Expert Group Meeting
on
Coordinating Responses to Climate Change & Disaster Risk Reduction in the Arab Region
UN-House, Beirut, 19-20 December 2017

Capacity Building to Support Climate Change and DRR Policymaking in the Arab Region

Abdel Monem Sanad

Environmental Studies & Sustainable Development

Arab Academy for Sciences, Technology & Maritime Transport

AASTMT in Arab Region

- 5 Cities, 12 Campus, 2 Countries
- 30 Nationalities from MENA & Africa
- Member of IMO, University, Consultancy
- Many Centers; Maritime Safety Institute (MSI),
- Regional Maritime Security Institute (RMSI),
- Maritime Research & Consultancy Center (MRCC)
- Integrated Simulators Complex (ISC),

AASTMT in Arab Region

- Environment Protection and Crisis Management Center:
- Environmental Studies and Sustainable Development:
- Training Arab & African Countries for:

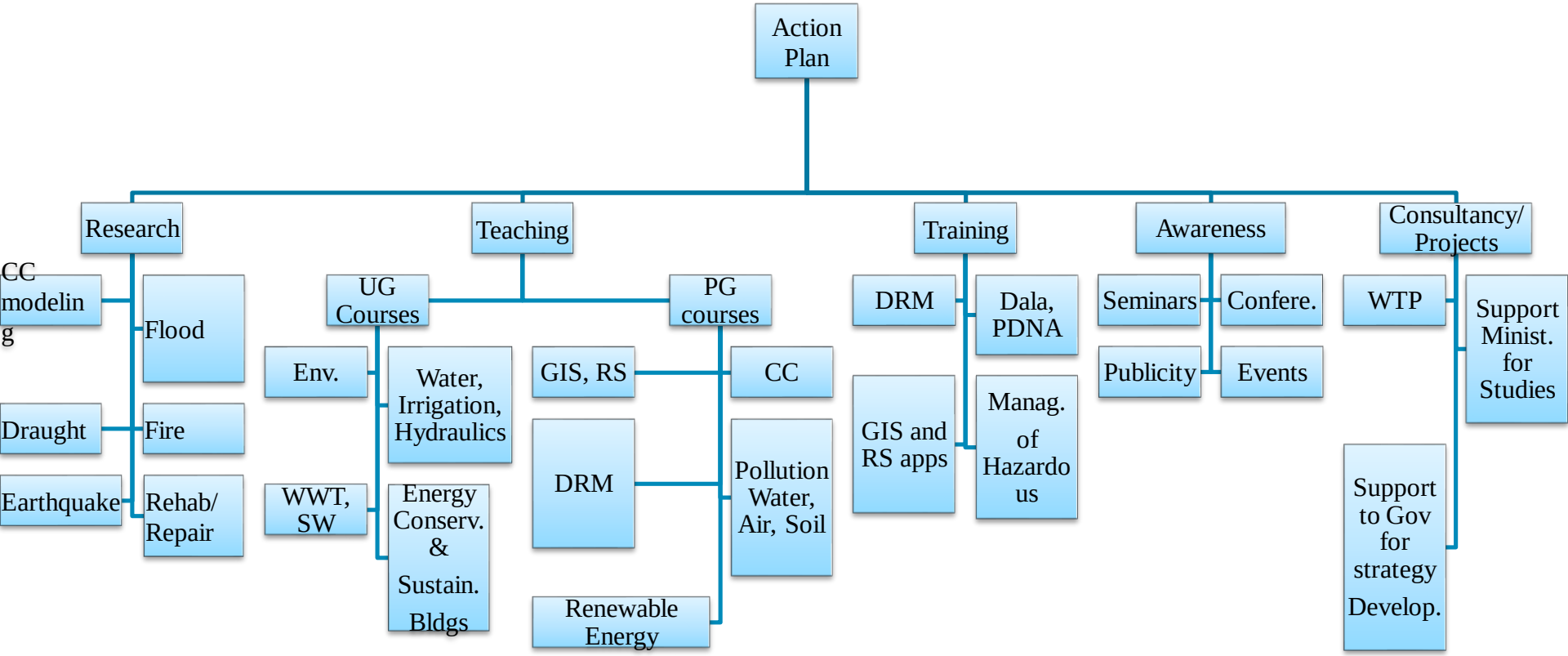
- Field of Oil Spill Response,
- Crisis Management,
- Marine Pollution,
- Environmental Damage and Loss,
- DRR and Integrated Management for Water Resources
- Environmental Monitoring Activities
- GIS & RS applications

AASTMT part of LAS

Non-Profitable & Self-financed Organization

- Teaching
- Research
- Training
- Consultancy
- Society Responsibility
- Support to Arab Governments
- Public Awareness, Conferences, Seminars

AASTMT Vision for CC & DRR in Arab Region



AASTMT Capacities for Training & Capacity Bldg

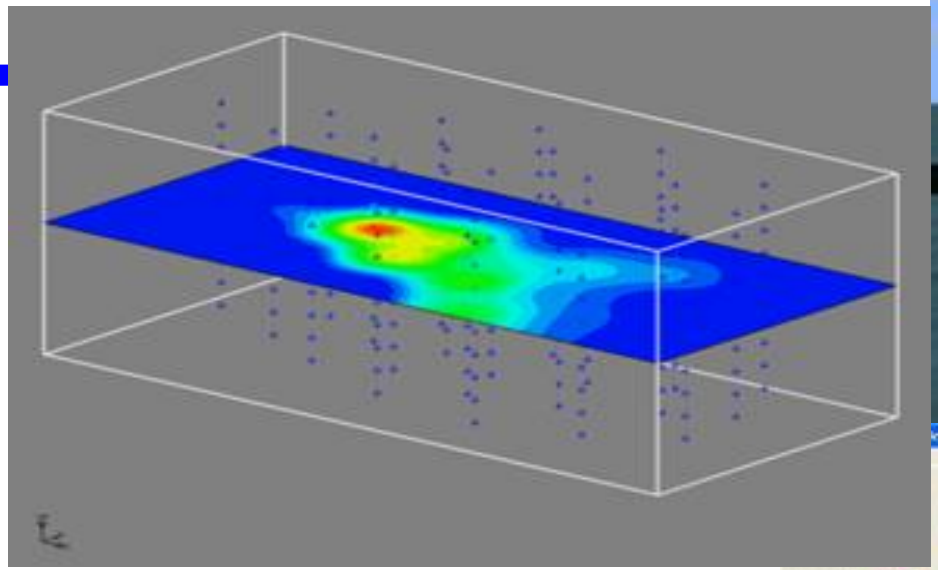
- Labs H/E
- Maritime Vessels & Equipment
- Training Facilities
- Conference Halls
- H/P IT infrastructures

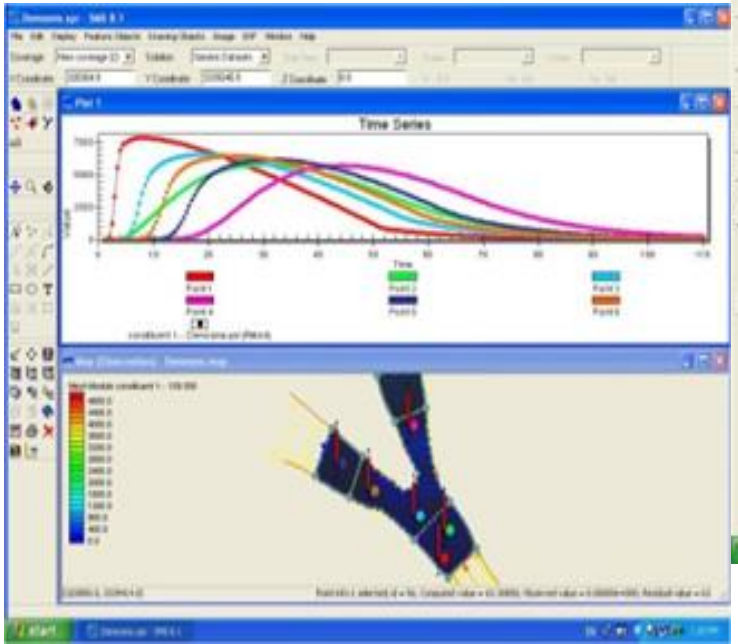
Practical Training

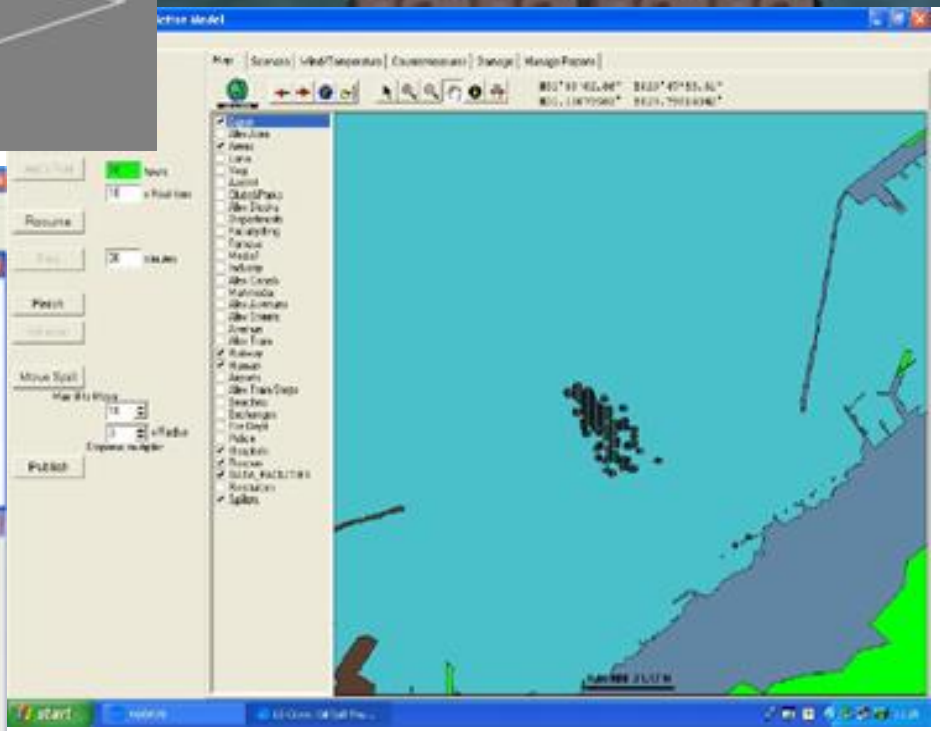
Training Facilities

Different locations Alex, Cairo, PortSaid, Aswan…

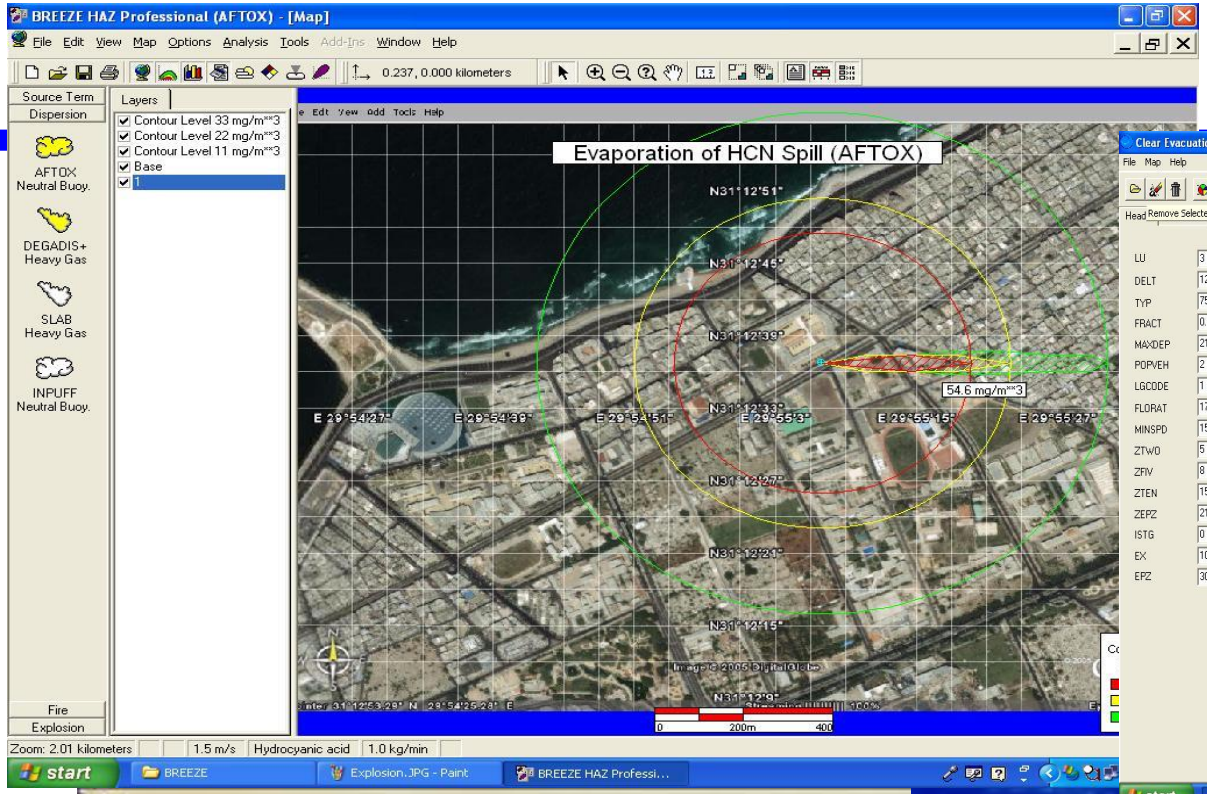
Simulators & IT

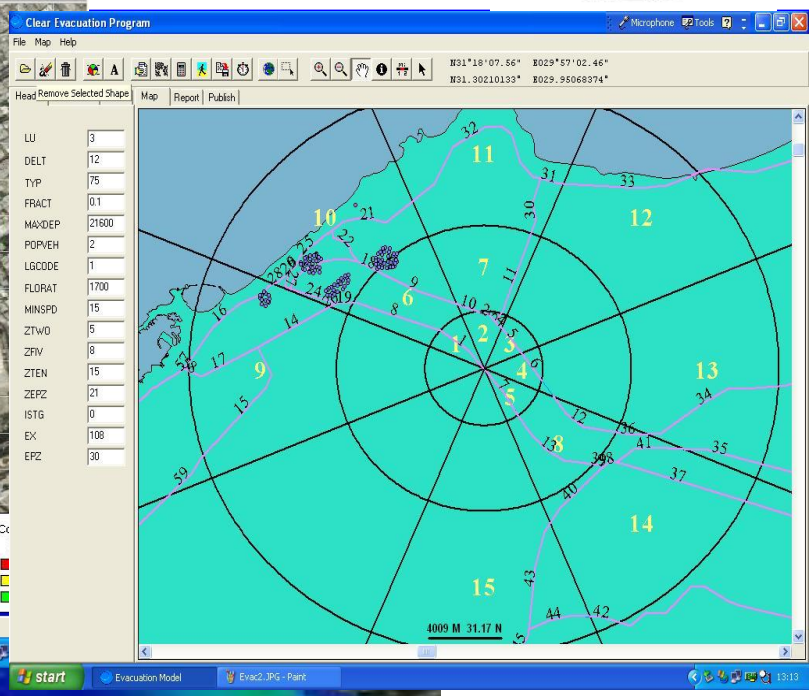


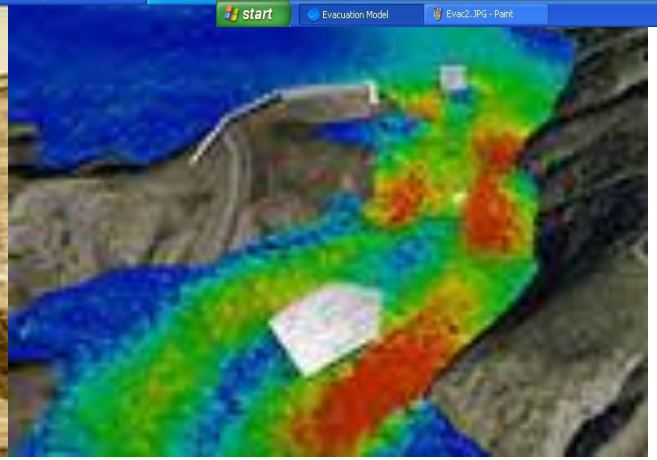




GIS & Remote Sensing







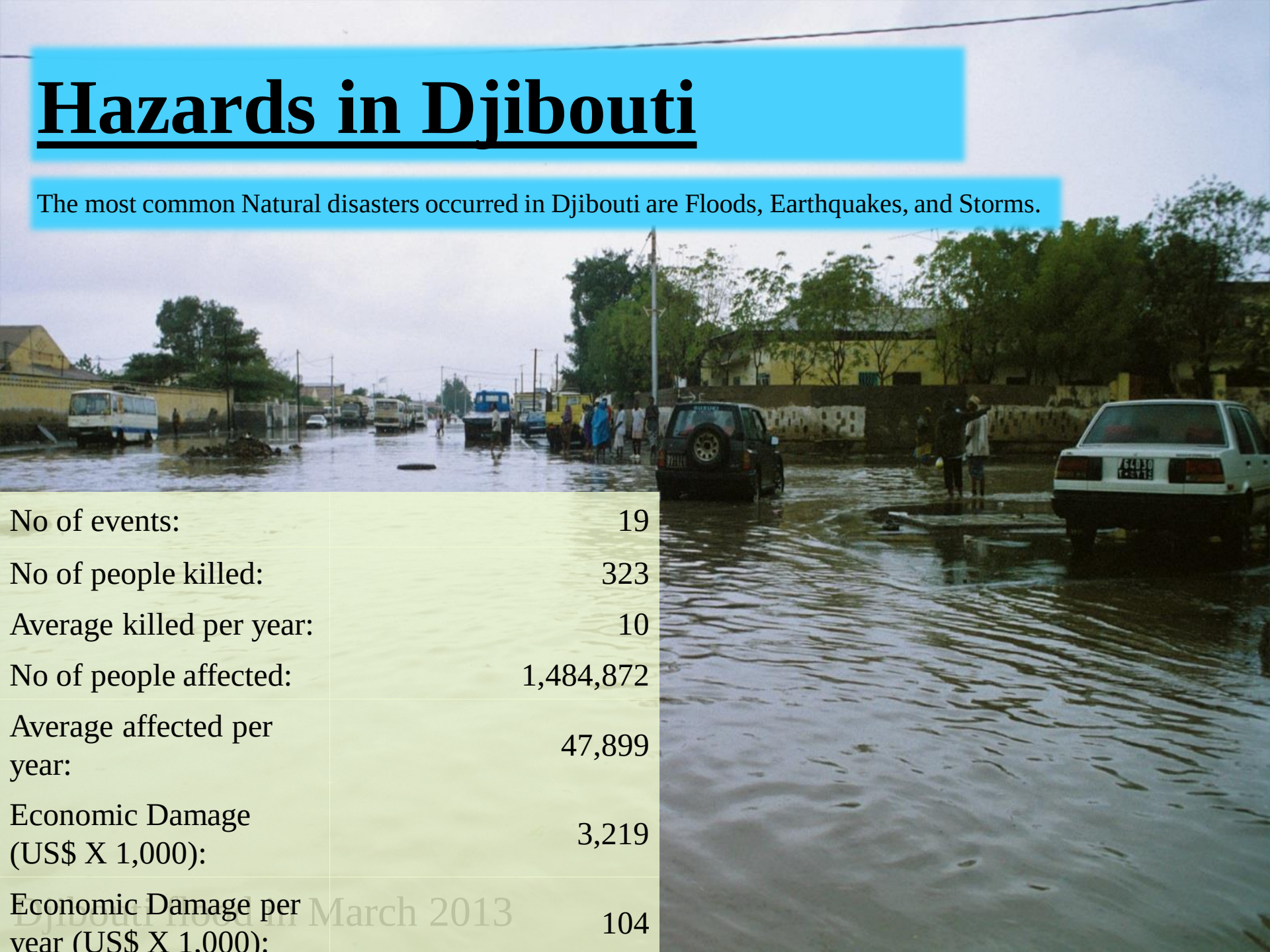
CC & DRR in Arab Region

- Flood, Draught & DRR Studies:
- Djibouti
- Yemen
- KSA
- Egypt

Hazards in Djibouti

Hazards in Djibouti

The most common Natural disasters occurred in Djibouti are Floods, Earthquakes, and Storms.



