Satellite Topographic Mapping: A key Space Technology for Sustainable Water Resources Monitoring & Management.

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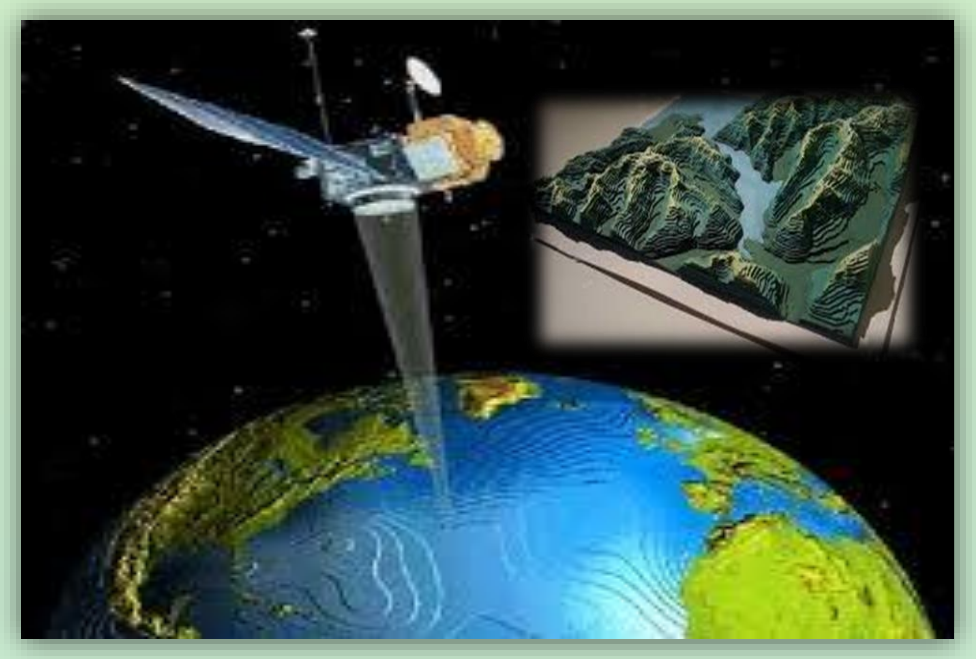
UNITED NATIONS
Office for Outer Space Affairs



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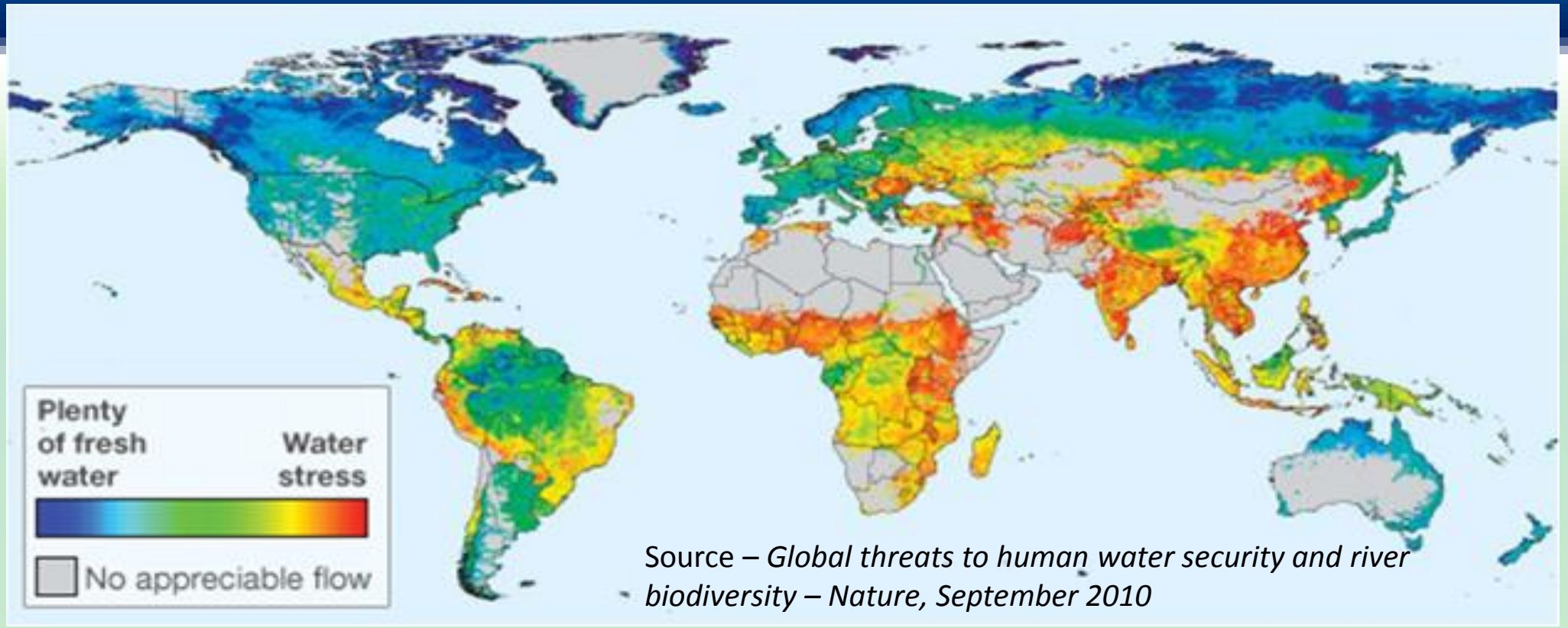
Outline

