



SRTM Workshop
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Assesment on the use of SRTM DEM during post tsunami operations

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Why such an analysis ?

- In geospatial emergency production, each crisis is unique, in terms of :
 - causes
 - symptoms
 - adequate solutions
 - Available tools and sources
- Due to the limited number of major crisis, military and civilian events have to be analysed alike
- Generic lessons can be learned
- But their temporal validity is short

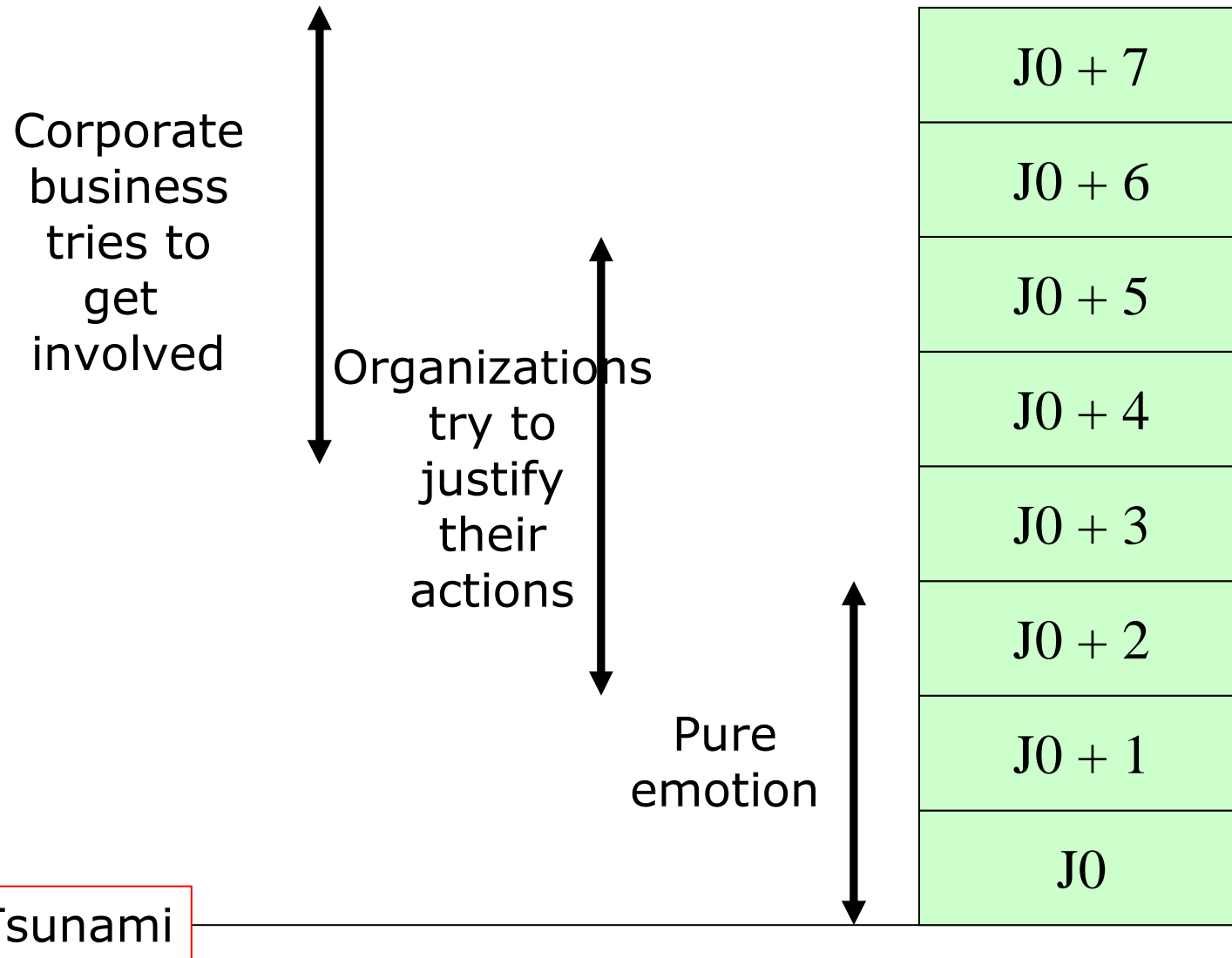


Methodology

- The main point is to get all relevant informations during the crisis (and not after)
- Any product must be analysed based :
 - On ops requirements (not always easy to know)
 - On available sources at the moment
 - On general context
- It is a day to day work
 - Referencing the products
 - Links with events of the days
- Analysis afterwards is never a judgement on products or their authors. It must only give hints on futures services, products and organisational changes