No of events:	19
No of people killed:	323
Average killed per year:	10
No of people affected:	1,484,872
Average affected per year:	47,899
Economic Damage (US$ X 1,000):	3,219
Economic Damage per year (US$ X 1,000):	104

Hazards in Djibouti

- **Natural Disasters from 1980 - 2010**

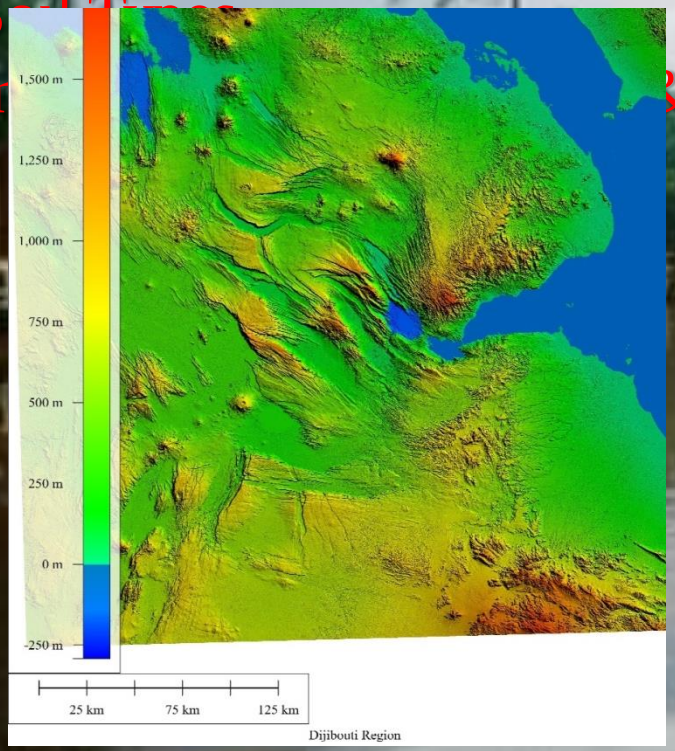
No of events:	19
No of people killed:	323
Average killed per year:	10
No of people affected:	1,484,872
Average affected per year:	47,899
Economic Damage (US$ X 1,000):	3,219
Economic Damage per year (US$ X 1,000):	104

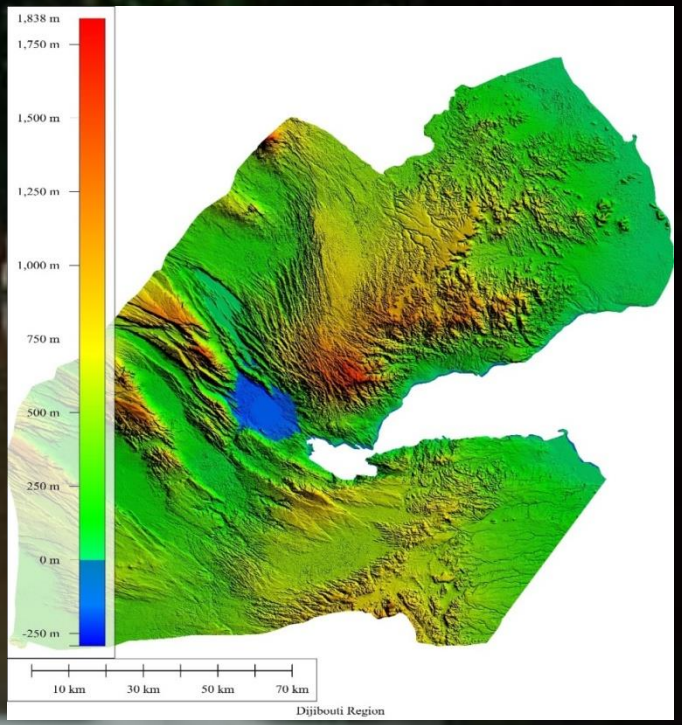
Djibouti flood in March

Methodology:

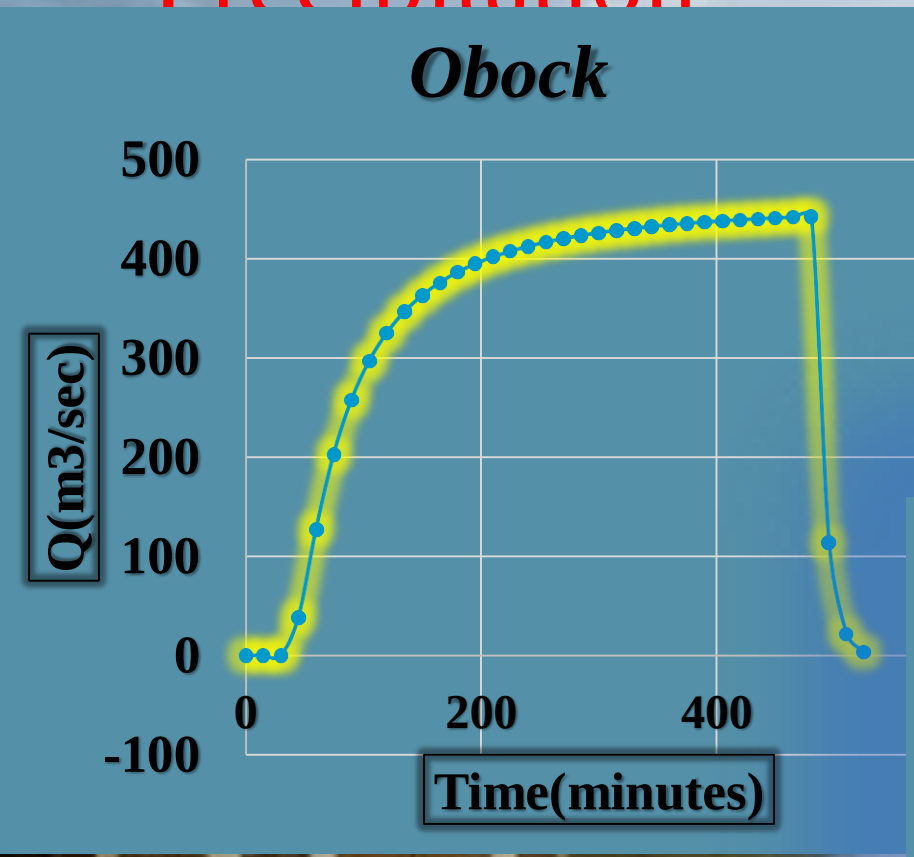
Using DEM of Djibouti .

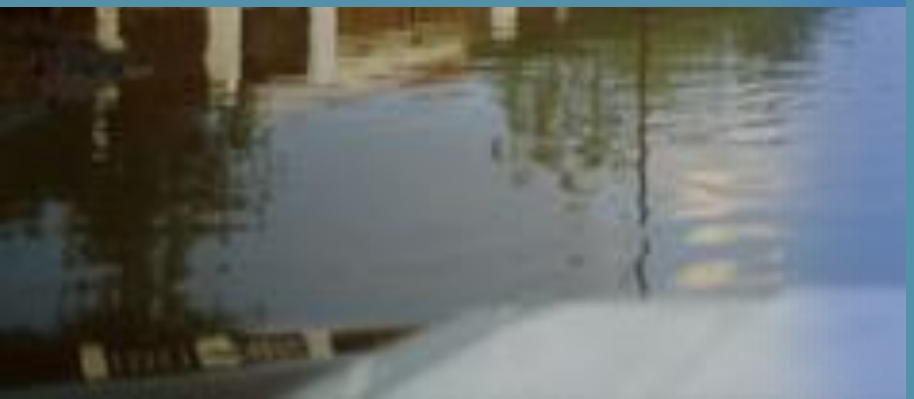
- Point of Flood outcome in Arta ,Djibouti,Tadjoura,Obock .
- Simulation of watershed calculation.
- S
- I & duration.

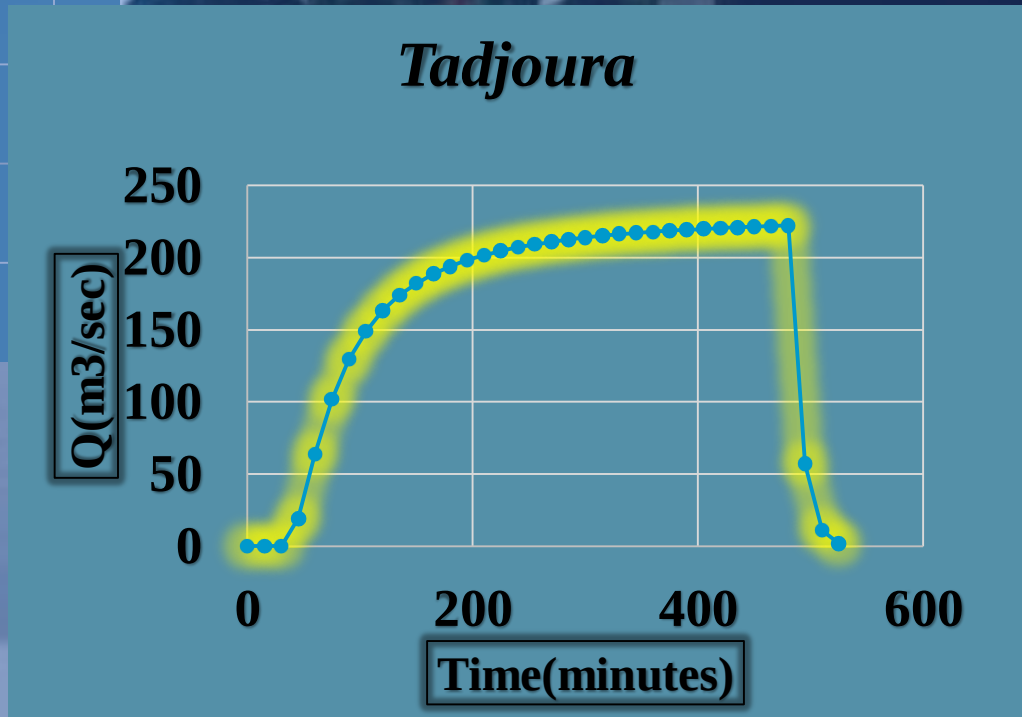




Precipitation





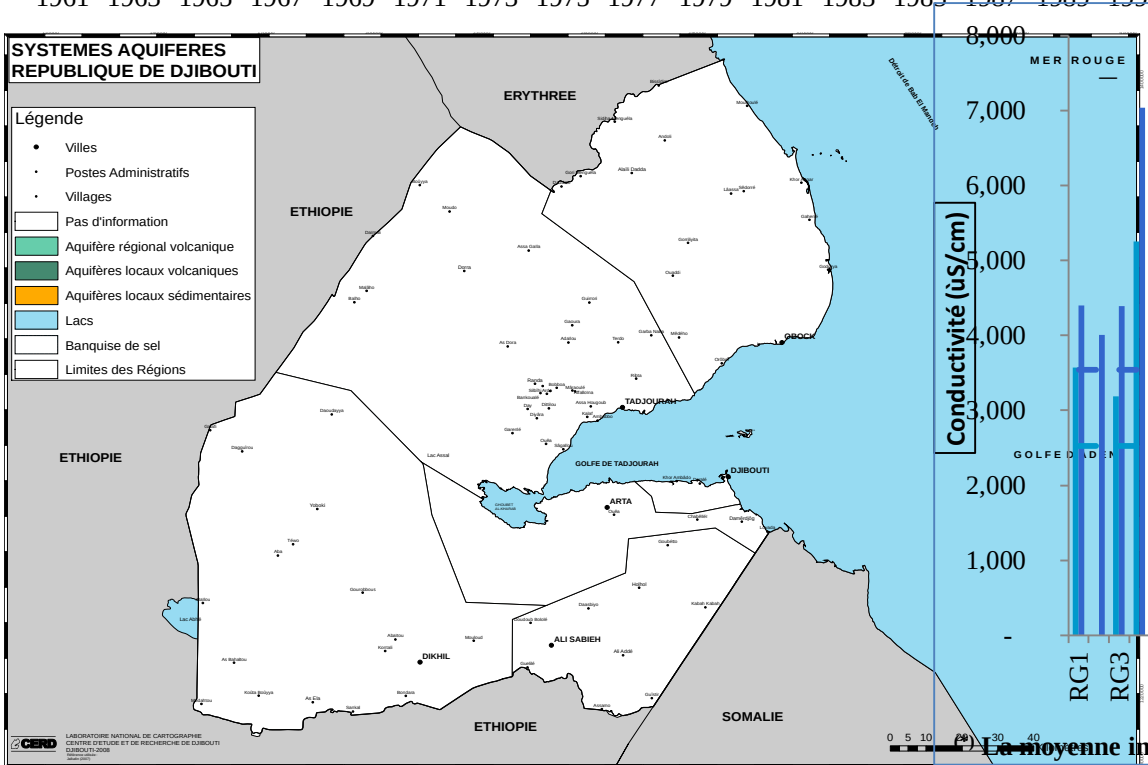


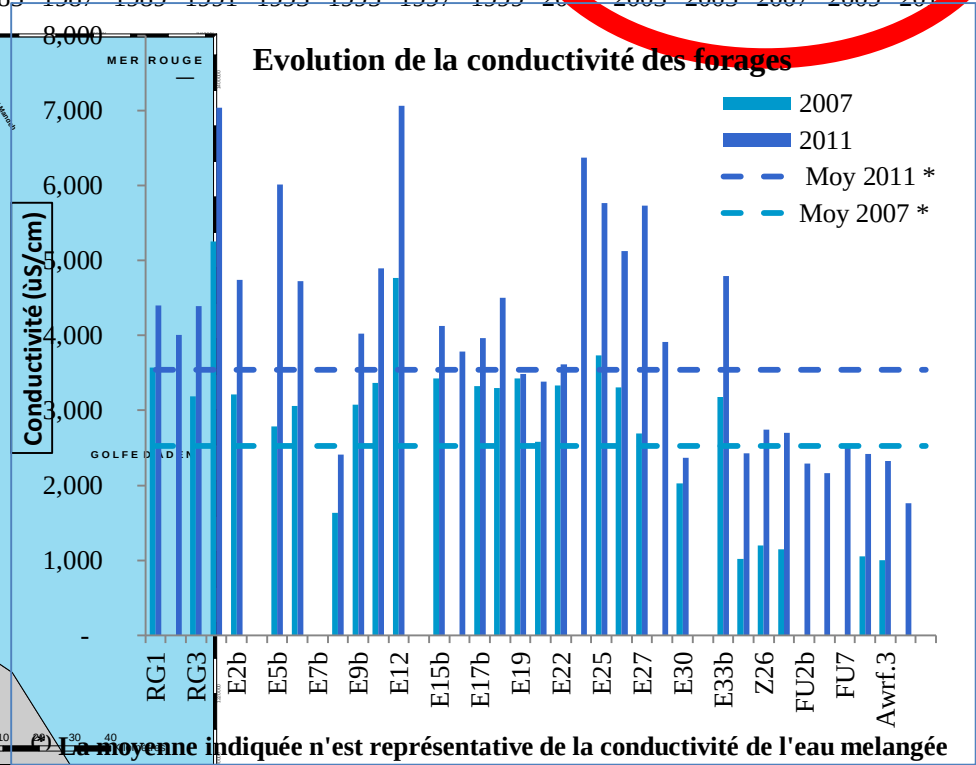
Drought in Djibouti

Extreme Drought in the Horn of Africa (2011)
Estimating Losses and Damage using GIS