- Introduction
- Water scarcity issues
- The benefit of Satellite Topographic Mapping?
- Satellite for mapping potential flood areas.
- Conclusion
- Recommendations

Global Water Crisis



Source – *Global threats to human water security and river biodiversity – Nature, September 2010*

- 2/3 world's population currently lives in areas of water scarcity for at least one month a year.

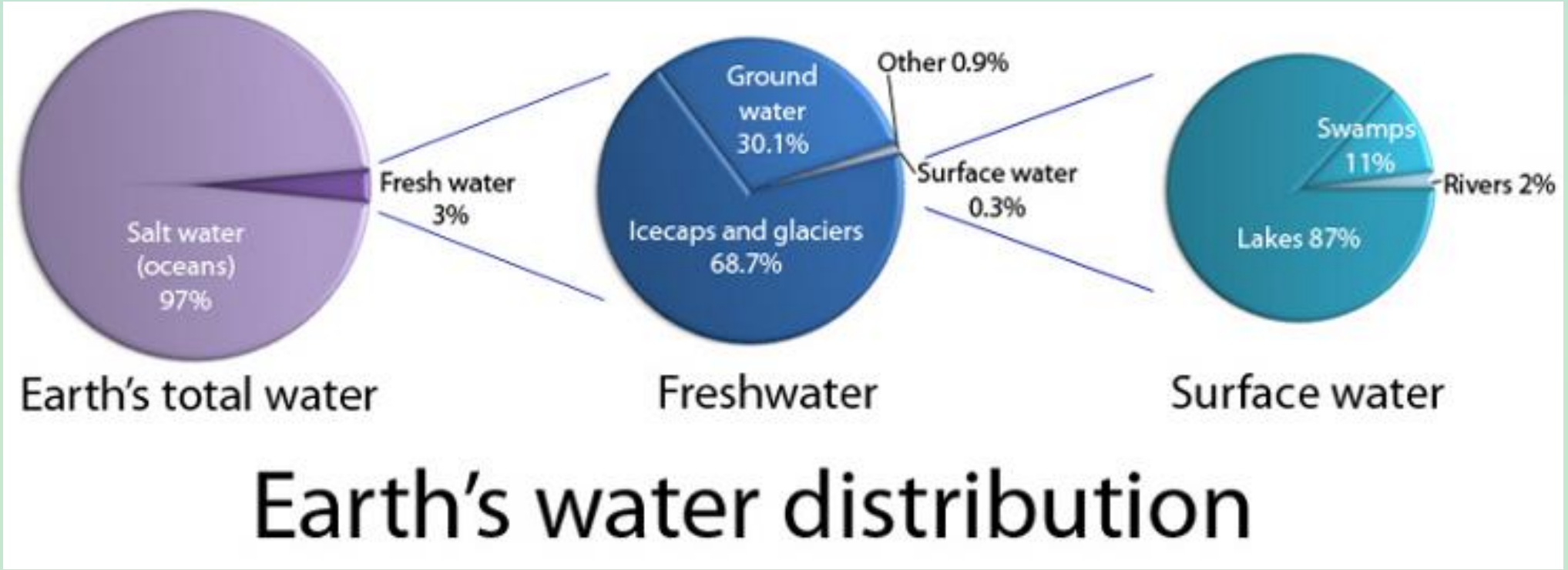
- About 500 million people live in areas where water consumption exceeds the locally renewable water resources by a factor of 2 (UN World Water Development Report 2017).

