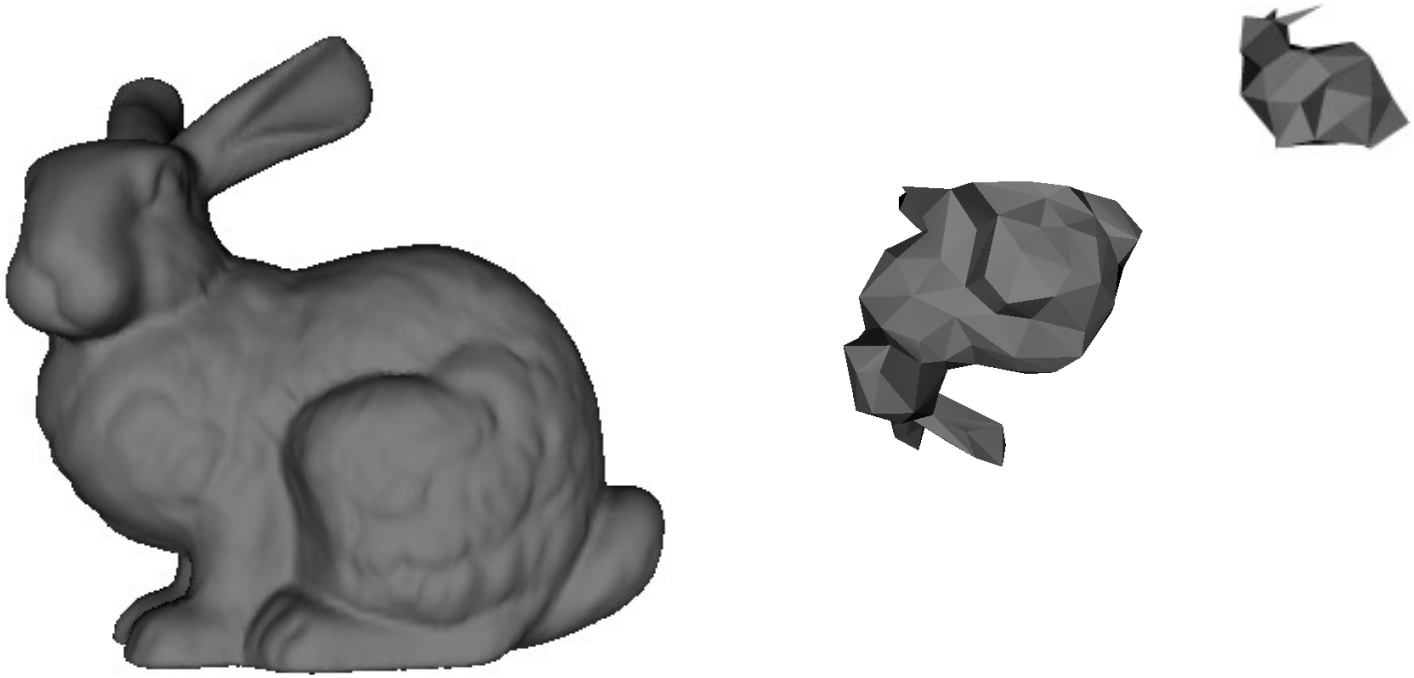
Mostly treated as two aspects of same phenomenon

Cartographic Generalization

Road and river network, 3 different scales:



Level of Detail (LOD)