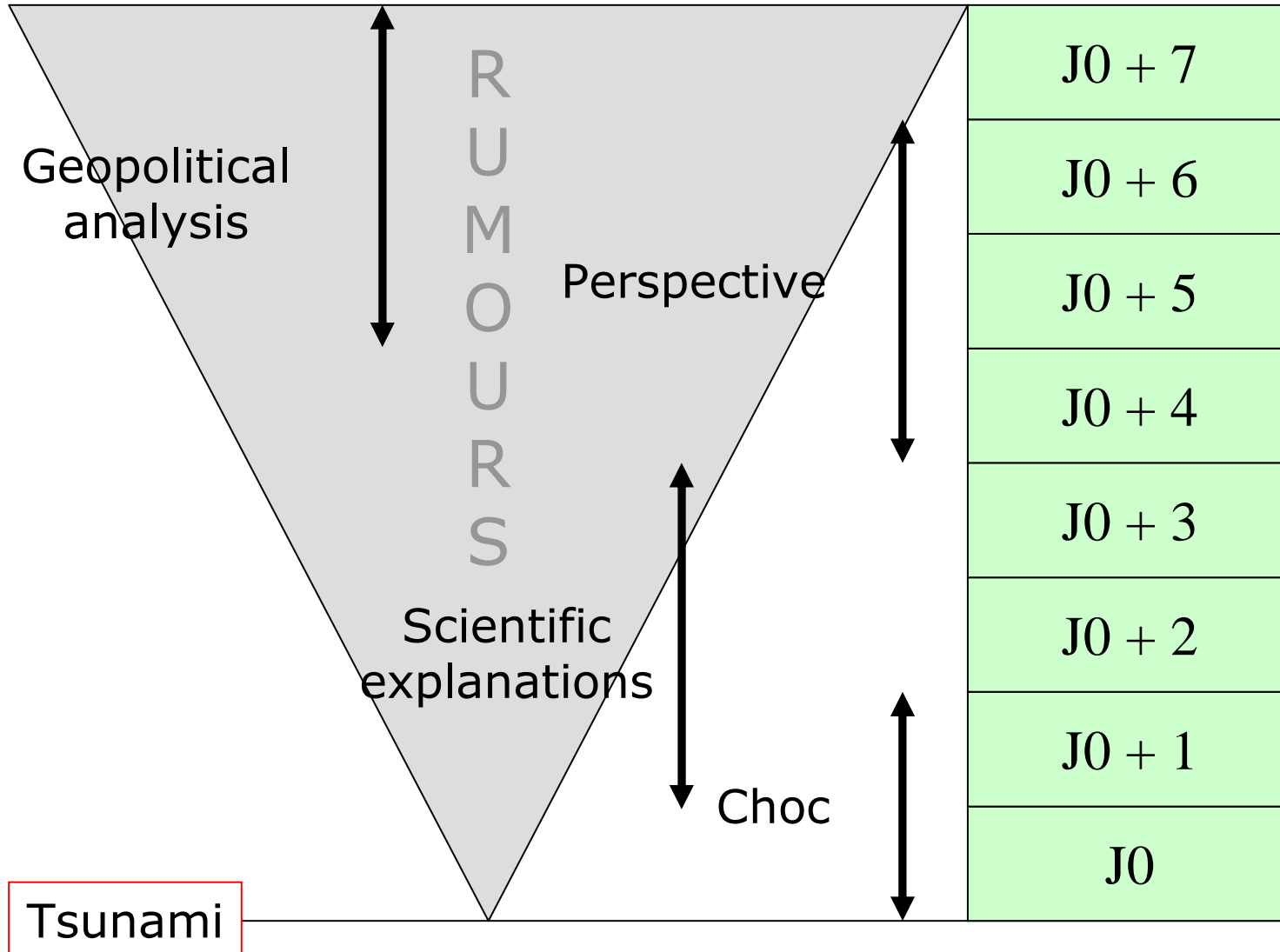


Technical issues are not everything





Technical issues are not everything





Specific problems of this crisis

- A lot of different areas of interest
- Diversity of landscapes, local situations, issues
- A lot of flat coastal areas where any error in z on the DEM creates large x, y errors on the interpretation
- A lot of areas difficult for optical observation



Two types of requirements involved DEM use :

- Contextual information necessary to feed C3i systems and help field teams :
 - DEM where a part of the stack of data
- A rough estimate of potentially destroyed areas based on the determination of low altitude zones
 - DEM where the main source of information on this issue during the 3 or 4 first days (before we got field crews reports)



Contextual information

Data Mining
Image Information Mining
Cartography



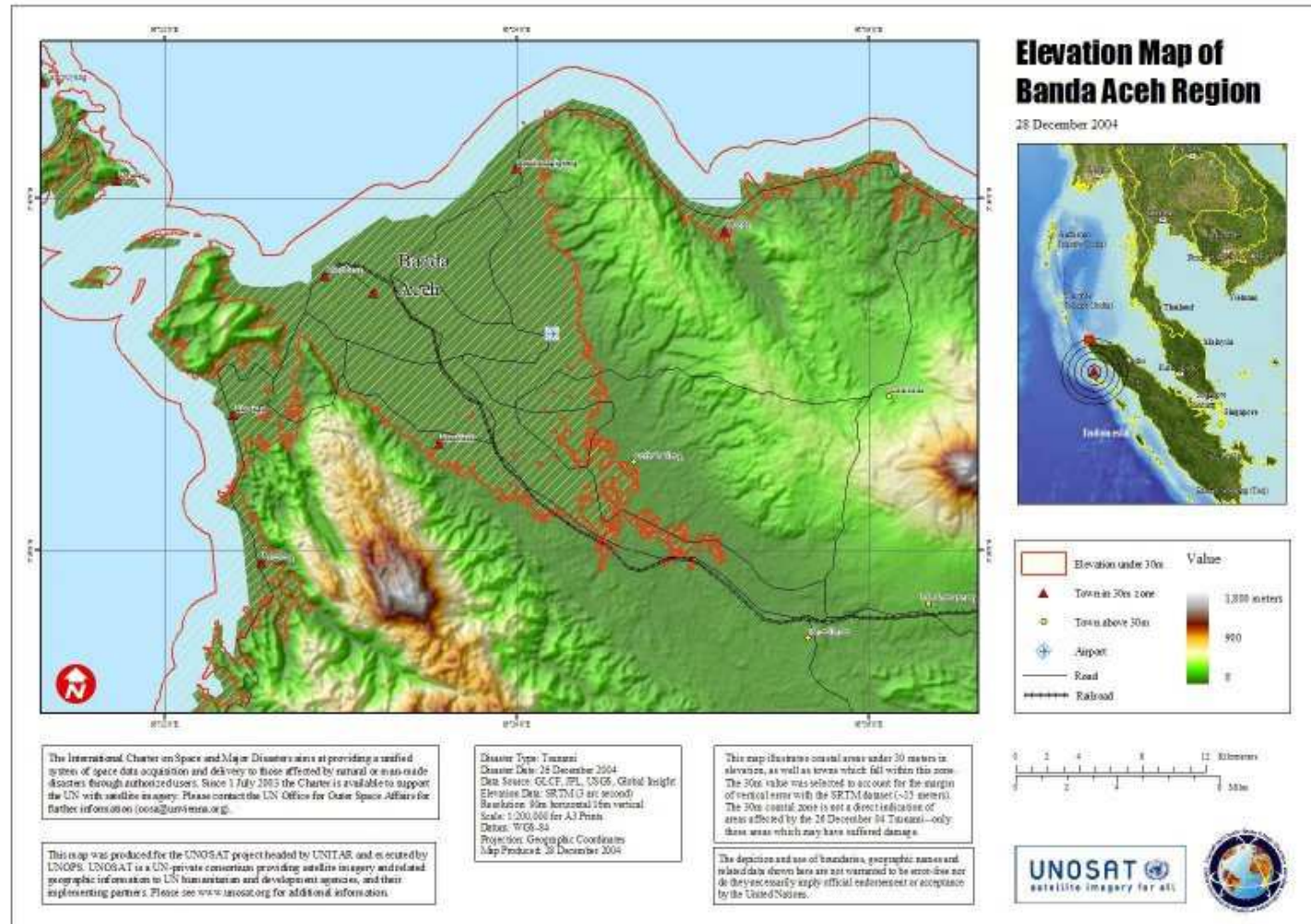
Why such a large use of SRTM DEM ?