Total Annual Rainfall

Drought





a moyenne indiquée n'est représentative de la conductivité de l'eau melangée

Djibouti Main Basin / Reservoir

Drought Losses & Damages

Composantes des dommages et pertes	Nombre d'unit	Prix unitaire	Total $	Total MDj
A. Infrastructure Endommagés (Non Utilisables)				
1. Eau de surface (0-20m) pour eau potable				
Puits cimentes Endommagés (Q=5m3/j, P=12 000$, H=12m,	272	12 000	3 264 000	
2. Eau de surface pour agriculture/elevage				
Puits traditionnels Endommagés (Q=20l/h, P=7500$, H=4m	350	7 500	2 625 000	
Réservoirs Agricoles (50m3, 10 000$)	140	10 000	1 400 000	
3. Sources d'eau profondes (>30m)				
Forages Endommagés (Q=20m3/h, P=100 000$, H=120m, I	7	100 000	700 000	
Réservoirs (100m3, 20 000$)	7	20 000	140 000	
4. Coût de dommages			**8 129 000**	**1 438 833 000**
B. Réhabilitation / remplacement d'infrastructure				
5. Eau de surface (0-20m) pour eau potable				
Puits cimentes réhabilités	400	3 000	1 200 000	
6. Eau de surface (0-20m) pour agriculture/elevage				
Citernes réparées (Augmentation de capacité de 100 a 140	25	7 000	175 000	
Retenues reconstruites (10000m3, 31 000$; 20000m3, 40 00	17	31 818	540 909	
7. Eau souterraines (>30m)				
forages de remplacement (20m3/h, 100 000$)	52	100 000	5 200 000	
Réservoirs de remplacement (50m3, 20 000$)	21	20 000	420 000	
Nouveaux forages ONEAD pour compenser perte de debi	9	100 000	900 000	
8. Unites de dessalement				
Installation unites d'urgence 200m3/J (Balbala, Khor Angar)			1 400 000	
9. Coût de réhabilitation et remplacement			**9 835 909**	**1 740 955 909**
C. Couts d´opérations plus élèves				
Coûts opérationnels, pré désastre (pompage 3h/jour) (40 l	504 000	1	626 441	
Coûts opérationnels, pendant la sécheresse (pompage 8h/	1 344 000	1	1 670 508	
Coût de l'eau importé par camions (2x12m3/région/jour, 30	1 800	450	810 000	
Distribution par camion citerne MEE (carburant)	720 000	1.1	801 356	
Autres coûts opérationnels pendant la sécheresse ("food	6 364	11	70 000	
Coût total opérationnel pendant la sécheresse (10+11+12)			3 351 864	
10. Augmentation du cout operationnel (zone rurale)			2 725 424	
gmentation cout operationnel (Djibouti+5 villes) (extrapolation en absence de			5 450 847	
gmentation des coûts opérationnels (14+13 – 9)			**8 176 271**	**1 447 200 000**
D. Pertes de Patrimoine (Ville de Djibouti)				
13. Potentiel d'eau exploitable (m3) avec cout alternative	60 000 000	0.50	**30 000 000**	**5 310 000 000**
Pertes totales pour la sécheresse (4 + 8 + 14 + 15 + 16)			**56 141 180**	**9 936 988 909**

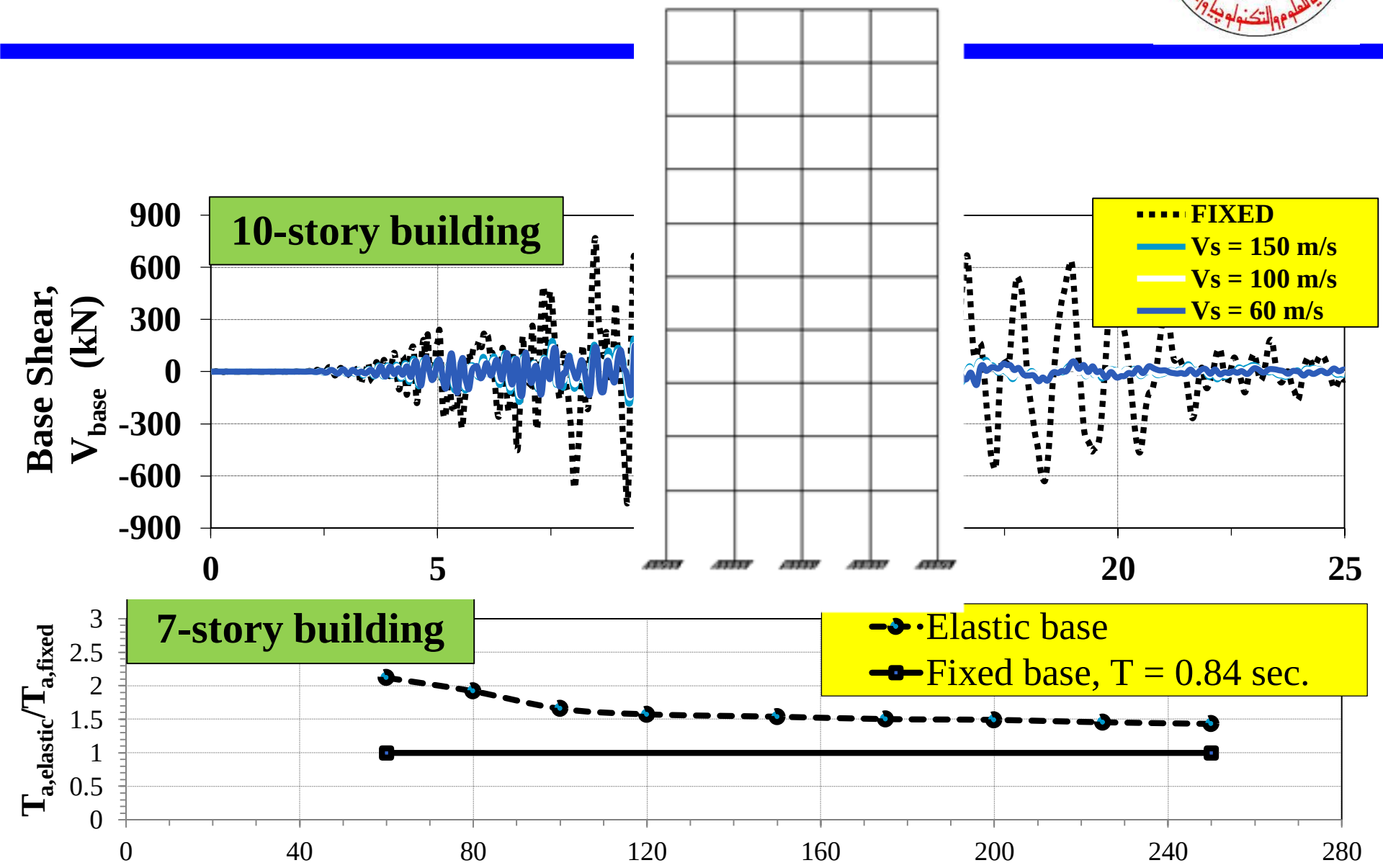
Water Loss

Earthquake Research:

- Earthquake Impact & Building Rehabilitation

- 2 years MSc research project, Inter-university collaboration, “Effect of Soil-Structure Interaction on Nonlinear Seismic Response of Buildings”.
- 2 years MSc research project, Cairo University collaboration, “Design Procedure for Seismic Retrofitting of RC Columns using GFRP jacket”.
- 1 year MSc research project with Cairo University” Seismic Rehabilitation of existing Structures using FRP confinement”.
- 2 years MSc research project, “Effect of Environmental Corrosion on Sea Front Reinforced Concrete Structures”.
- 2 years MSc research project, “Nano material to prevent Corrosion on Sea Front Buildings”.

Earthquake *- Effects of Soil-Structure Interaction on Nonlinear Seismic Response of Buildings*



Conclusion:

- For V_s=60 to 250m/s, ignoring SSI decreased the fundamental period by up to 53%, 43%, 33%, and 25% for buildings with 7, 10, 14, and 18 stories, respectively.
- Ignoring SSI increased the spectral acceleration by 313% and 61% for the 7- and the 18-story buildings, respectively.
- The maximum base shear for fixed base buildings can be three and four multiples of its correct “flexible base” value for the 10-story and the 7-story buildings, respectively.
- For the same PGA and fixed-base case, the base shear of the 10-story building for the Victoria record is about 70% of its value for the Kobe one but the base shear of the 7-story building is almost the same under both earthquakes.
- SSI effects become highest for low-rise buildings on soft soils when subjected to earthquakes with large PGA’s.

Fire Risk:

Fire Effect, Building Exposure & Protection

- Large Scale Tests
- Heat Transfer
- Flame Propagatio
- Thermal Analysis

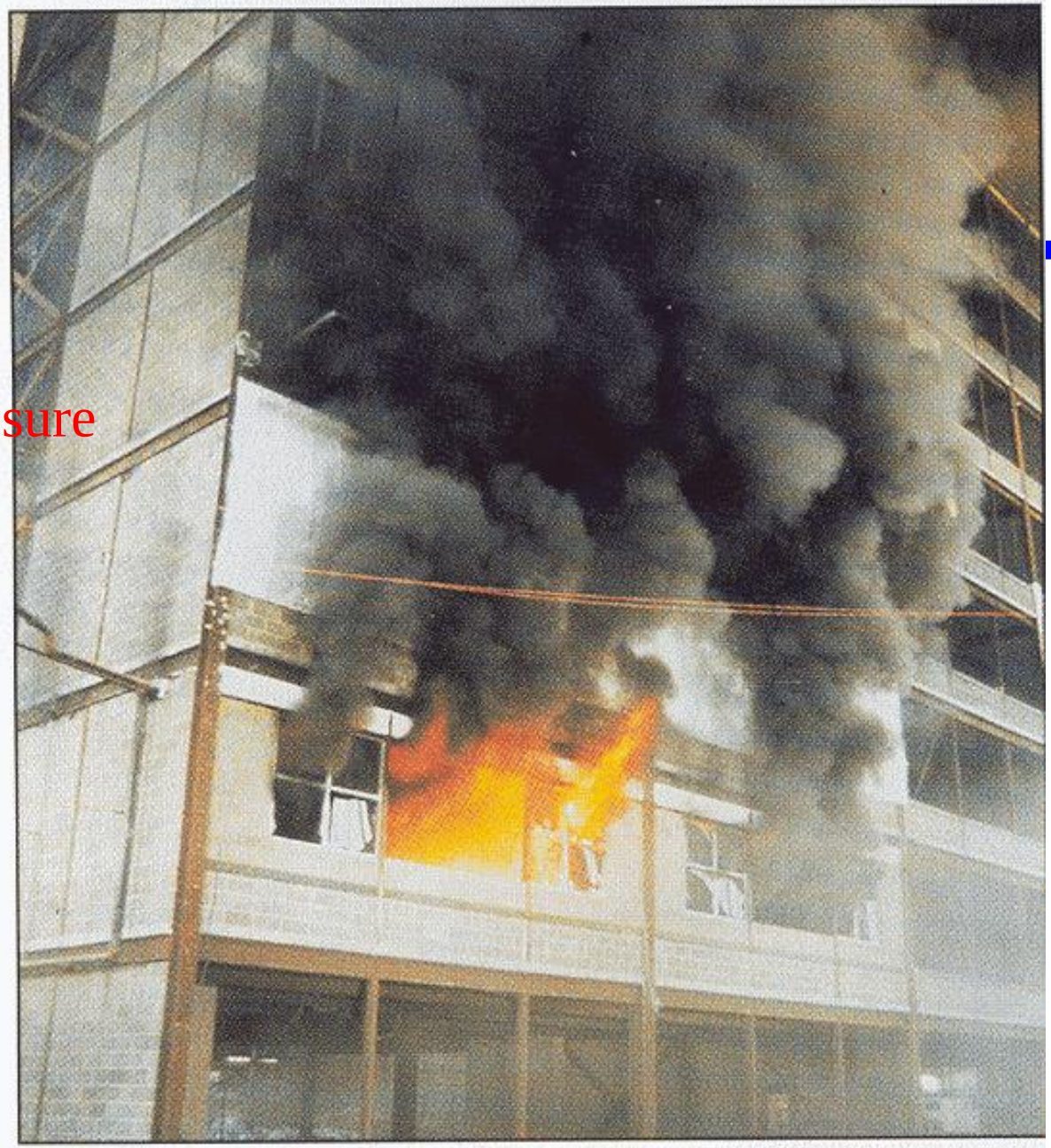
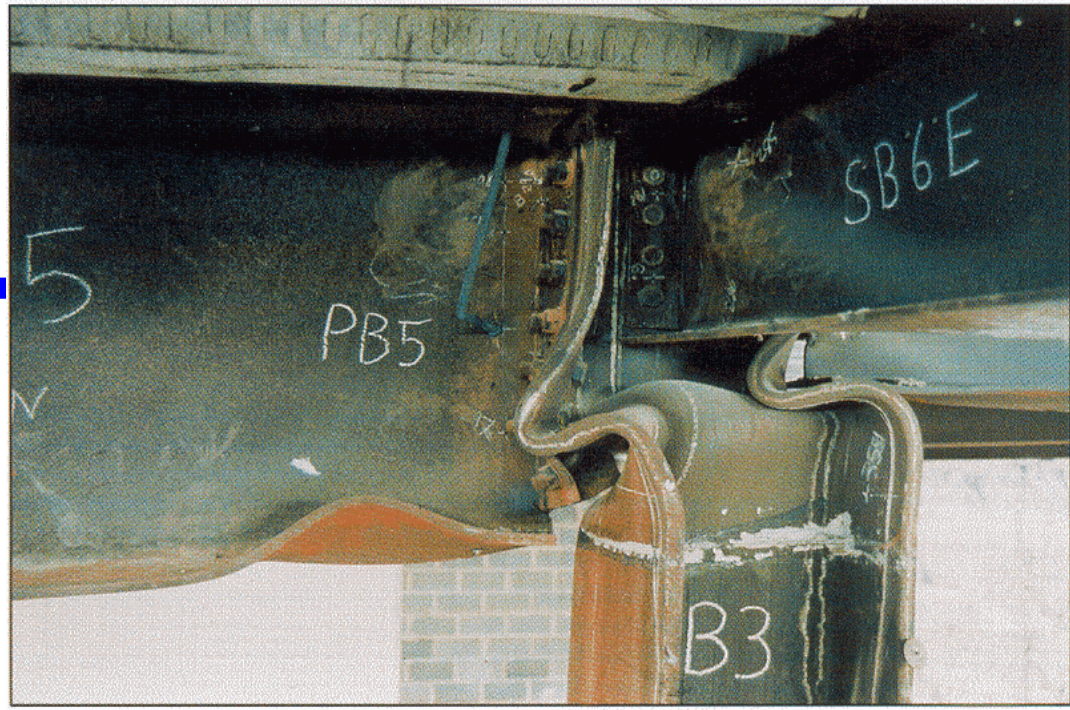


Figure B.3.17 *External view of fire*

Fire Risk:
Struct. Collapse



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Teaching in DRM:

- ***Energy Conservation & Sastinability:***
- Graduation project on reduction of heat transfer from buildings to reduce CO2 emission.
- Graduation project on passive cooling of brick wall using domestic water.
- ***Development project:***
- Graduation projects on Design of Development Corridor in Egypt using GIS (Phase1).
- Graduation projects on Design & Risk Assessment of Development Corridor project (Phase2).
- ***Environment Engineering:***
- Creation of new MSc program in Environment Engineering.
- Creation and integration of new courses for Engineers on Climate Changes impact.
- Modification of undergraduate courses in Renewable Energy, Waste Water Treatment Plant and Solid Waste Treatment .

Trained Staff for DRM:

- ***Training of Trainers Course for PDNA, UNDG & World Bank***
- *Training Course "Comprehensive Disaster Risk Management Framework",WB-GFDRR.*
- ***Training Course on Post-Disaster Damage, Loss and Needs Assessment, WB-GFDRR.***
- ***Workshop on Risk Assessment Overview and Some Mechanics, World Bank, GFDRR.***
- *Course on " Fire Safety & Forensic Science", Edinburgh.*
- ***World Bank Mission to Djibouti for Draught-Post Disaster Needs Assessment.***

National and Regional Objectives:

- **Teaching and Training**
- Development of Regional Database for DR Assessment and DRR tools and methodology (Historical Data for EQ, Floods, Draughts)
- Creation of Strong web site to become the regional hub and/or data bank for DRR (similar to the japan site)
- Promotion of DRR for Regional and national stakeholders and general public through the Internet tools (Facebook, Twiter etc…)
- Promotion of DRR for Regional and National decision maker through seminars ,workshop and conferences.
- Link between the training institutes (DRR experts, WB, UN, Local experts and the regional government trainers (clients)

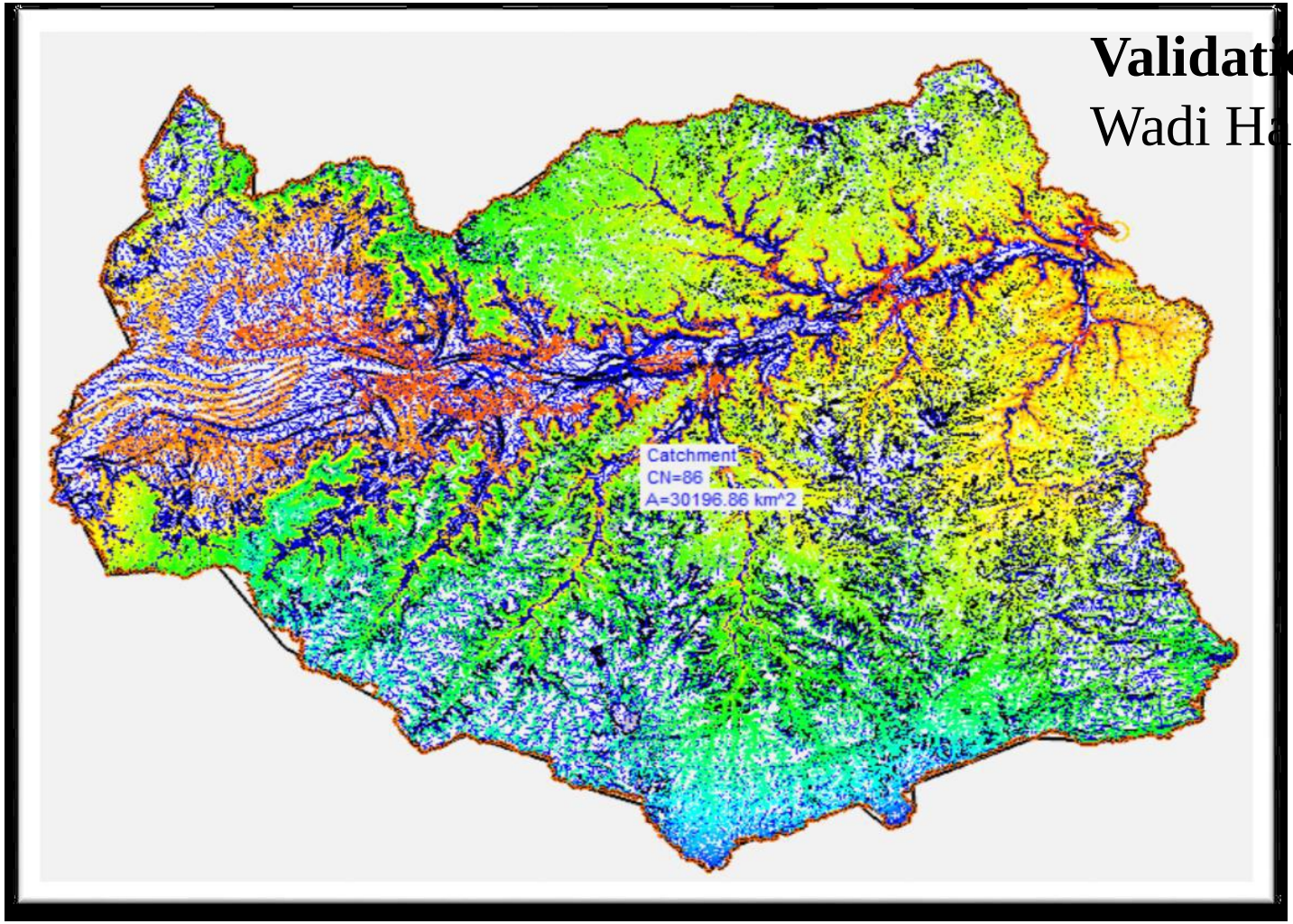
Capacity Building for CC & DRR in Arab Region