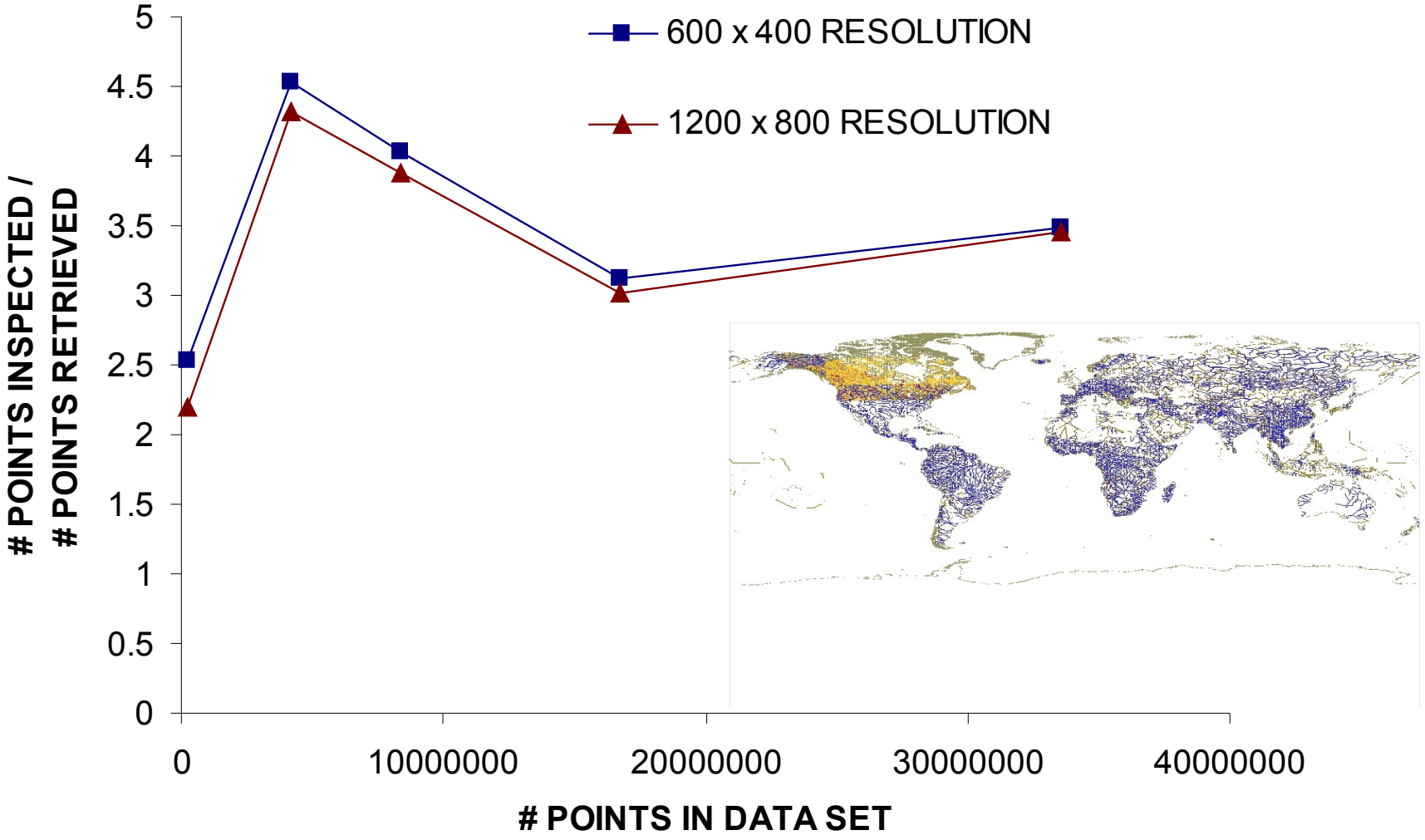
MASSIVE MAPS SERVERS – SOME REQUIREMENTS I

- Efficient storage:
  - The size of the database should propotional with the size of the dataset
  - Multiple representations should be avoided, prone to inconstency problems
- Efficient retrieval:
  - Efficient window query
  - Efficient approximation of the data in the query window
  - The combined query/approximation requests must run in sublinear time
  - Can’t afford to inspect every point in the data set
  - Should be close to logaritmic order
  - Must run in external memory
- Efficient maintaince:
  - Removals, additions and modifications must run in sublinear time