- We needed existing data
 - no time to produce DEM
 - We needed data available on all the tsunami areas
 - With the same quality everywhere
 - We needed data easy to access
-
- ▶ **SRTM 3'' x 3'' was immediately the best answer to this problem**

 - ▶ **We reviewed 55 products using this source of information**

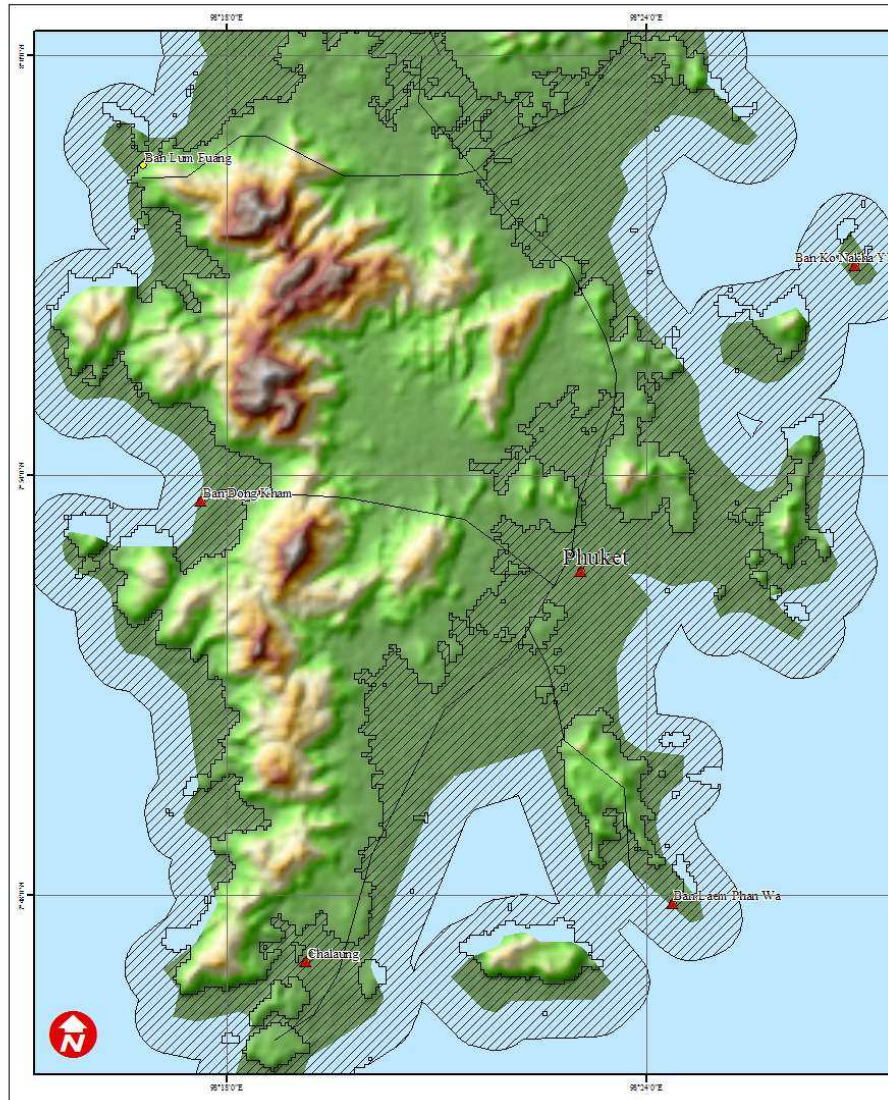


First products on line over Banda Aceh





First products on line over Phuket



This map illustrates coastal areas under 20 meters in elevation, as well as towns which fall within this zone. The 20m value was selected to account for the margin of vertical error with the SRTM dataset (~1.5 meters). The 20m coastal zone is not a direct indication of areas affected by the 26 December 04 Tsunami—only those areas which may have suffered damage.

Disaster Type: Tsunami
 Disaster Date: 26 December 2004
 Data Source: GLCF, JPL, USGS, Global Insight
 Elevation Data: SRTM (3 arc second)
 Resolution: 90m horizontal/16m vertical
 Scale: 1:100,000 for A3 Prints
 Datum: WGS-84
 Projection: Geographic Coordinates
 Map Produced: 29 December 2004

This map was produced for the UNOSAT project headed by UNITAR and executed by UNOPS. UNOSAT is a UN-private consortium providing satellite imagery and related geographic information to UN humanitarian and development agencies, and their implementing partners. See www.unosat.org for additional information.