- RS, GIS
- Disaster and Loss of Disasters
- Management & RR of Hazardous Substance
- KSA
- Egypt

Study of Flood Risk in Yemen

- Destruction of property and agricultural land in t

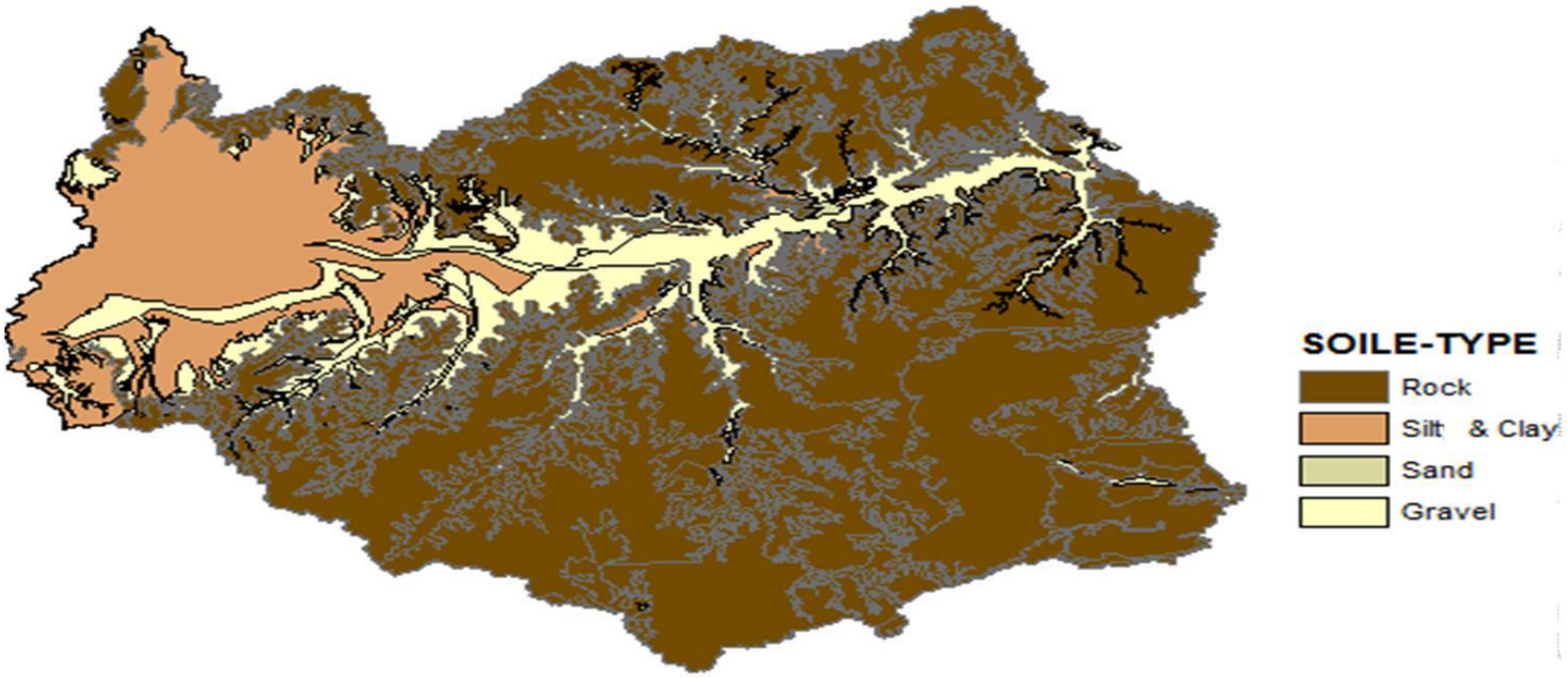
Flood Risk in Yemen



Validation and Testing

Wadi Hadramout Catchme

Flood Risk in Yemen



Modeling of Surface Runoff
Mean soil classification map Wadi Hadramout.

Mitigation of Flood Risk in Yemen:

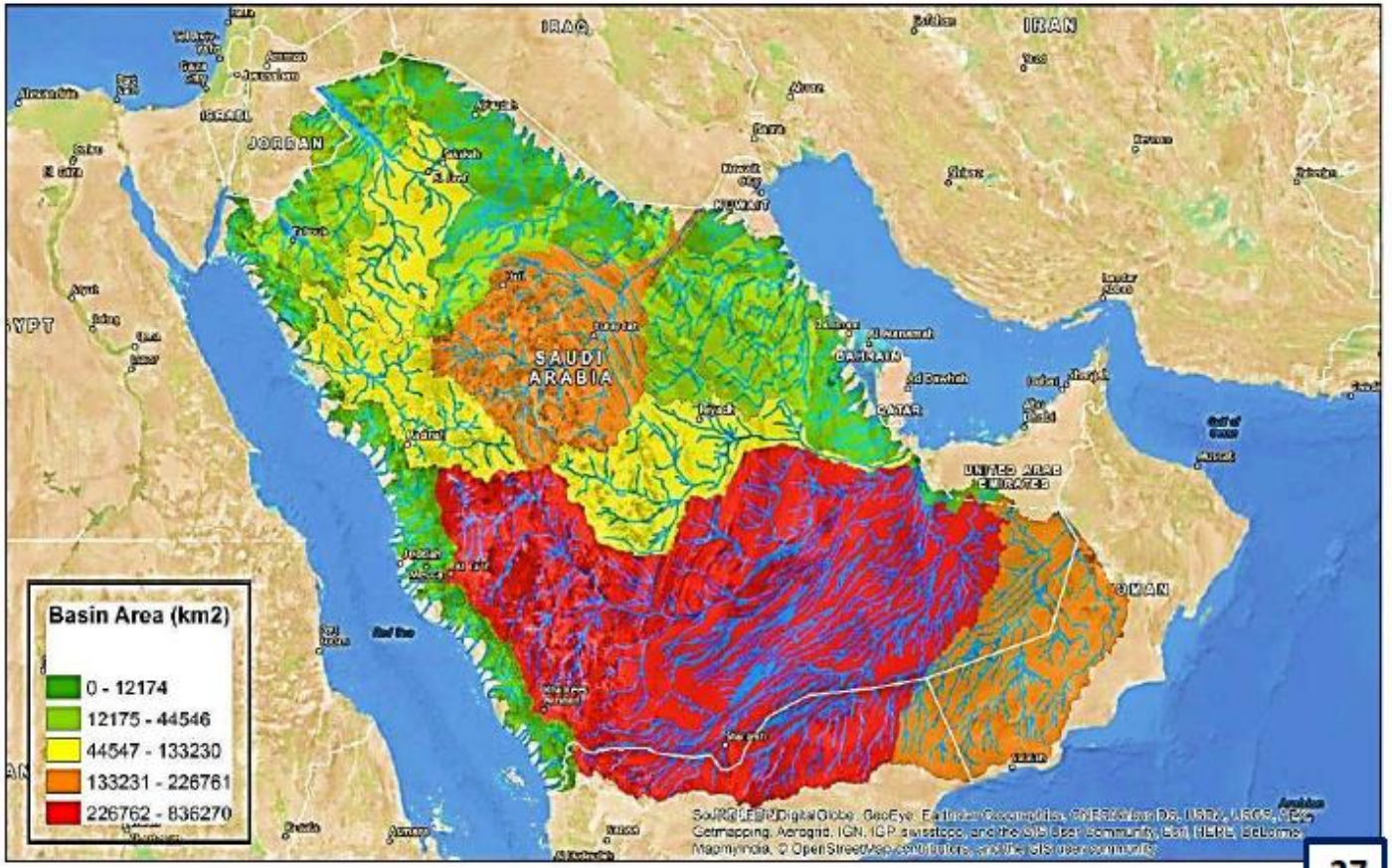
- Mitigate the flood risk should be controlled by a control system.
- In Hadramout catchment the control system is dam construction to store
- flood water and reduce the flood peak.
- Two scenarios were selected. The first scenario is to build one dam at the outlet of the biggest sub-catchment.
- One dam is not enough for the reduction needed.
- It was found that another sub-catchment is suitable in Hadramout Catchment.

Flood in KSA

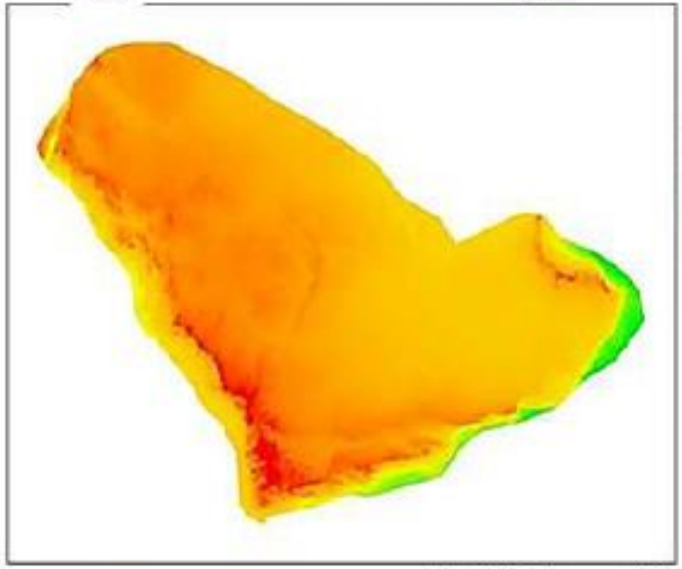
Study area characteristics

(Step 2-Delenating Streams)

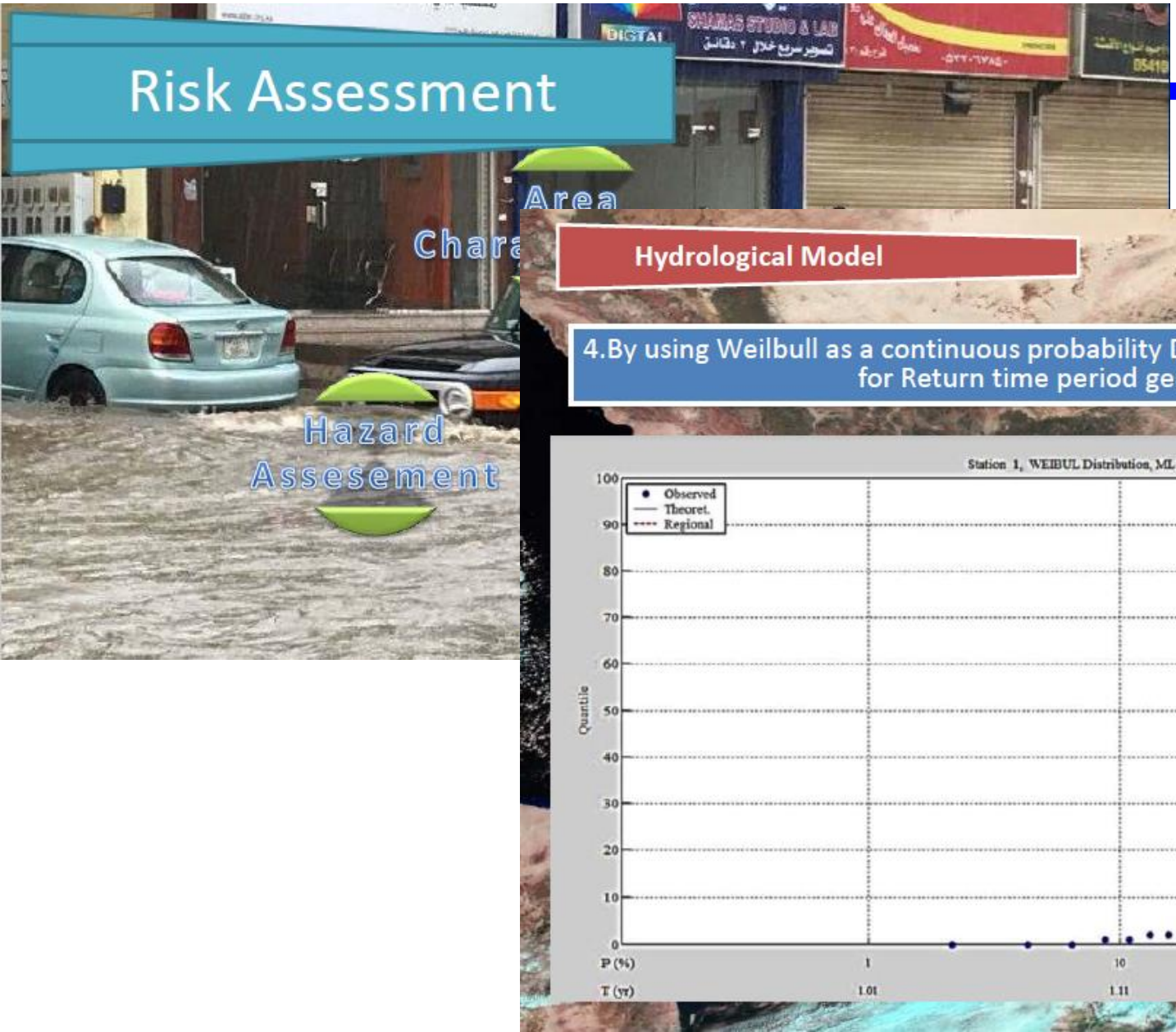
Kingdom of Saudi Arabia Major Watersheds



DEM OF KINGDOM OF SAUDI ARABIA

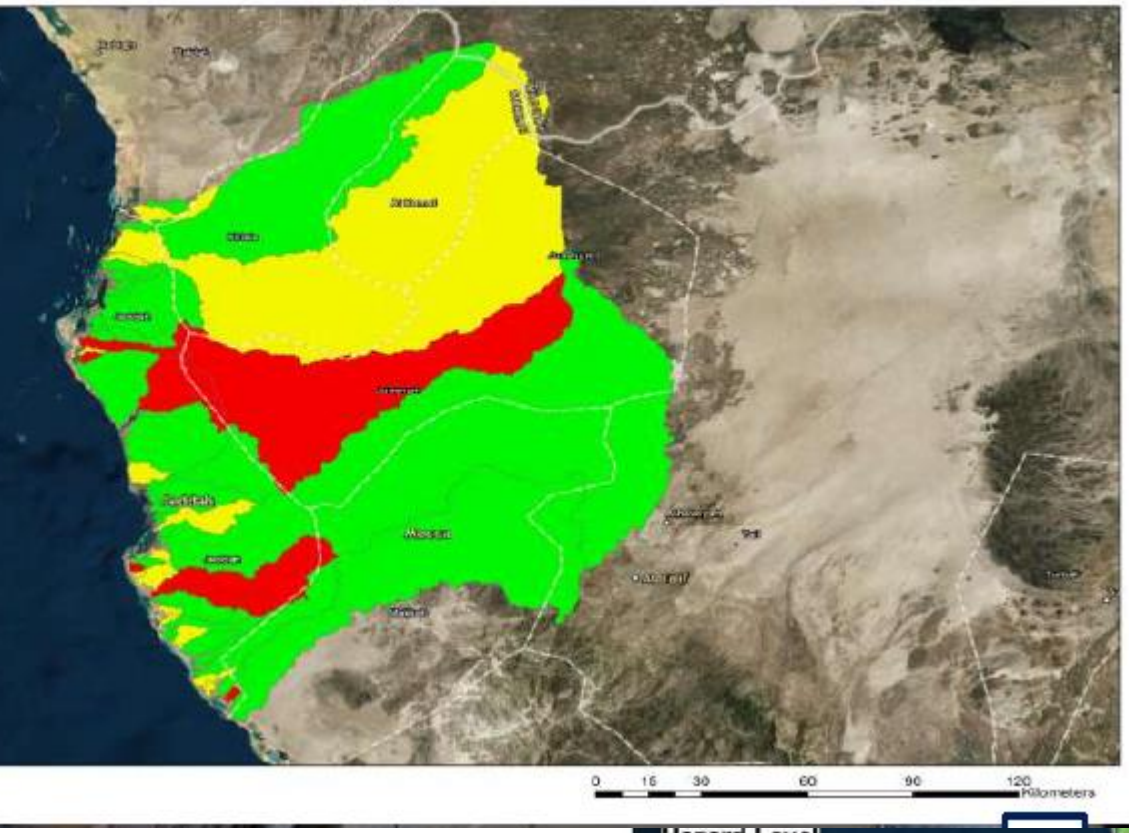


Flood in KSA


Risk Assessment
Area
Chara
Hazard
Assesement
Hydrological Model
4.By using Weilbull as a continuous probability Distribution For Jeddah Station for Return time period generation
Station 1, WEIBUL Distribution, ML Method
Observed
Theoret.
Regional
Quantile
P (%)
T (yr)