Earth`s Water Distribution

Salt water (Oceans)(97%)
Fresh water (3%)

Ground water (30.1%)
Icecaps &Glaciers (68.7%)

Lake (87%)
Swaps (11%)
River (2%)



Source: Science Learning Hub, 2009

Causes of Water Scarcity

- ✓Climate change
- ✓Rapid population growth
- ✓Increase of industries
- ✓Agriculture
- ✓Poor water resources management

The quality of water is affected by many factors such as land use activities, industrial activities etc.

“Satellite topographic mapping is the solution”

Why Satellite Topographic Mapping?

- To identify water sources and catchment areas.
- To assess surface water quality.
- Provide accurate elevation information

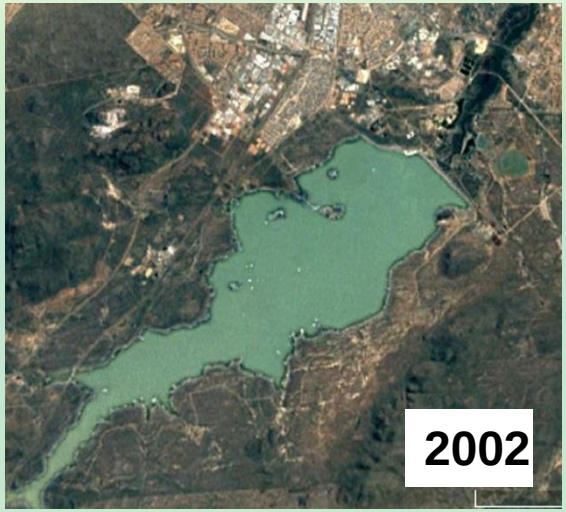
  by using modern instruments or sensors.

Why Satellite Topographic Mapping?

- To monitor change of water volume in reservoirs.
- To solve trans-boundary water conflict issues.
- To identify potential areas of flood risks.