The International Charter on Space and Major Disasters aims at providing a unified system of space data acquisition and delivery to those affected by natural or man-made disasters through authorized users. Since 1 July 2003 the Charter is available to support the UN with satellite imagery. Please contact the UN Office for Outer Space Affairs for further information (ooaa@unvienna.org).

▲ Town in 20m zone
◆ Town above 20m
✈ Airport
 Road
 Railroad
 Elevation under 30m

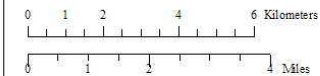
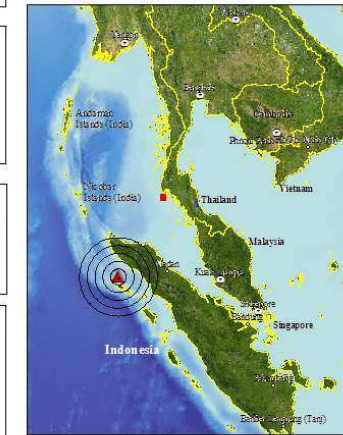
Elevation (meters)

600 m
300 m
0 m

The depiction and use of boundaries, geographic names and related data shown here are not warranted to be error-free nor do they necessarily imply official endorsement or acceptance by the United Nations.

Elevation Map of Phuket Island

29 December 2004





Analysis : Very good emergency products

- Good geometry
- A simple access to three main problems :
 - Land use
 - Elevation
 - Populations
- Based entirely on existing information
- Belle facture cartographique
- User alerts on possible uses of the data
- Good metadata
 - Confusions between SRTM90 and SRTM30)



Landsat 2000 + DEM SRTM + DCW



**Spacemap produced at J0+3
but offered at J0+5 as soon as
1/5 000 spacemaps**



Analysis : Another good example

- Those medium scale (1/75 000) spacemaps where produced at J0+3. At this scale, alone, they did not give a lot of original information
- But at J0+5 they were put on-line in a multi-scale data stack with change detection high resolution products.
- Good optimization of :
 - Image resolution
 - Digital product « scale »
 - Printed dpi resolution
- Same product at 1/50 000 scale would have been mediocre.



A lot of « bad » products

- Qualitative main findings :
 - Obsession on the creation of spacemaps where half an hour of OSINT helped to find much better existing data
 - Bad adequation between image sources resolution and cartographic scale choices
 - Bad cartographic representation (espacially in terms of hypsometry representation)
- Quantitative main findings (over 55 products)
 - 56% of the products lacked metadata (descriptive and intended use)
 - 27% of the products appeared during the 2nd and 3rd weeks when there was no need anymore for such data



**A rough estimate of potentially
destroyed areas**



Operational needs

- To get a first idea of potentially destroyed areas by identification of low altitude zones (30 m or 20 m depending on the areas)
- Represent this information on cartographic documents distributed to authorities and field teams