Flood in KSA

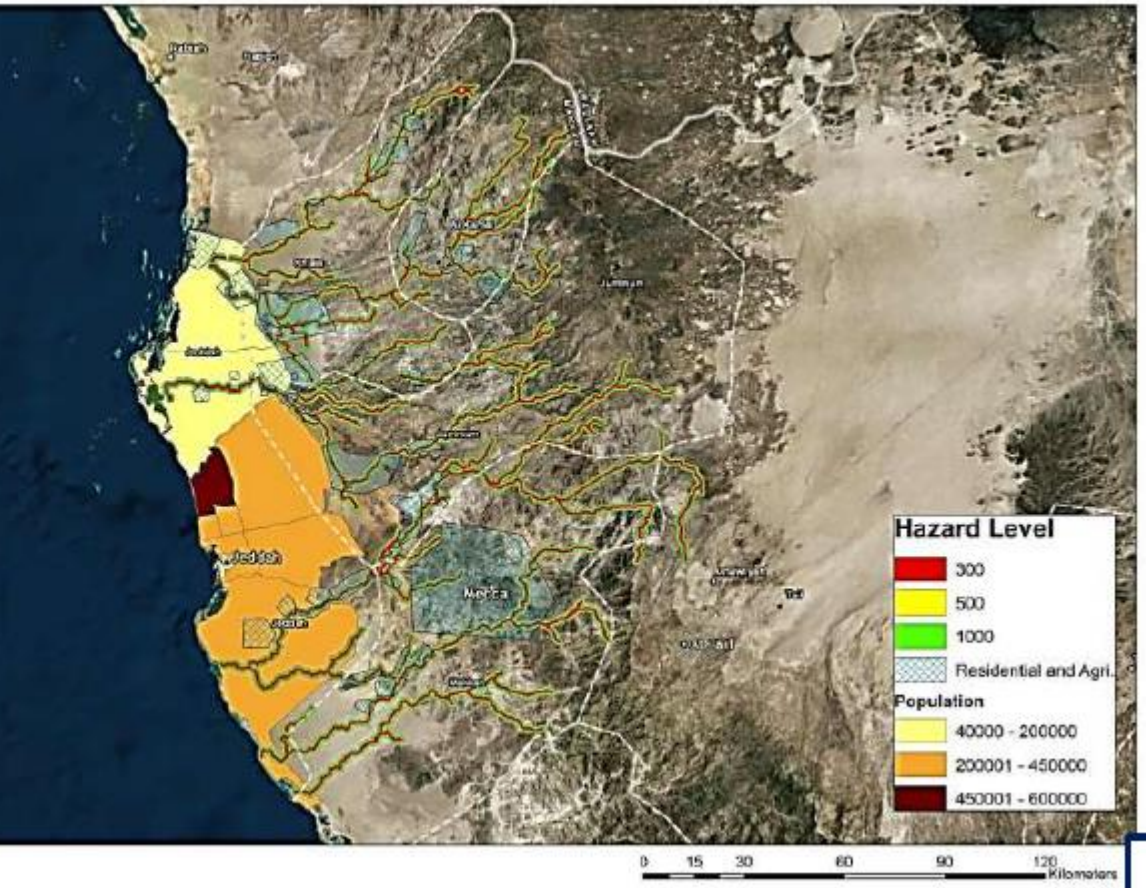
Global Hazard Map of Watersheds



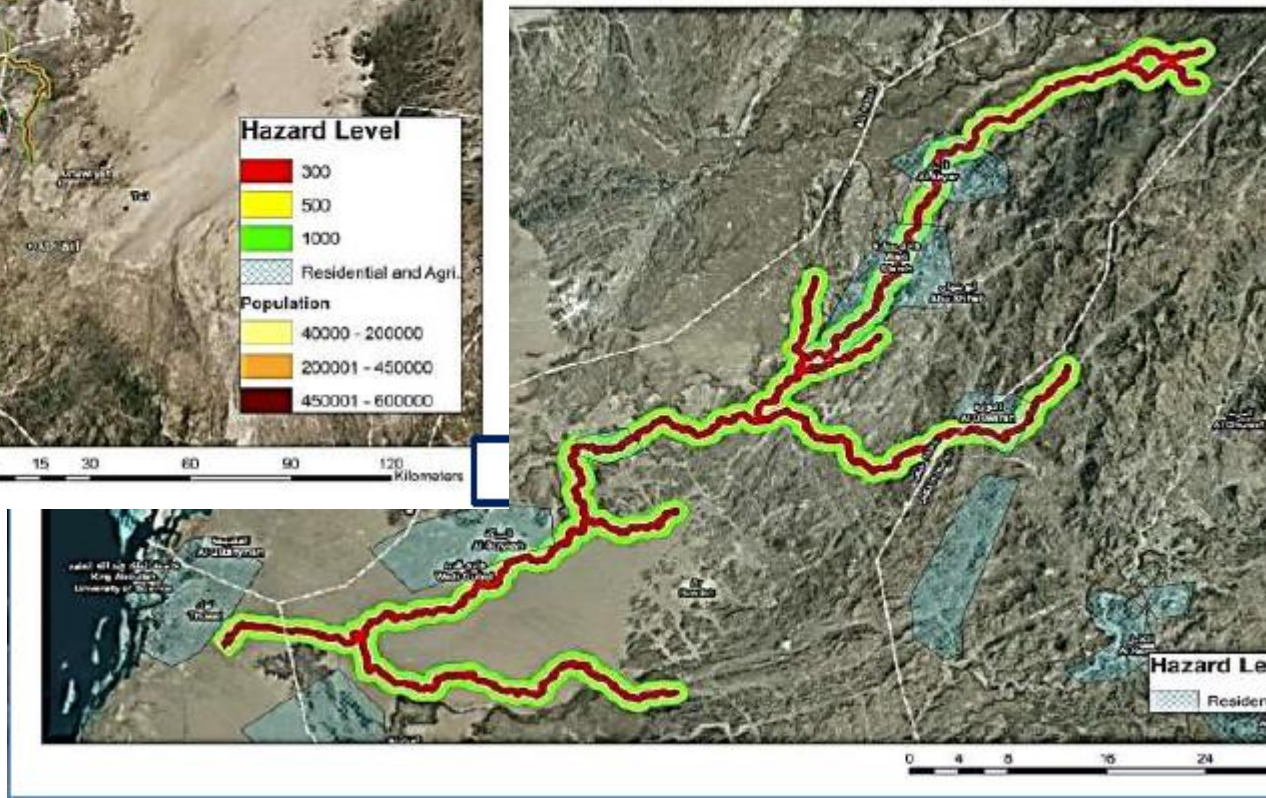
f Streams Acoording to Flood Intenisty

Flood in KSA

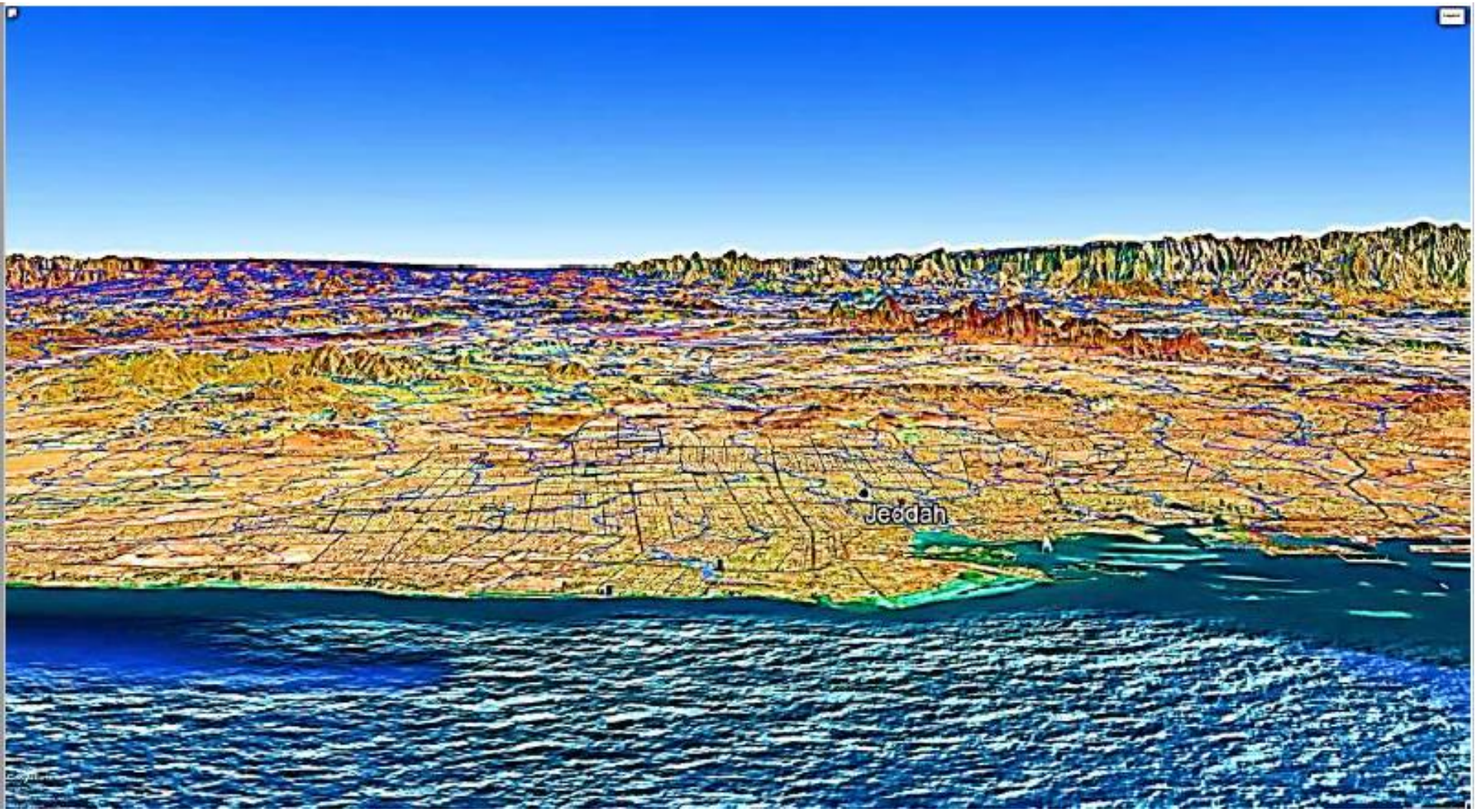
High Risk zones for All Streams and Population Density



nes for Stream 3B



Flood in KSA



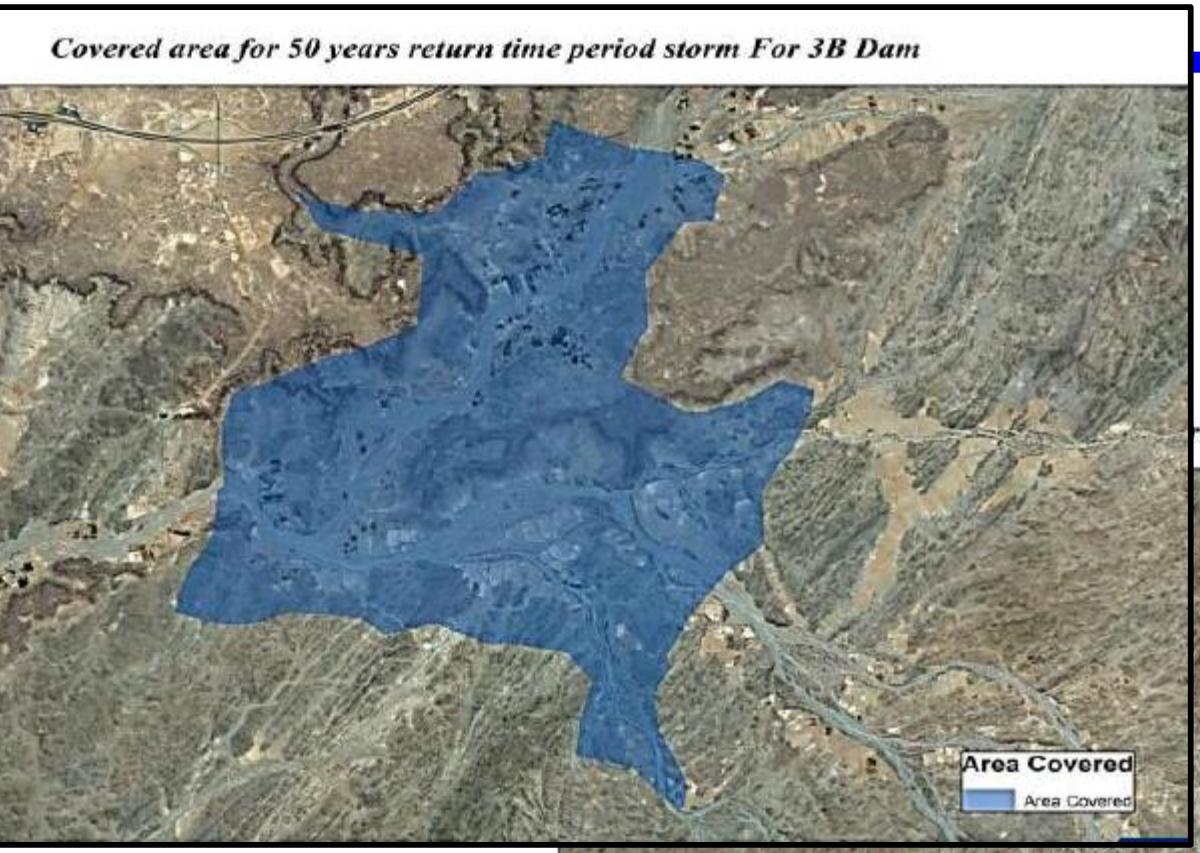
Cost of Damage estimated

- the cost for damage over the last 10 years in Jeddah has exceeded **1.3Billion US Dollars**

Flood Mitigation Measures - KSA

All Proposed Solution for Mitigation of Effect of Flood

Flood Mitigation Measures - KSA



RISK ASSESSMENT OF FLASH FLOOD IN SINAI

Introduction

Flash flood is a natural process generated during heavy rainfall or shortly afterward. High risk zones are mountains, steep hill slopes with shallow impermeable soils and exposed rocks without vegetation. Flood hazard seems to be increasing as climate change takes effect. Floods can lead to disaster when humans or human interests are located within the exposed areas. Flash floods are one of the most devastating natural disasters because of their rapid occurrence, little lead time for warning and tremendous amount of water flowing with high energy. In Egypt, Sinai region is the most vulnerable area and had already suffered from many flash floods due to its huge variation in elevation and high-intensity rain falls.

Fig. 1. Al-Rwafaa Dam in Jan. 2010 Flash flood

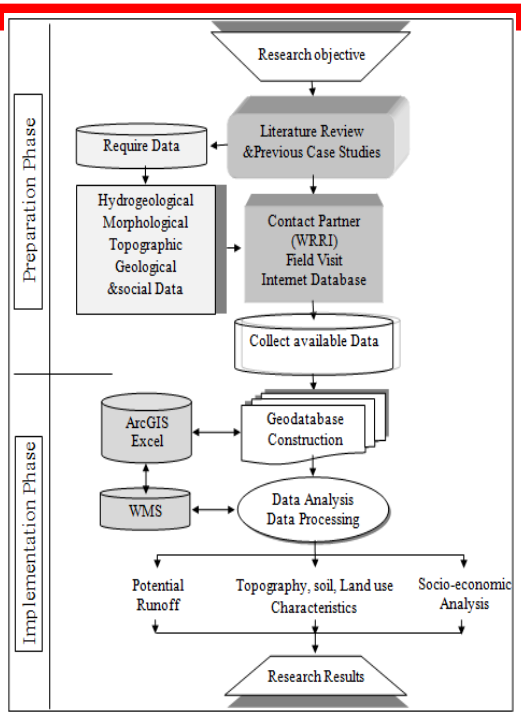
Objective

The main objective of this research is to localize floodable zones, modeling the water flow under different storm scenarios, study the vulnerability of special buildings and assess the risk of specific construction to flash flood.

Fig. 2. Watersheds in Sinai

Thesis plan

Data collection is conducted using literature review and field visits. The collected data are analyzed and processed using Arc GIS, Excel, and hydrological model software. The methodology is based on collection and analysis of physical, socioeconomic, environmental and institutional data for active wadis in Sinai. Followed by the constitution of GIS-based database "Geodatabase" that includes hydrology, geology, topographic, and social data.



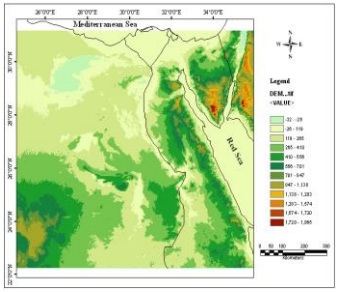


Fig. 3. Elevation map of Egypt

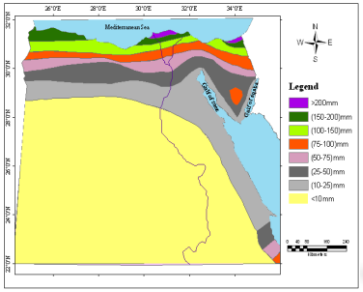


Fig. 4. Rainfall height in Egypt

Watershed modeling system (WMS)

The Watershed Modeling System (WMS) is a comprehensive graphical modeling environment for all phases of watershed hydrology and hydraulics. WMS includes powerful tools to automate modeling processes such as automated basin delineation, geometric parameter calculations, GIS overlay computations (CN, rainfall depth, roughness coefficients, etc.),

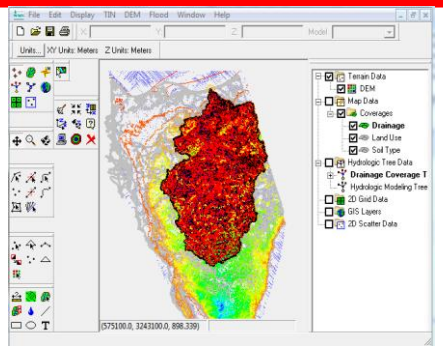


Fig. 5. Watershed modeling (WMS program)

HEC-1(HEC-HMS)

The HEC-1 model is designed to simulate the surface runoff response of a river basin to precipitation by representing the basin as an interconnected system of hydrologic and hydraulic components. Each component models an aspect of the precipitation-runoff process within a portion of the basin, commonly referred to as a sub-basin. A component may represent a surface runoff entity, a stream channel, or a reservoir.