Satellite for monitoring water volume change

Example: Gaborone Dam, Botswana



Satellite Trans-boundary water management

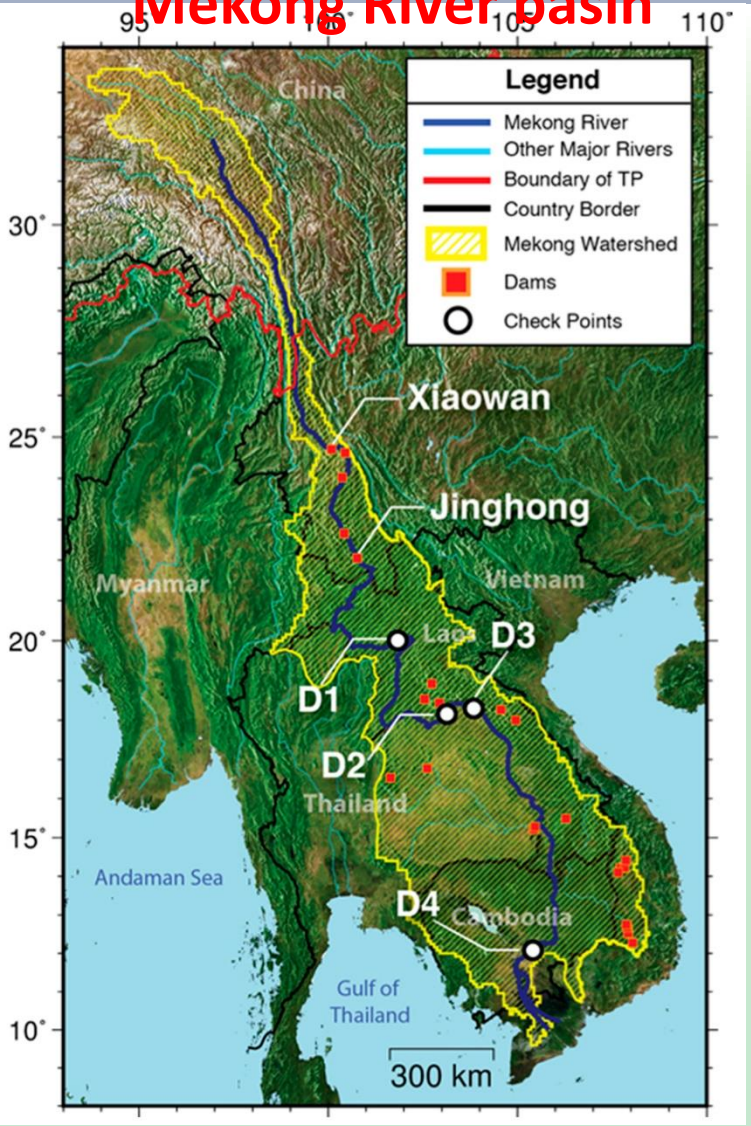
Water is a shared resources. **60% of fresh water comes from river basins that cross national borders** (UN University Institute for Water, Environment and Health Report 2017).

Eg. 1. Mekong River basin
2. Okavango river basin
3. Jordan river basin

Management of shared resources is a challenge.
In addition conflicts may arise.