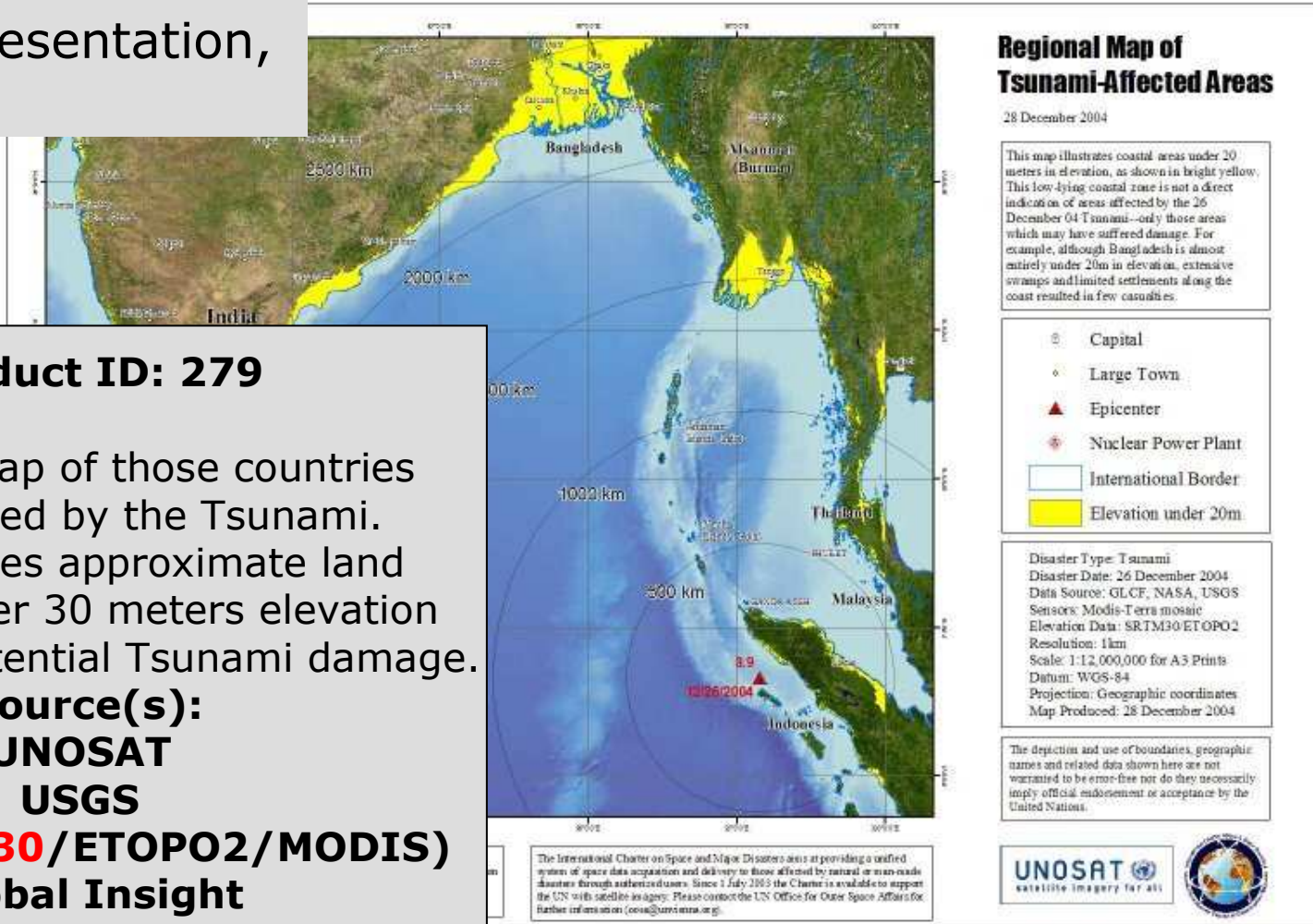
The sources

- 5 possible sources
 - GTOPO30
 - SRTM90 corrected
 - SRTM90 non corrected
 - SRTM30
 - Référence 3D
- Over 102 products analysed, none has used SRTM30 or Référence3D
- 91% used SRTM data (but in most cases, users did not really know during this emergency if it was corrected or not – finding based on interviews after the crisis)



Regional product available on 29/12/04

A good representation, at this scale



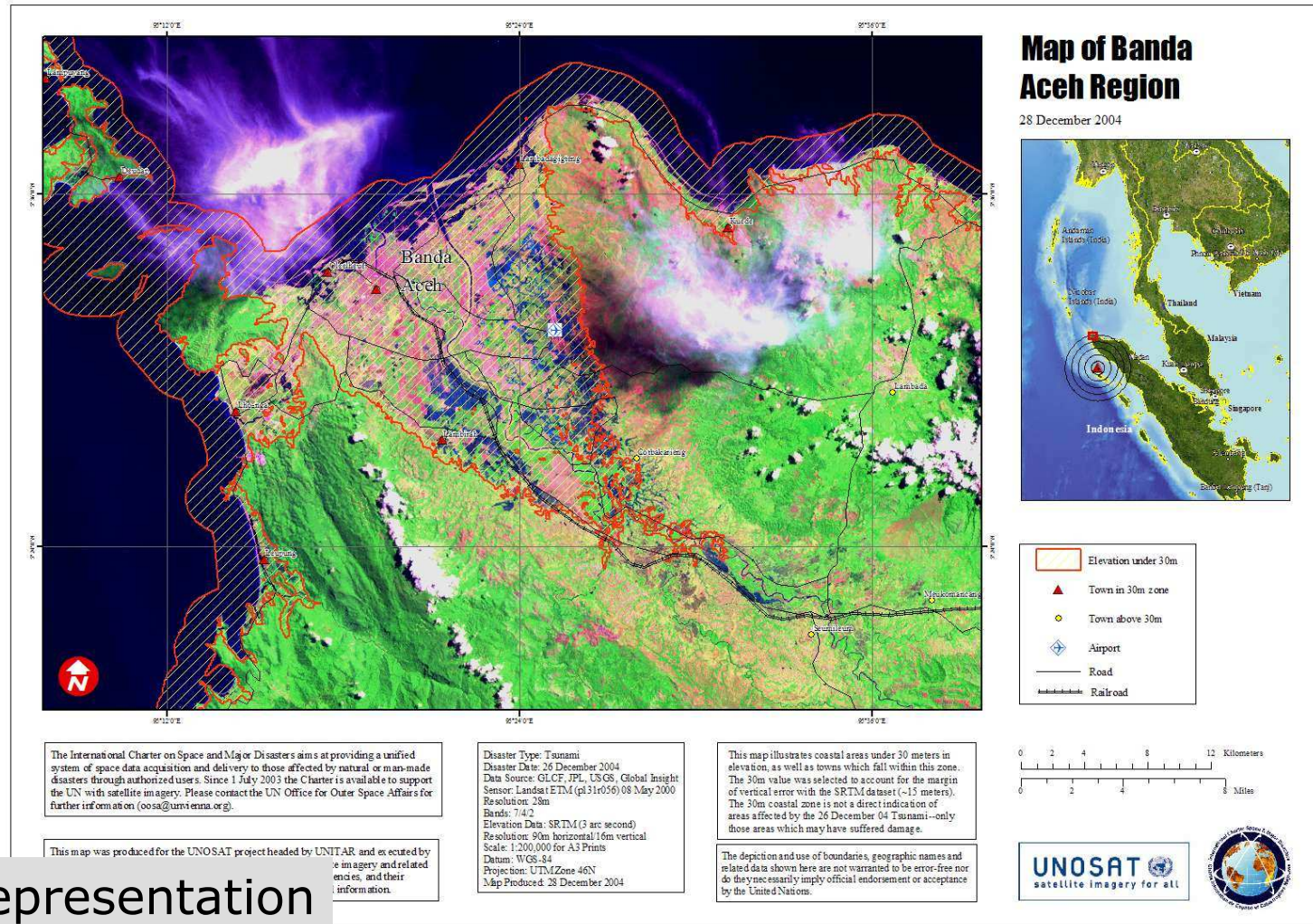
Product ID: 279

A regional map of those countries most affected by the Tsunami. Also illustrates approximate land coverage under 30 meters elevation as a zone of potential Tsunami damage.