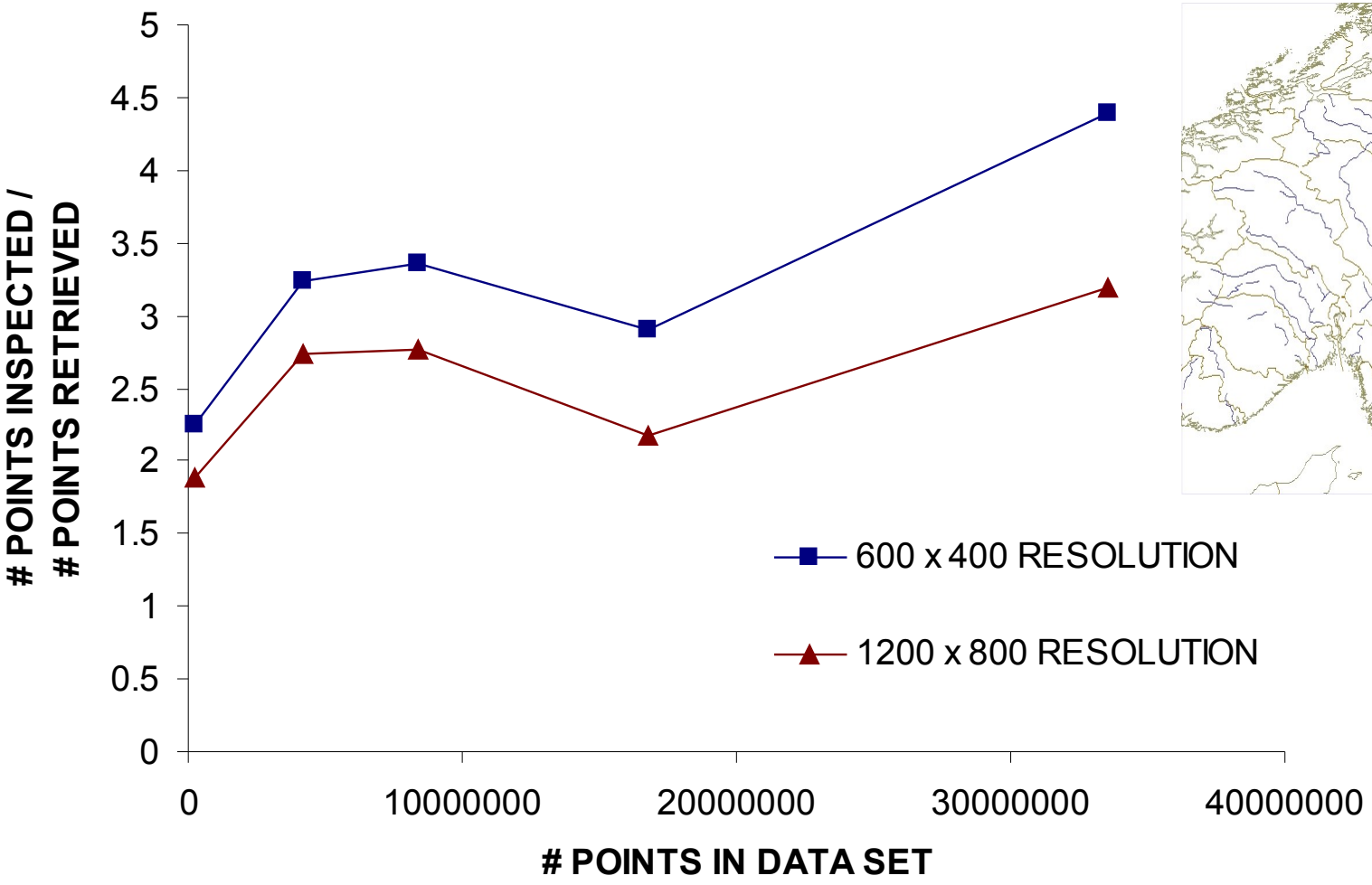
MASSIVE MAPS SERVERS – SOME REQUIREMENTS II

- Generalization:
  - Selection, aggregation and possible deformations should be performed more or less automatically
- Topology preservation:
  - Elevation contours must not cross, road networks have to remain consistent after a query process
- Scalability:
  - Operations should be decomposable:
    - Spatial partitioning allow for parallell methods
  - Should facilitate fusion of data from heterogenous sources
- Implementation:
  - Simple methods are easy to implement and maintain

GLOBAL QUERY WINDOW, VARYING DATA DENSITY



LOCAL QUERY WINDOW, FIXED DATA DENSITY



1W1M:
ONE WORLD – ONE MAP

- Long term project, coordinated from HiØ
  - Provide free access for all internet users to a virtual map with global coverage
- Gateway
  - Consumer side of 1W1M
  - Retrieval of customized maps for any area, in any resolution
  - Free of charge
  - ”Common” users will receive a graphic depiction as the result of the query (e.g. a JPEG image)
  - Producers are have access to fully functional GIS data
- Clearinghouse
  - Producer side of 1W1M
  - Any party can submit public domain geodata
  - Approval of submissions based on ”peer review”

COMMENTS

- One World – One Map solutions are technologically within reach
- New user demands, new sources of data and new technology calls for
  - new geodata models
  - rethinking of the generalization consept
  - distributed and integrated storage and retrival systems
  - increased focus on standards and integration issue