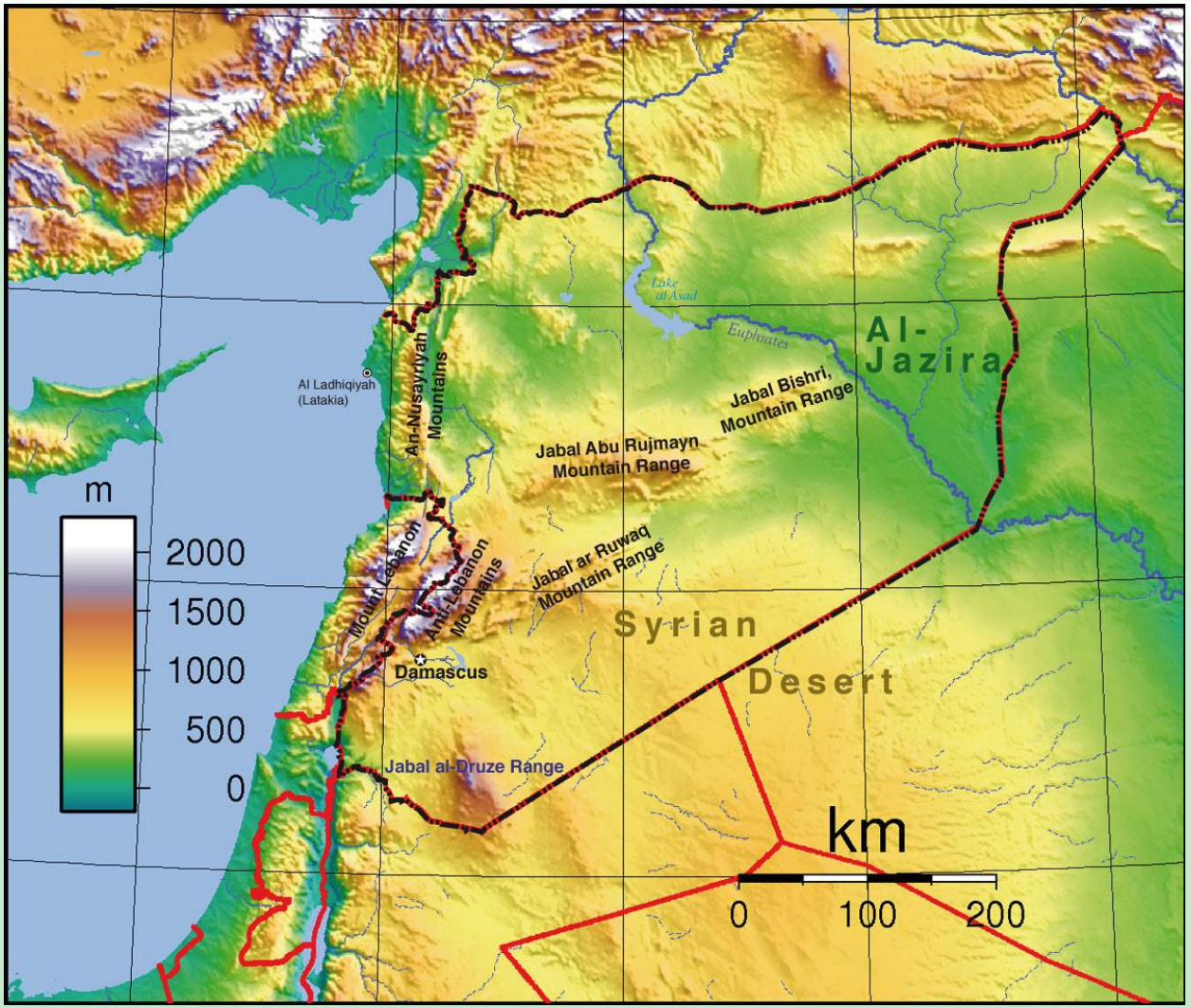
Satellite Trans-boundary water management

Mekong River basin



Kuan Ting Liu et al. 2016

Jordan River basin



http://www.nationsonline.org/oneworld/map/syria-topographic-map.htm

Satellite Trans-boundary water management

- Satellite can map all areas with conflict issues.
- Satellite can improve the international policies on shared water resources by providing real time and precise information for decision making.

Satellite Radio Detection and Ranging (RADAR) for topographic mapping

Selima Sand Sheet - Egypt/Sudan border

The radar waves had penetrated 5m or more of loose, porous sand to reveal the denser rock, gravel, and alluvium marking riverbeds that had dried up and been covered over tens of thousands of years ago.