Source(s):
UNOSAT
USGS
NASA (**SRTM30**/ETOPO2/MODIS)
Global Insight



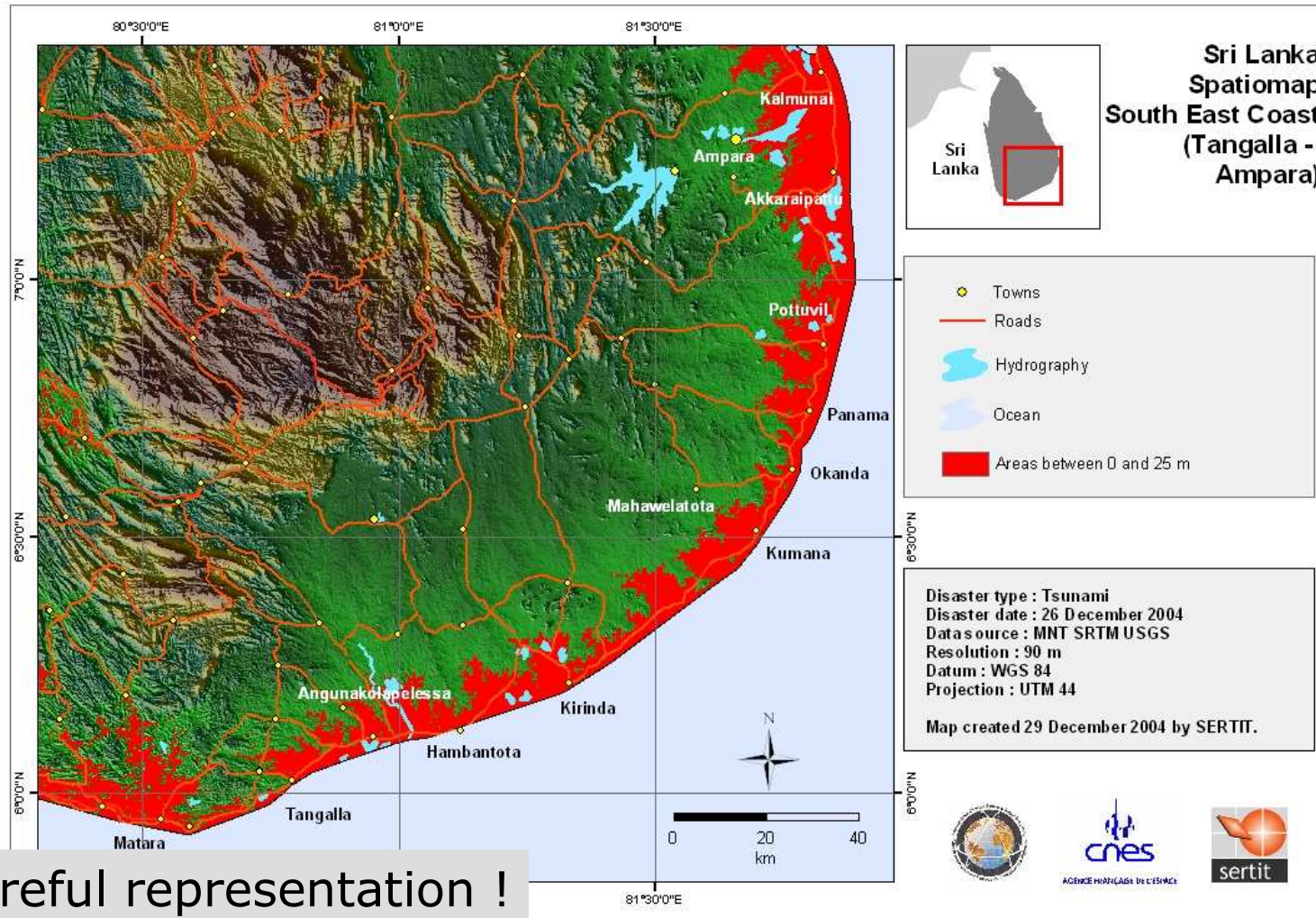
Aceh product available on 29/12/04



A careful representation



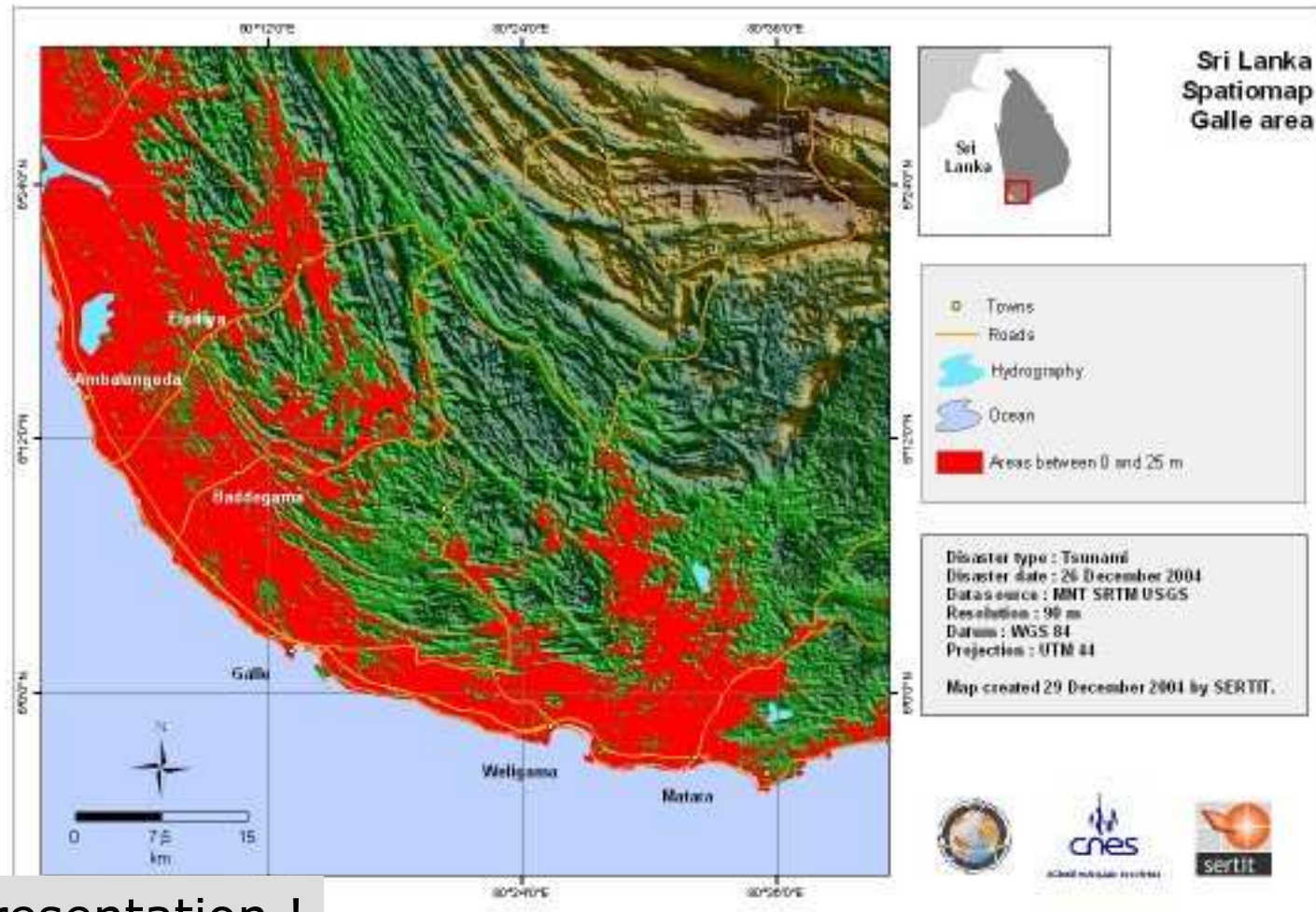