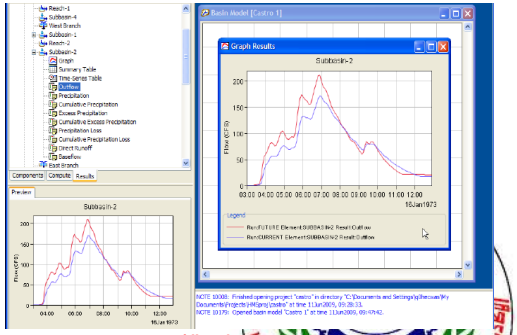


Fig. 6. Rainfall Discharge vs. Time (HEC-HMS program)

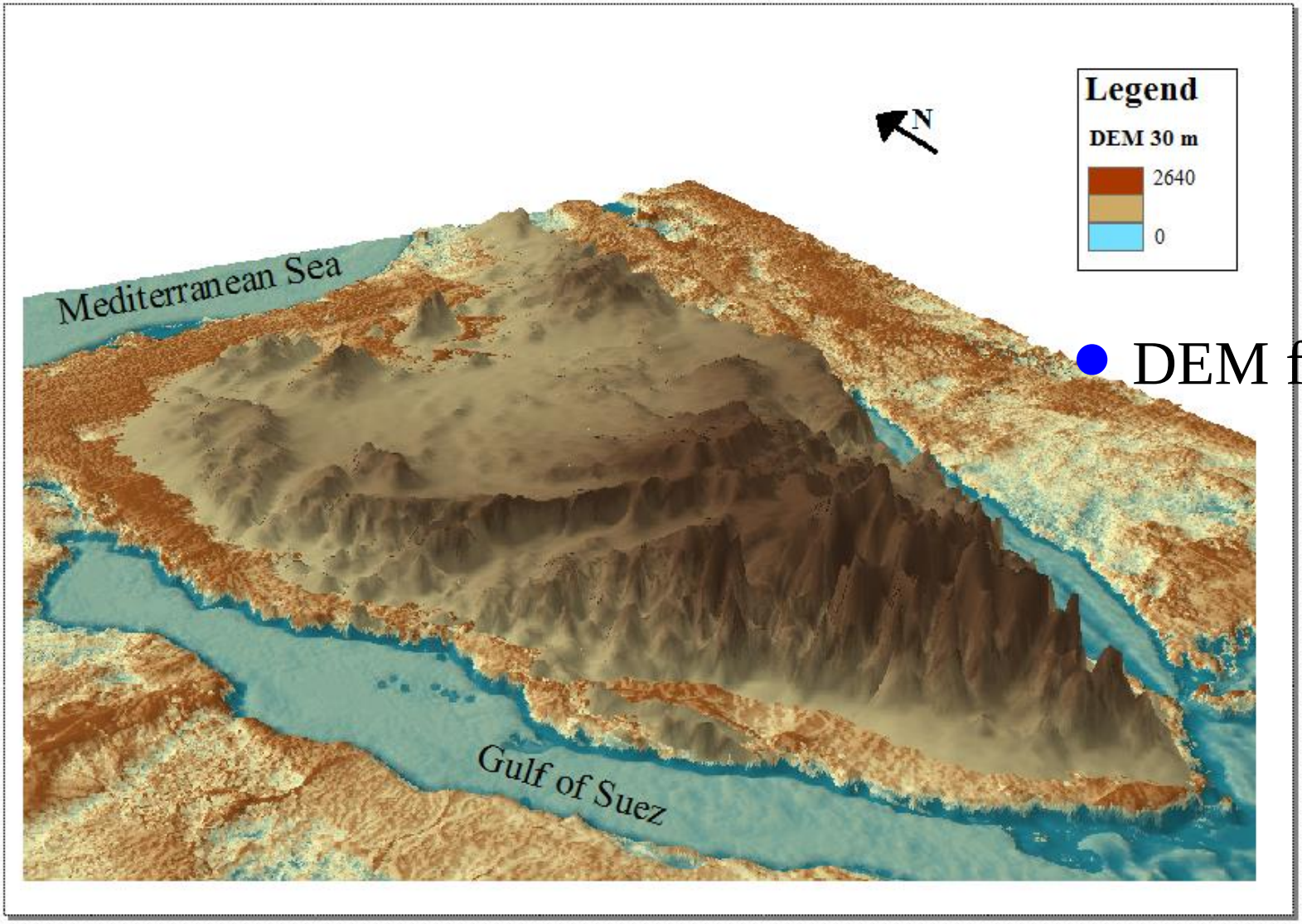
Eng. Mohamed Ashraf El-sayad

Supervisors:

Prof. Gamal Ibrahim Kotb

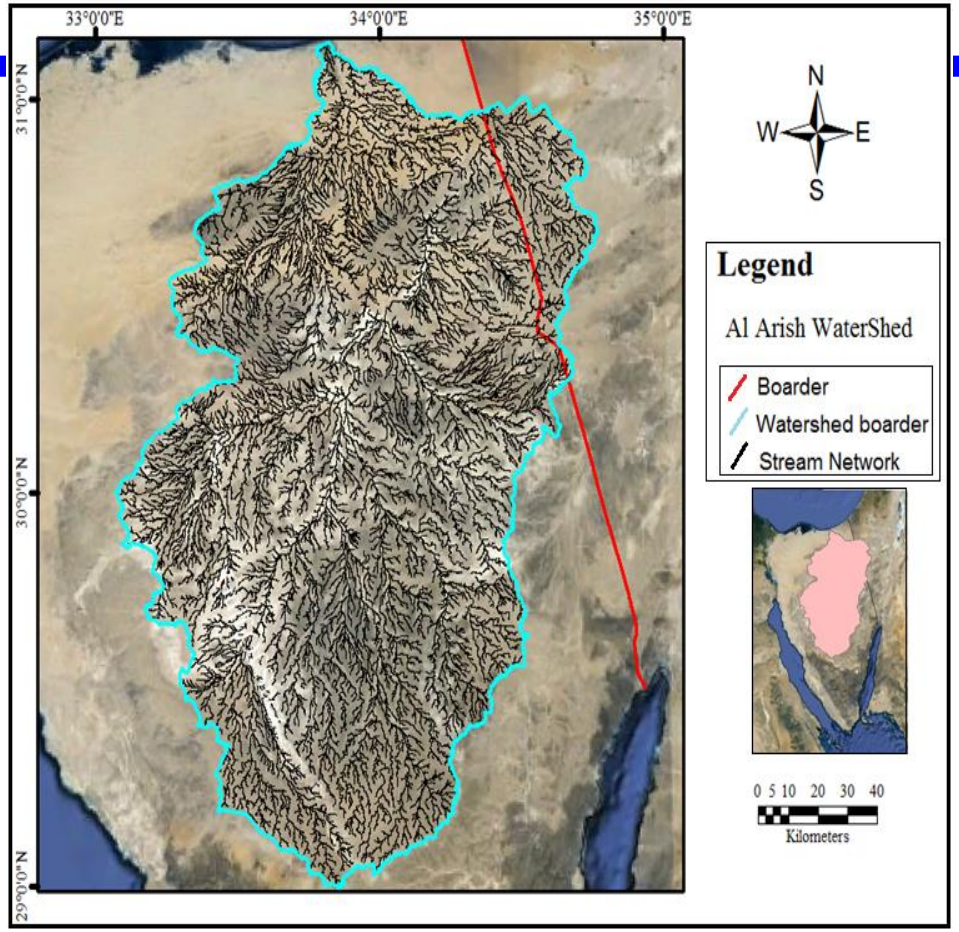
Ass. Prof. Abdel Moniem Sanad

Sinai – Flash Flood

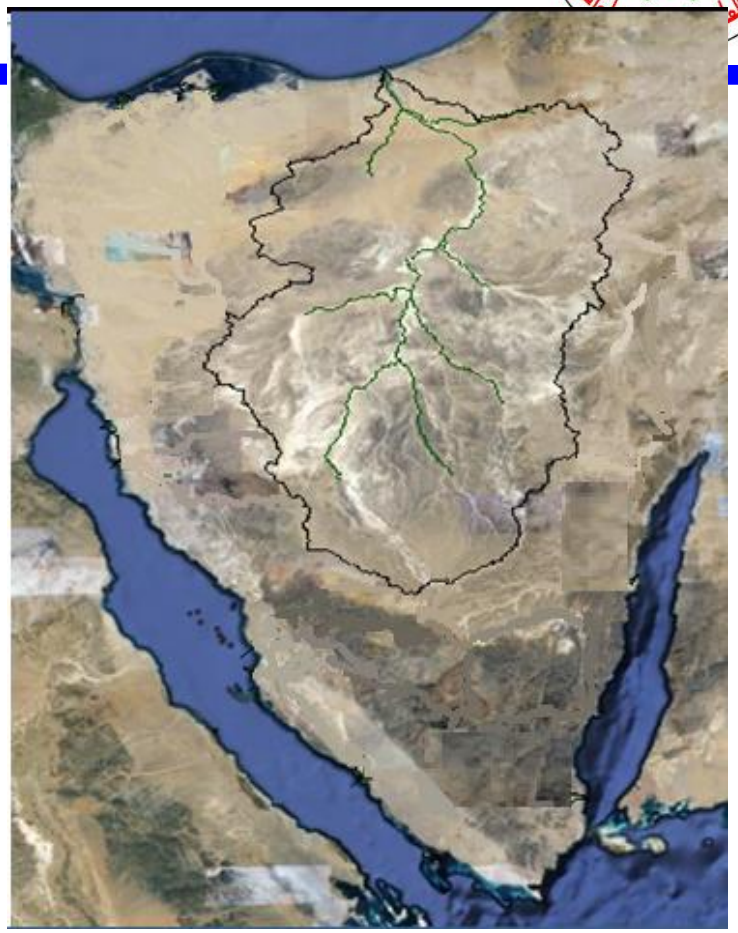


- DEM for Sinai

AL-Arish Streams

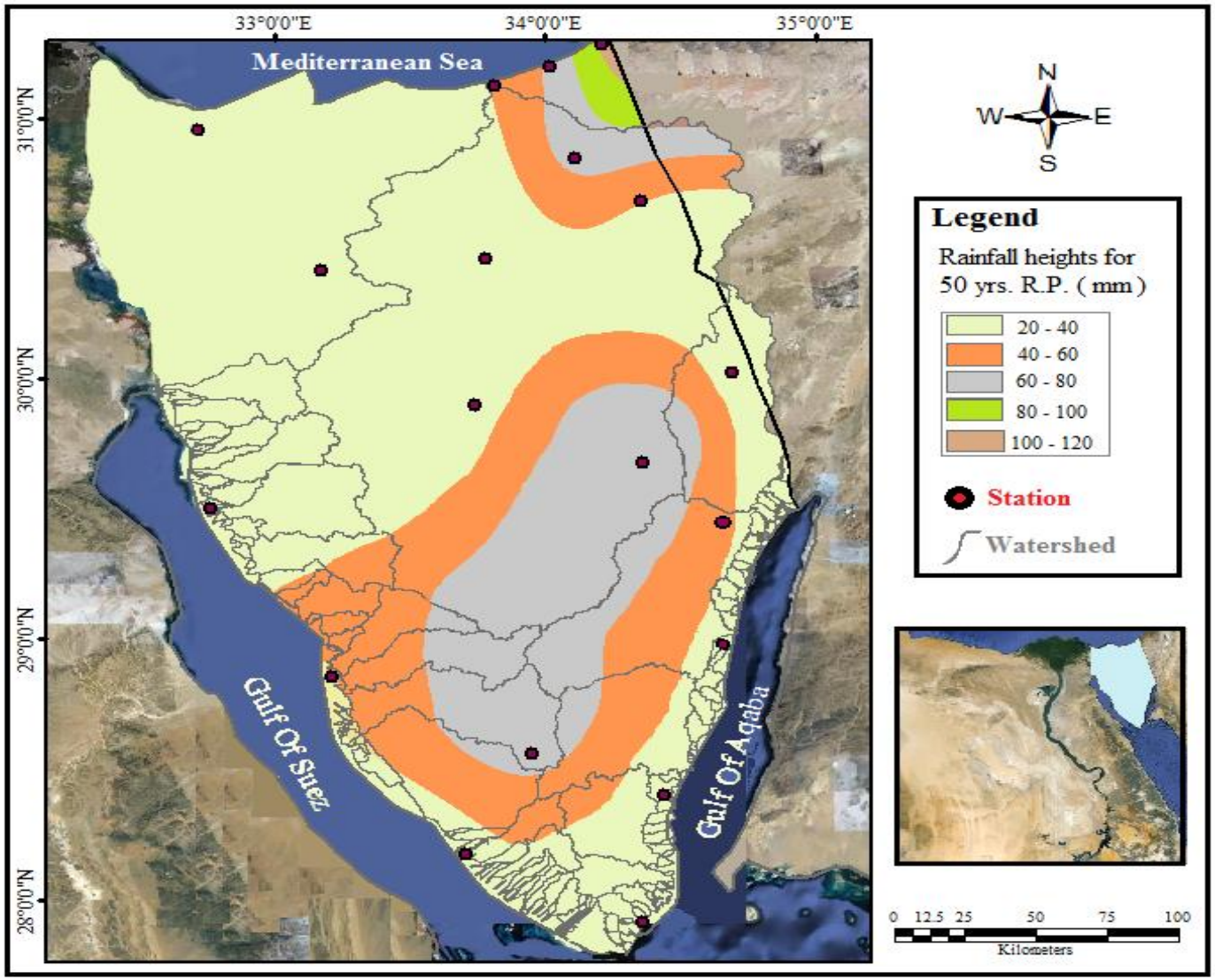


Al Arish streams networks



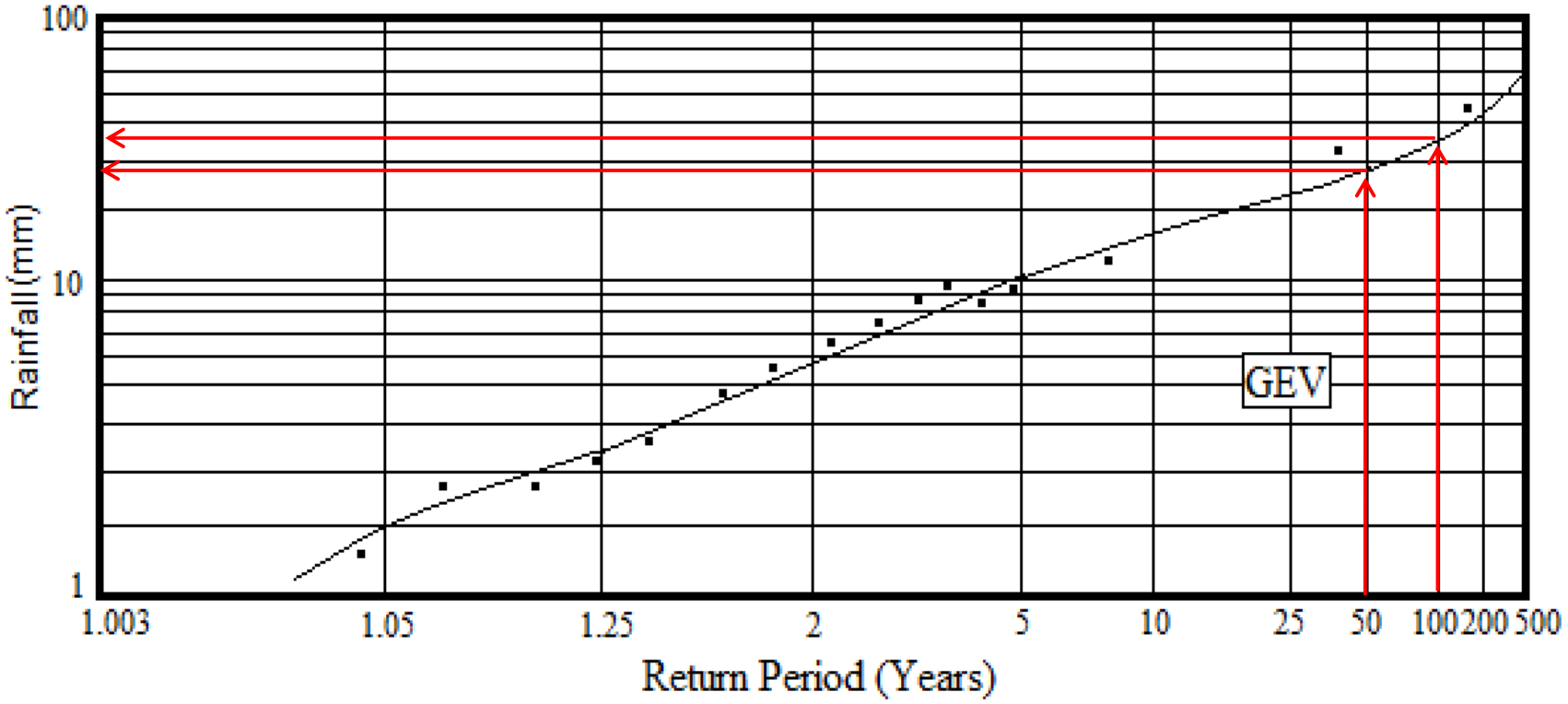
Al Arish main stream over Google Earth map

Rainfall heights map for 50-year R.P



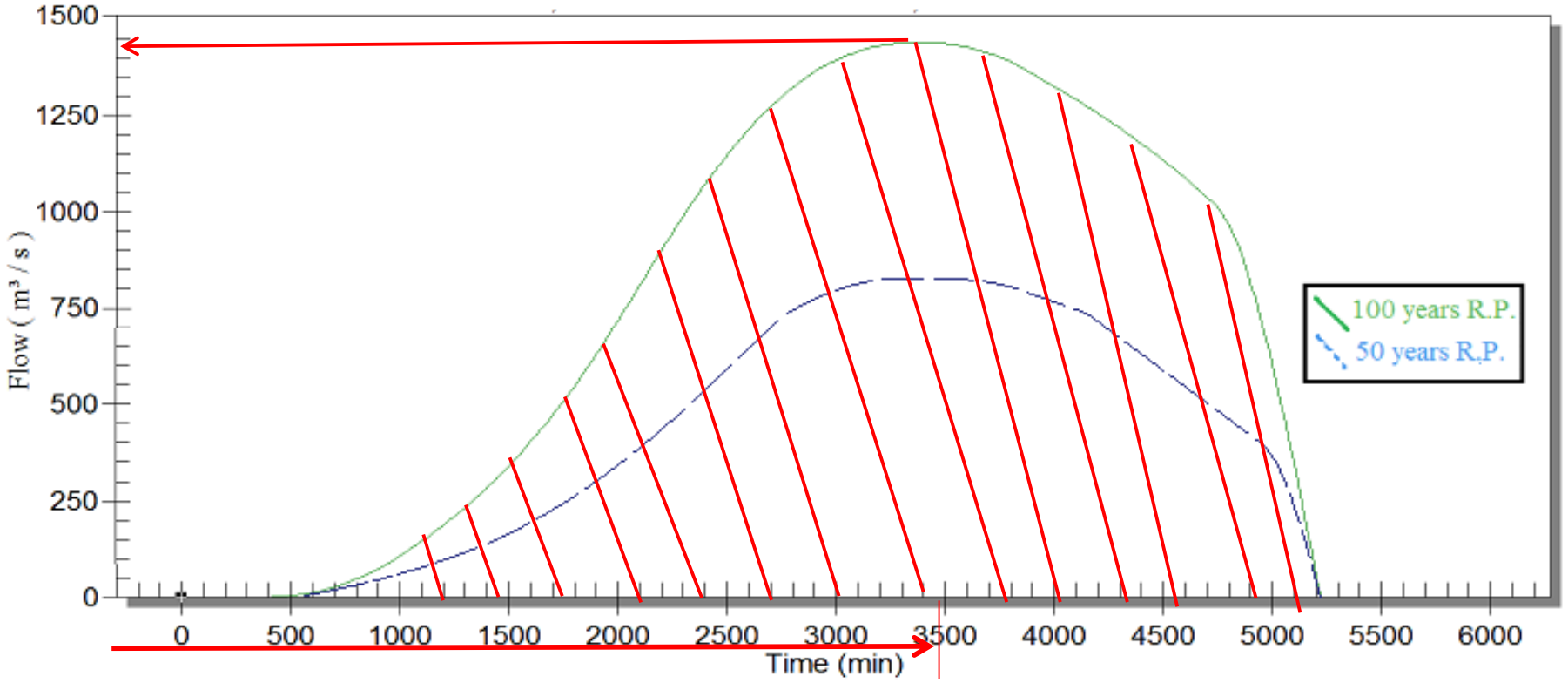
Isohyetal map of rainfall heights for 50-yr. R.P