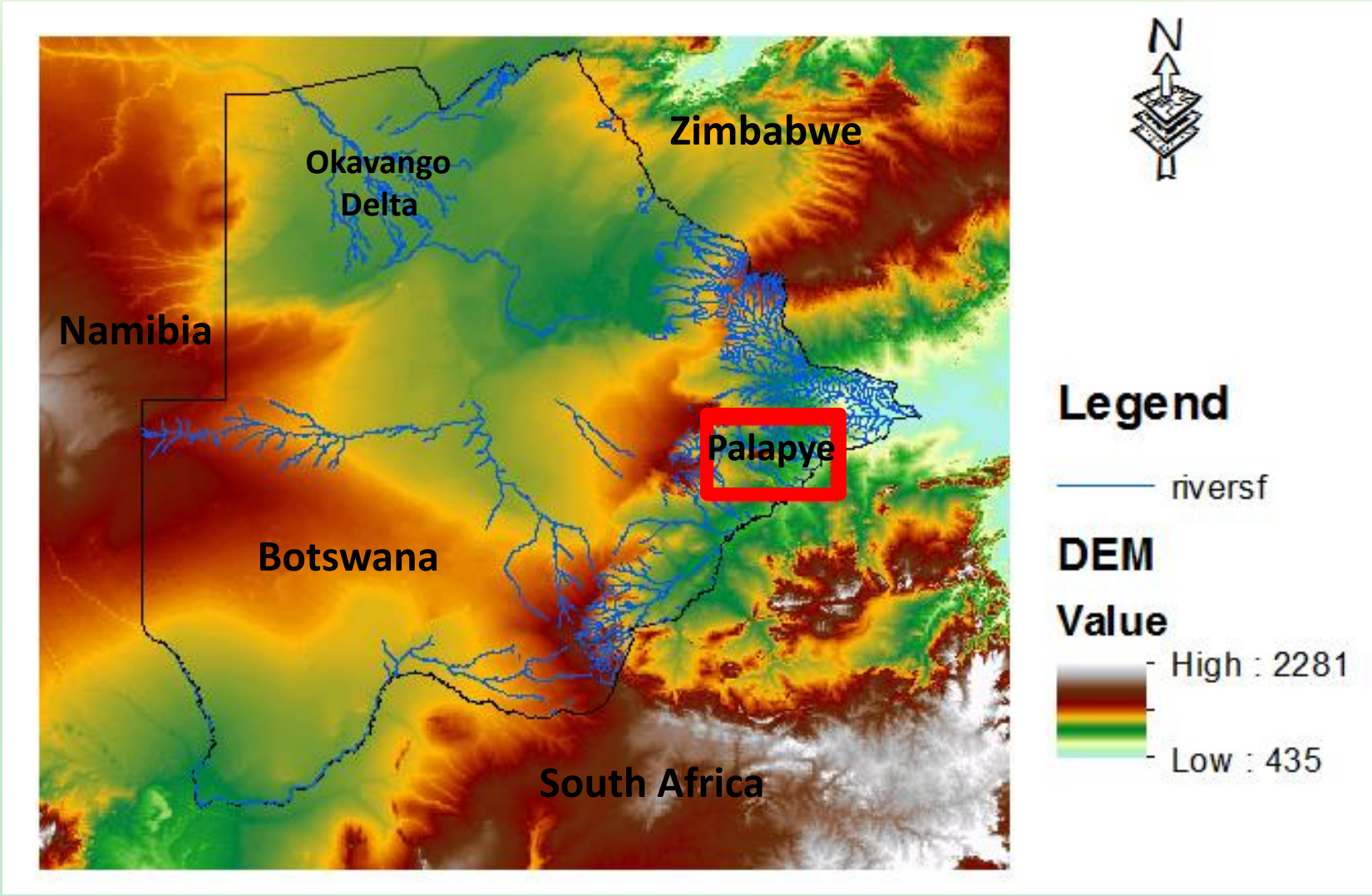
Left: *Optical view of the Sahara region (Africa) showing the vast, featureless expanse of sand. The white lines depict the radar flight path.*

Right: *Radar imagery over the same region, taken during STS-2 (1981), reveals the network of channels and dried-up rivers (radar rivers) beneath the sand sheets, thereby illustrating the power of radar for archeological mapping.*