Sri Lanka product available on 30/12/04



A not so careful representation !



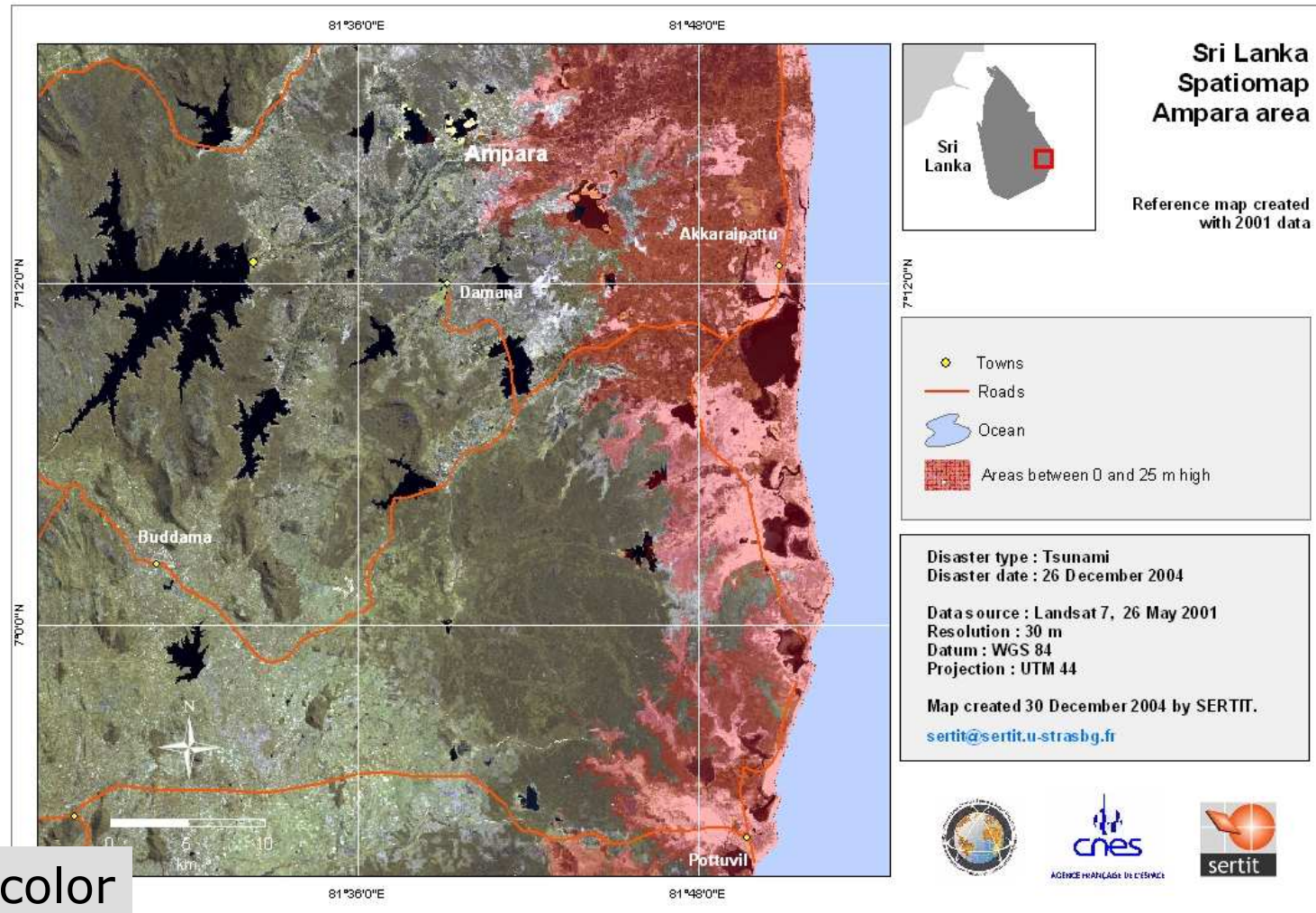
Sri Lanka product available on 30/12/04



An awful representation !