Return period generation



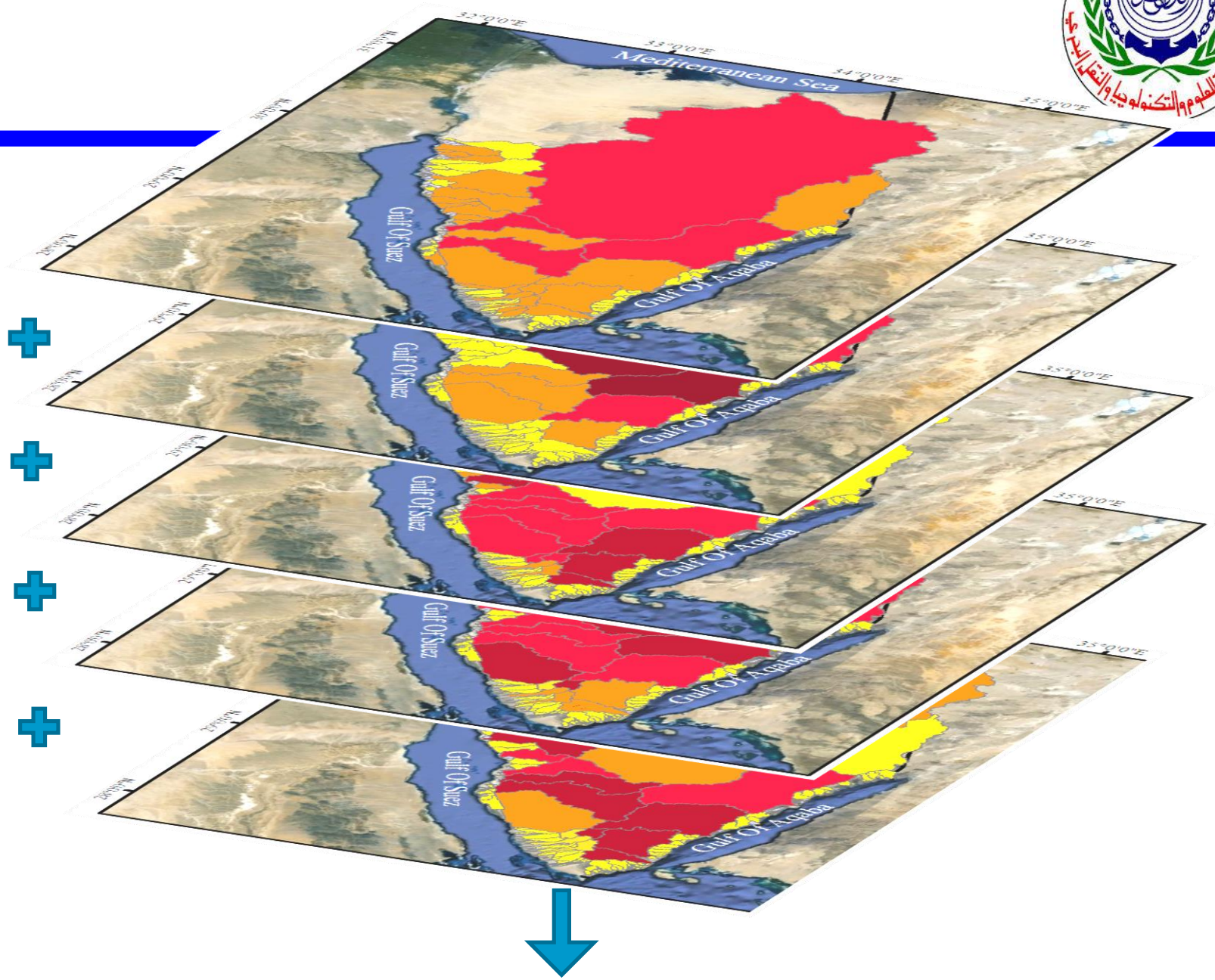
Return period rainfall heights for each station