Source: M. Kobrick & K. Lulla

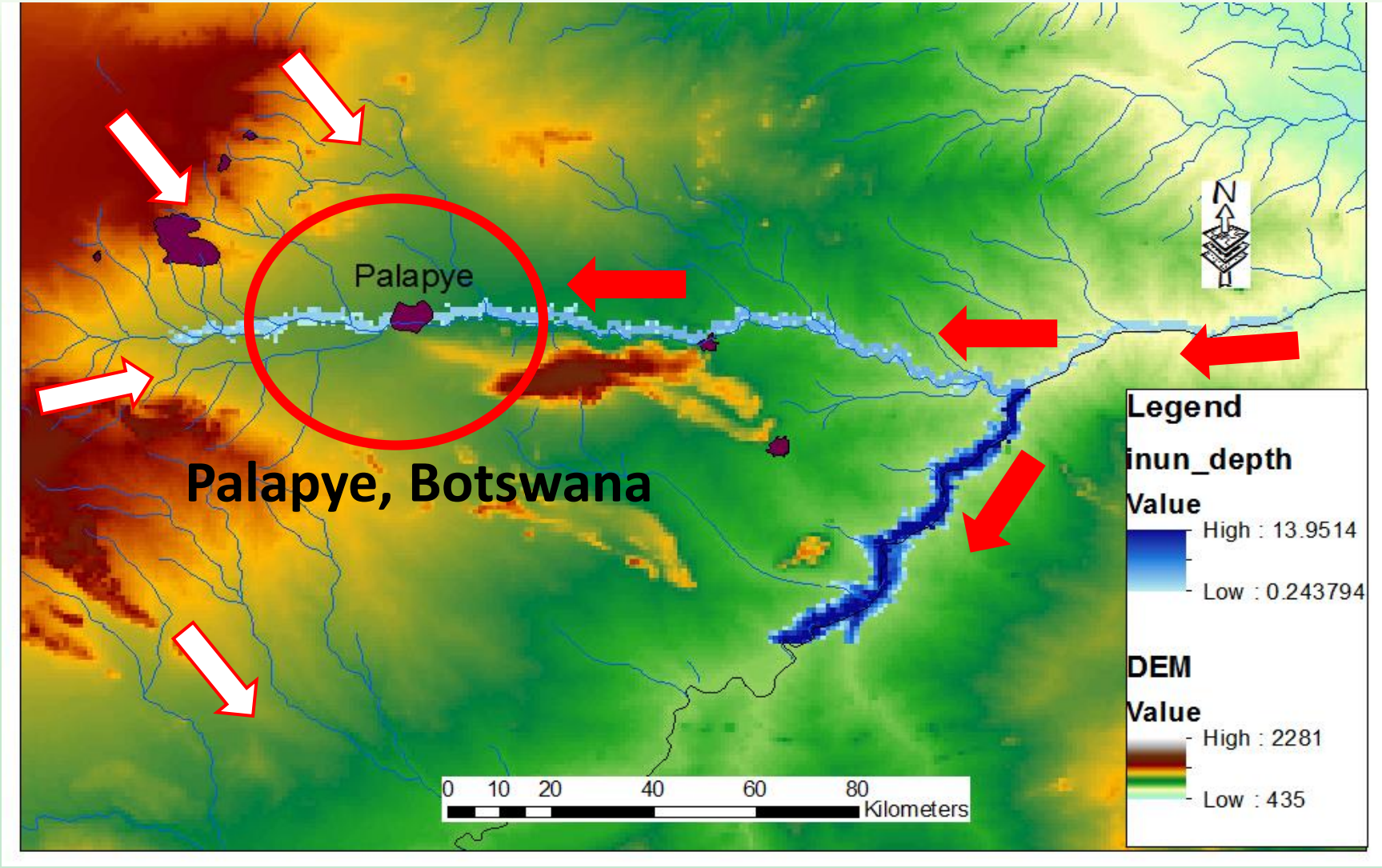
Potential flood areas, Botswana case

SRTM 30m Resolution



Potential flood areas 200m from a river .

using USGS GIS FLOOD TOOL



Water flow Direction

Flood Direction

Conclusion

- **Global precise water resources data and information is a need**
  - Satellite topographic mapping is a sustainable tool for
    - ✓ Monitoring,
    - ✓ Management
    - ✓ planning of water resources for decision making for Sustainable Development.
  - Satellite provide precise geospatial water information for better assessment and decision making.
  - Satellite provide long term solution for precision water management.

Recommendations

- Satellite topographic mapping should be used as a sustainable tool for precision water management
- Desserts and arid areas should be mapped with RADAR to reveal old rivers that have been covered by sands long time ago and channel the water to supply those areas.
- The river channels and water catchment should be mapped using satellite for a better precision water conservation.
- Satellite should be used to monitor the volume of water change in reservoirs.

Recommendations

- Water management research based on satellite mapping and related technologies should be encouraged and be supported
- Models and framework of water management should be developed for sustainable development.
- Water is a shared resource, therefore management of trans-boundaries should be done using satellite technology.

Thank You !