Landsat Spacemap available on 31/12/04



Misleading color



Analysis : a simple problem ... with not so simple answers (1/2)

- SRTM90 elevations in coastal areas (in the 0 – 25 m altitude range) are difficult to interpret
- Take those elevations and draw them in **RED on the spacemap** gives an erroneous perception of reality.
- Products where the 20 m level is represented by a contour line give a better idea to the user.
- In the same way, colorize the landsat spacemap in brown colors to give an idea of hypsometry is a theoretically a good idea except when it creates confusion with post tsunami imagery covered with brown mud.



Analysis : a simple problem ... with not so simple answers (2/2)

- More than half of the 102 products analysed in this field gave erroneous perception of the situation (and technical data quality of SRTM DEM had nothing to do with it)
- Data produced by official agencies (inside or outside the International Chart) contained the same proportion of bad product than data produced by private efforts (business, universities or individuals)
- Altitude informations are crucial but :
 - Metadata must accompany the product
 - Representation must be carefully selected

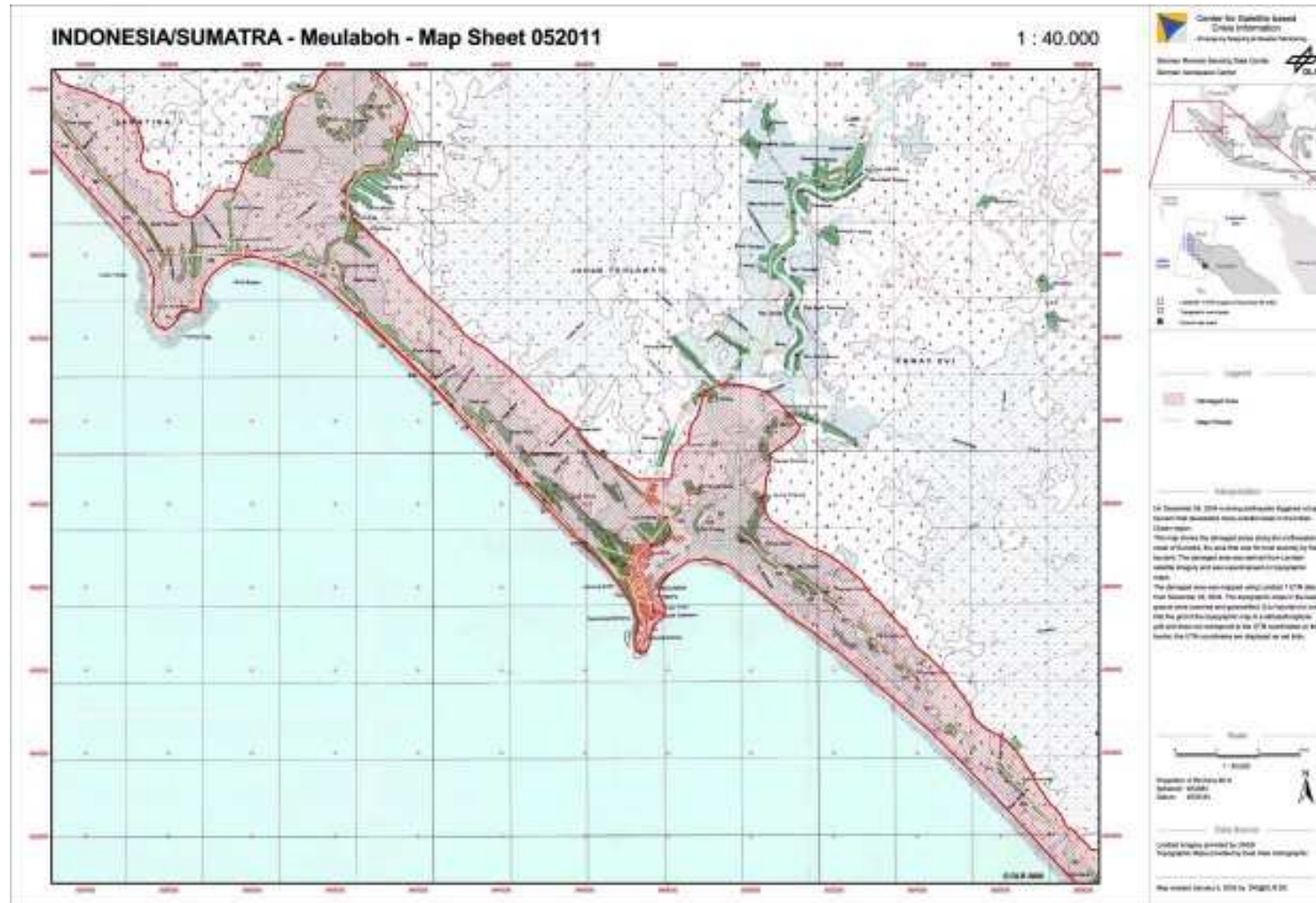


Of course, representation improves with time ...





Of course, representation improves with time ...





Conclusions



Positive side

- The emergency production system works
- It can deliver timely products
- The « good » sources were selected
- Almost 40% of the products were well designed and gave good metadata information.



Negative side

- More than 60% of the products could create misunderstandings and erroneous perceptions
- Metadata were very often forgotten
- Cartographic representation rules were not always understood :
 - In terms of scale
 - In terms of colors
- At least one third of the products (which means a large part of our limited emergency production resources and energies) was pointless :
 - Production effort on useless products
 - Not enough of OSINT analysis before decision to produce



How to improve ?

- Education and training
 - on radar data quality issues
 - on adequate emergency metadata selection
 - and on cartography 101 😊
- Coordination :
 - Between agencies
 - Between public and private sector in crisis where everybody wants to help