Results

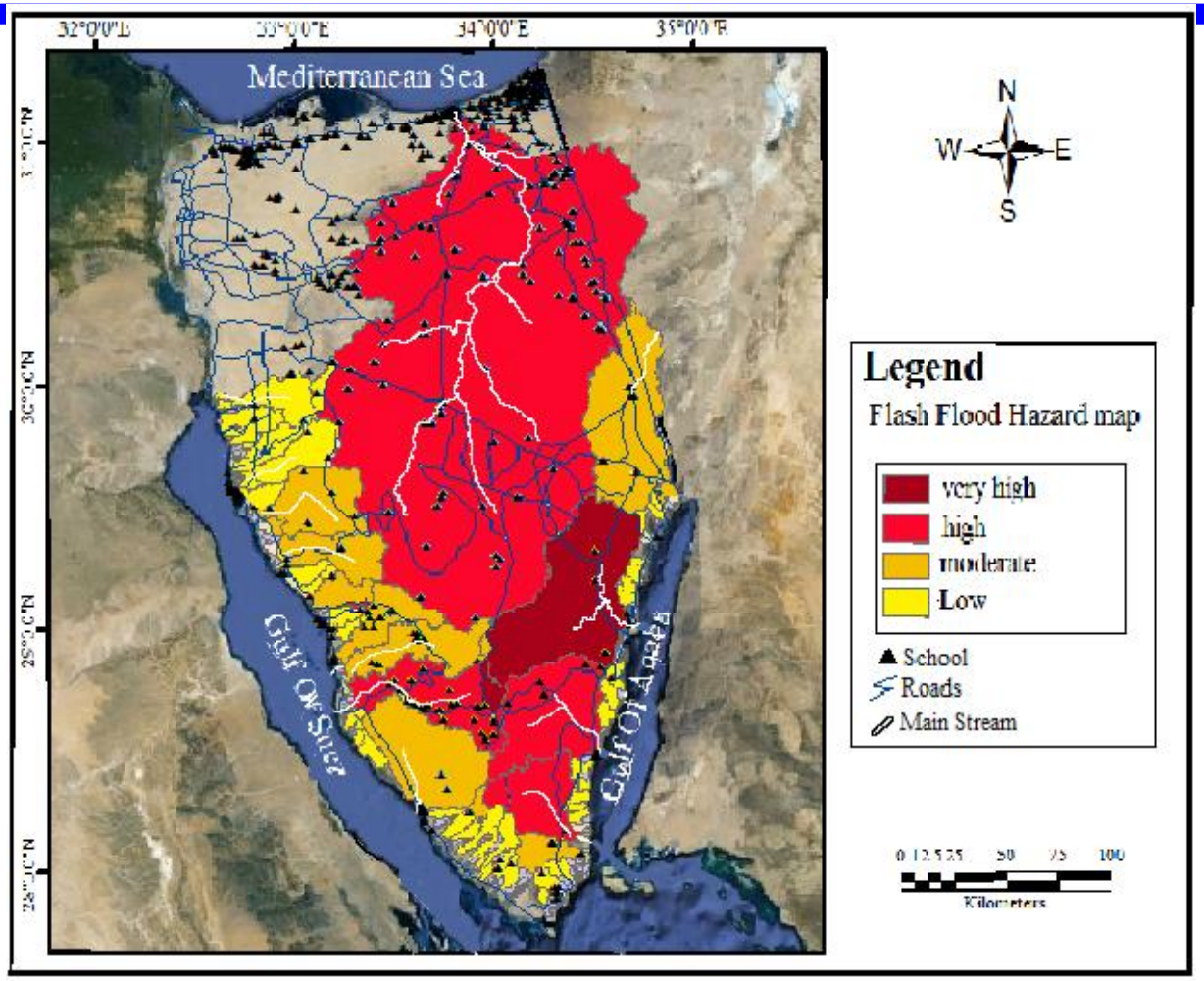


Runoff Hydrograph 50 and 100-year return period for Al-Arish basin

Compilation of all Hazard maps

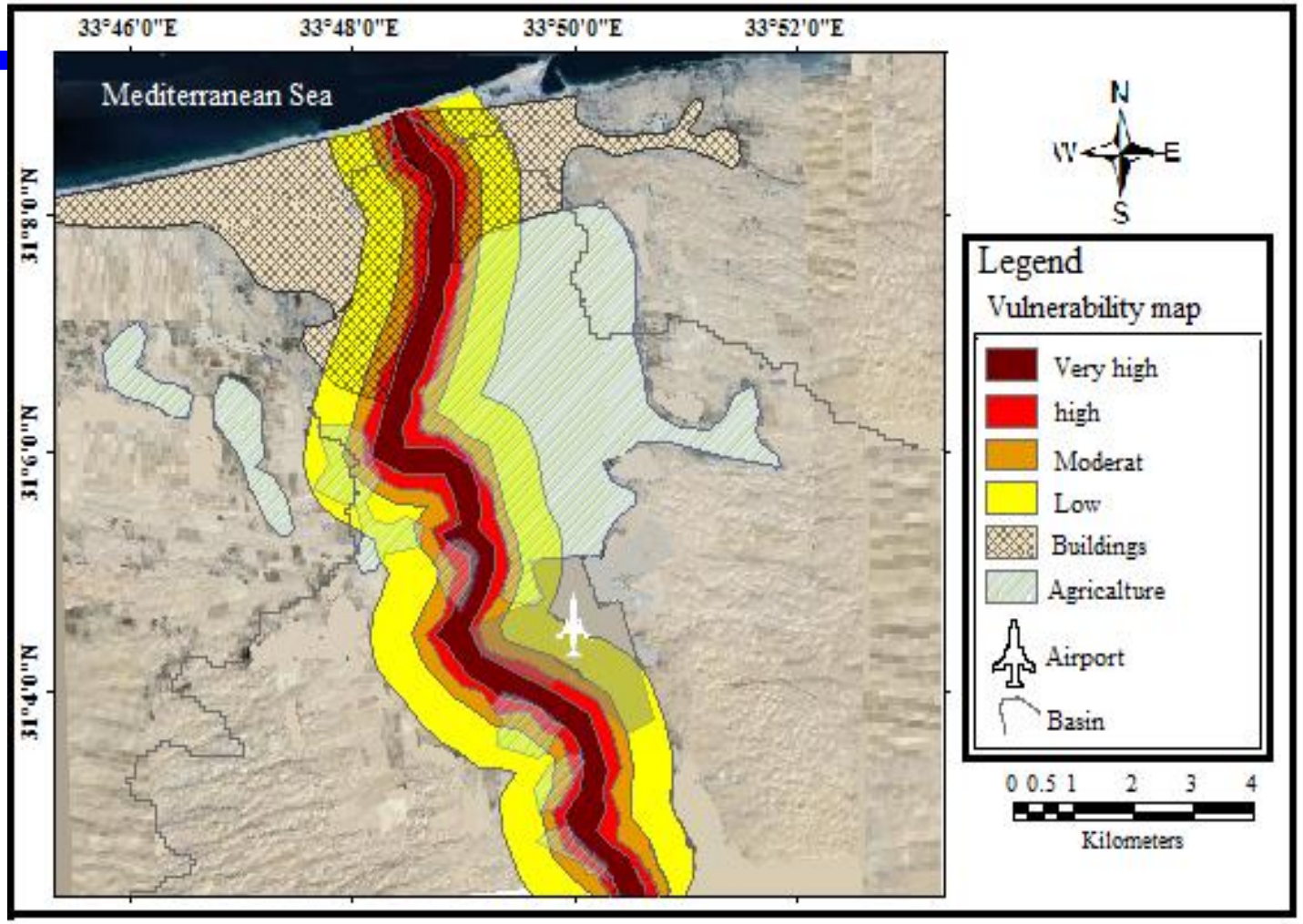


Hazard mapping based on hydrologic & morphological factors



Flash Flood Hazard Map with schools and roads

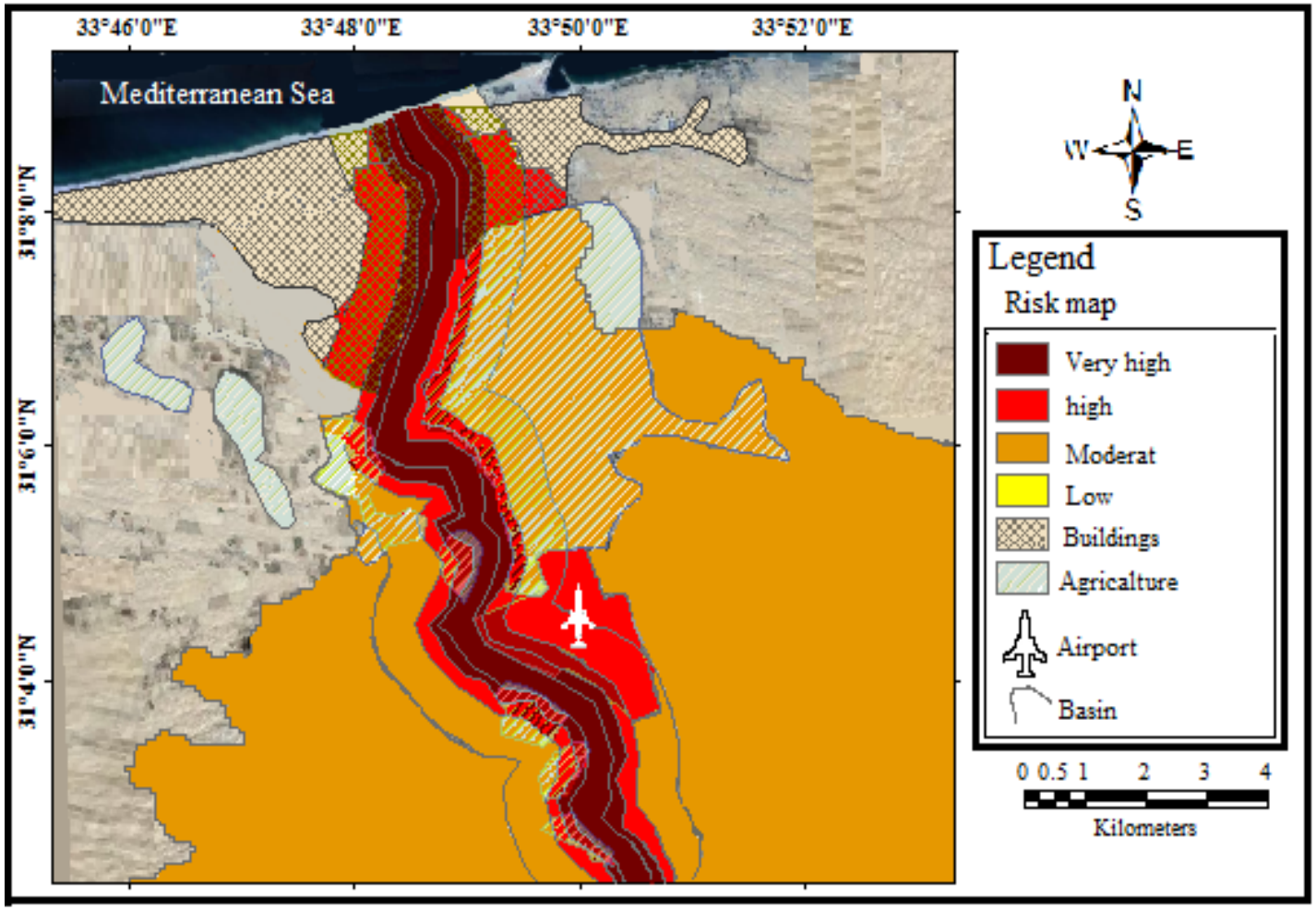
Vulnerability Assessment



vulnerability map for Al-Arish area

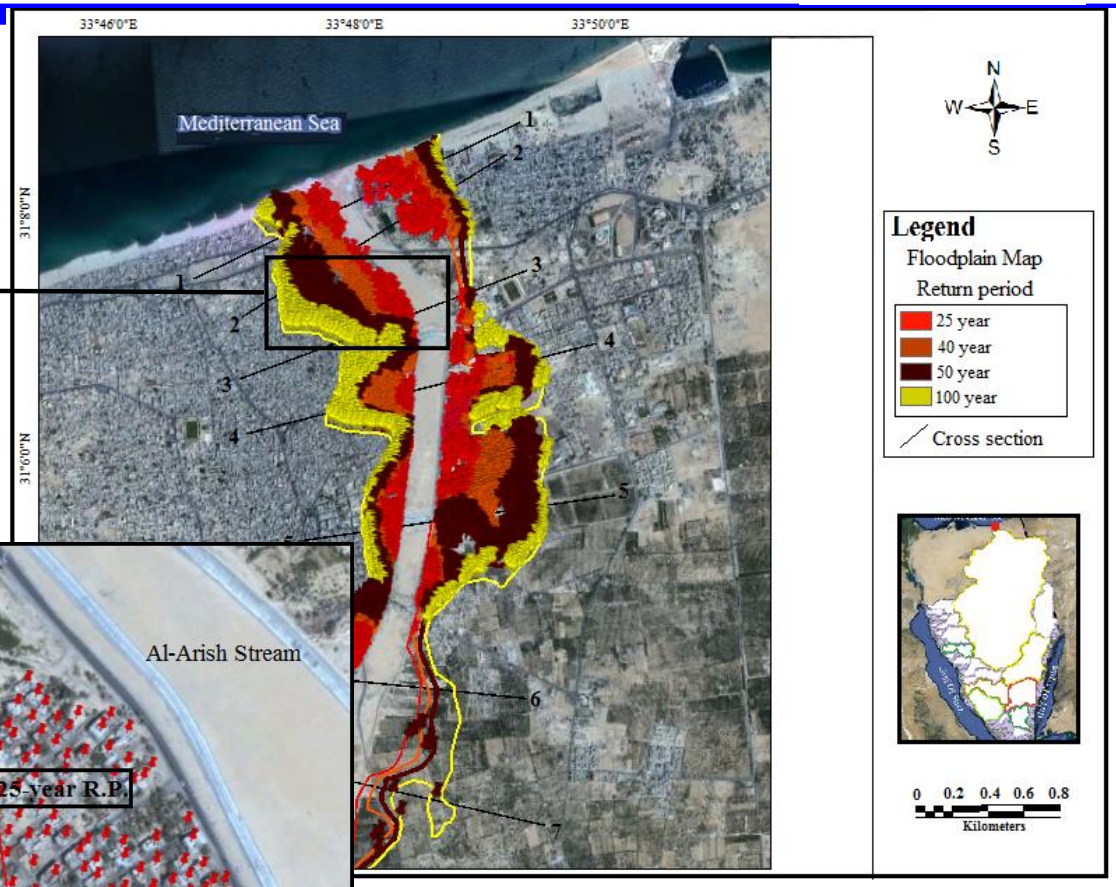
Flash flood risk assessment mapping

Risk = hazard x vulnerability

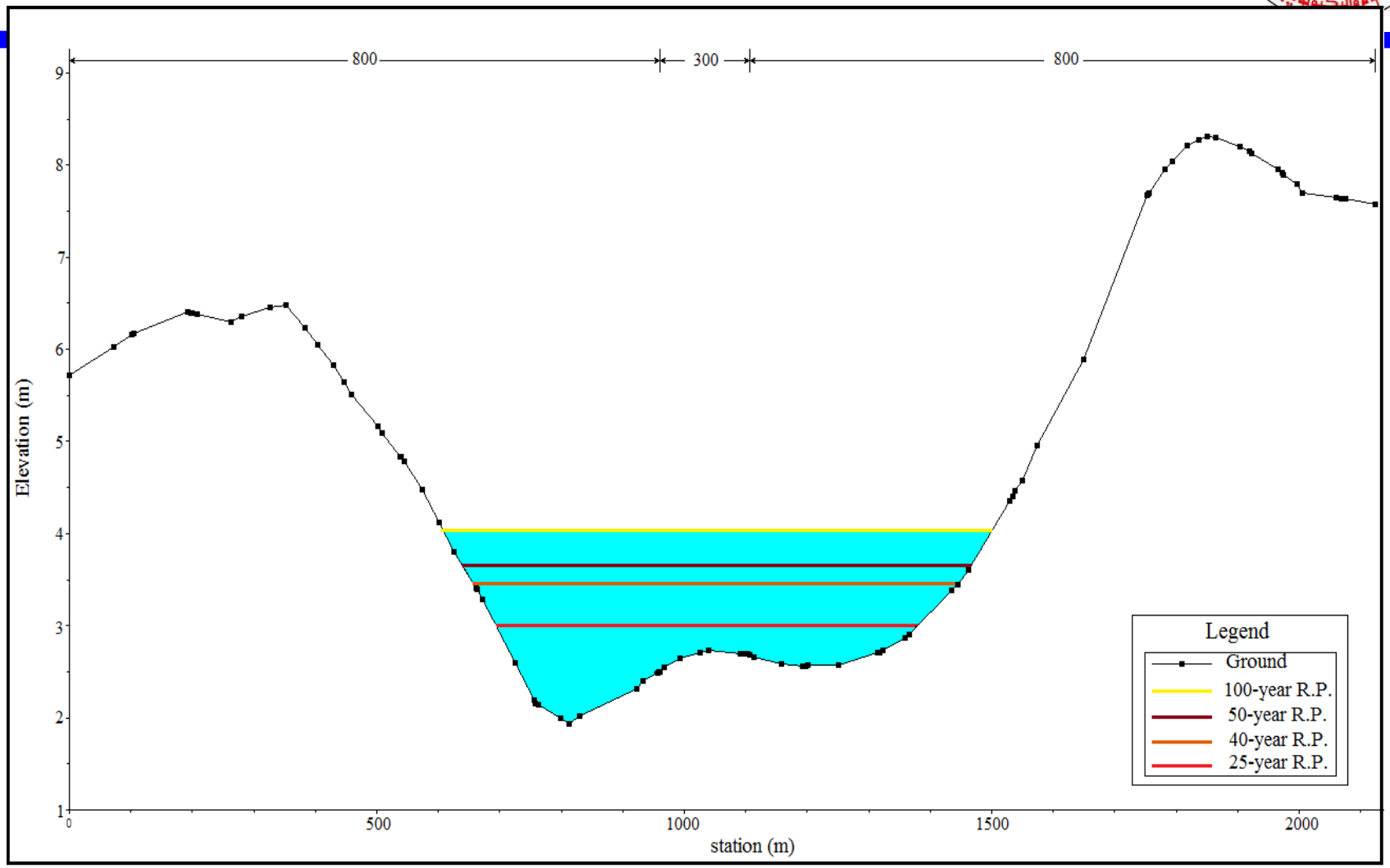


Flash flood risk map for Al-Arish area

Flash floodplain for 25, 40, 50, and 100-year return period for Al-Arish city



Flood water profile

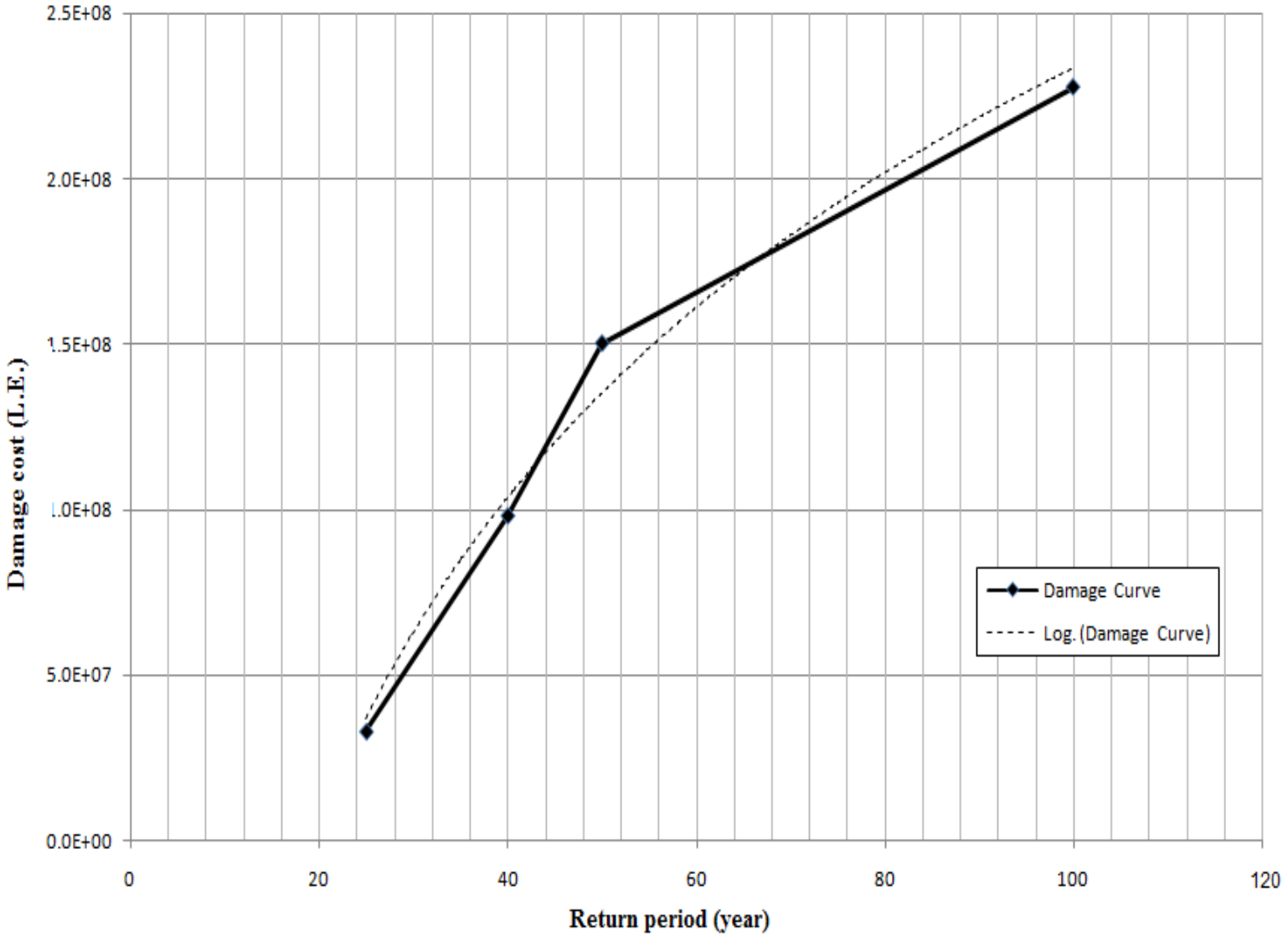


Section (1.1)

Estimated flash flood damage curve

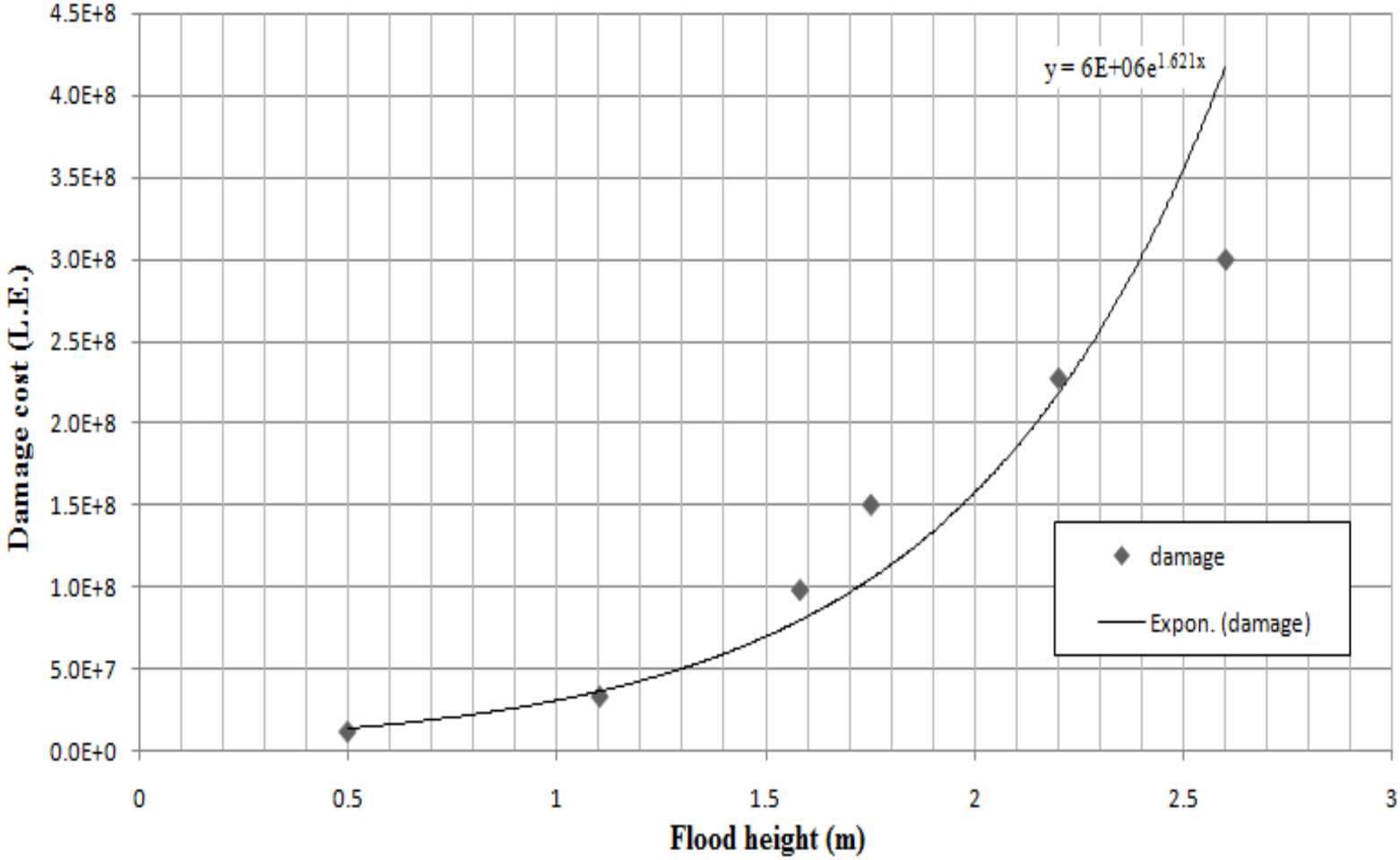
Return period (year)	Flood height (m)	Number of affected building	Number of building		No. of estimated Partially damage building		No. of estimated totally damage building		Buildings damage cost(L.E.)	Agricultural affected area	Cost/m2	Agriculture damage cost (L.E.)	Total damage cost (L.E.)
			Estimated concrete building (70%)	Estimated clay building(30%)	concrtet	clay	concrete	clay					
25	1-2	90	63	27	62	-	1	27	6,835,100	1664306	15	24,964,592	33,031,692
	0.5-1	301	211	90	-	15	-	75	1,155,000				
	<0.5	653	457	196	-	11	-	-	77,000				
2010 flood (40)	1-2	156	109	47	107	-	2	47	16,134,200	2773844	15	41,607,653	98,210,353
	0.5-1	511	358	153	353	26	5	127	40,335,500				
	<0.5	1071	750	321	-	19	-	-	133,000				
50	1-2	454	376	192	372	-	4	192	39,744,600	3198458	15	47,976,870	150,291,470
	0.5-1	1012	601	297	600	50	5	247	62,353,000				
	<0.5	1746	1223	523	-	31	-	-	217,000				
100	2-3	283	198	85	190	-	8	85	25,138,500	4807995	15	72,119,925	227,612,475
	1-2	659	461	198	456	-	5	198	48,277,800				
	0.5-1	1195	837	358	835	60	2	298	81,887,250				
	<0.5	1544	1081	463	-	27	-	-	189,000				

Estimated Damage vs Storm R.P.

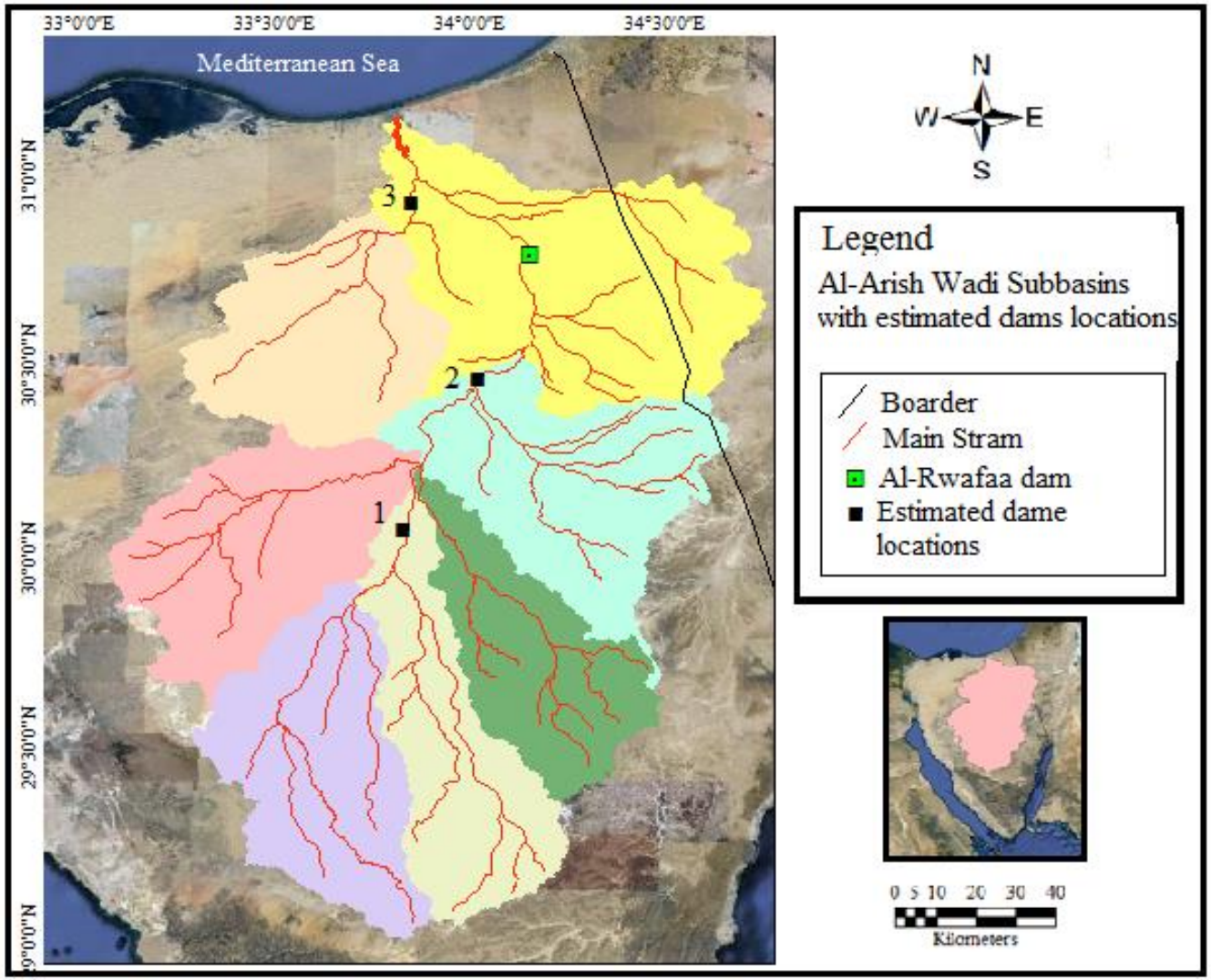


Estimated Damage vs Flood Height

The reference selected location to represent the flood height chart is chosen the maximum depth of flood water at the outlet of stream (1-1).



Selected locations of dams



Wadi Al-Arish sub-basins representing the recommended dams

Recommendations

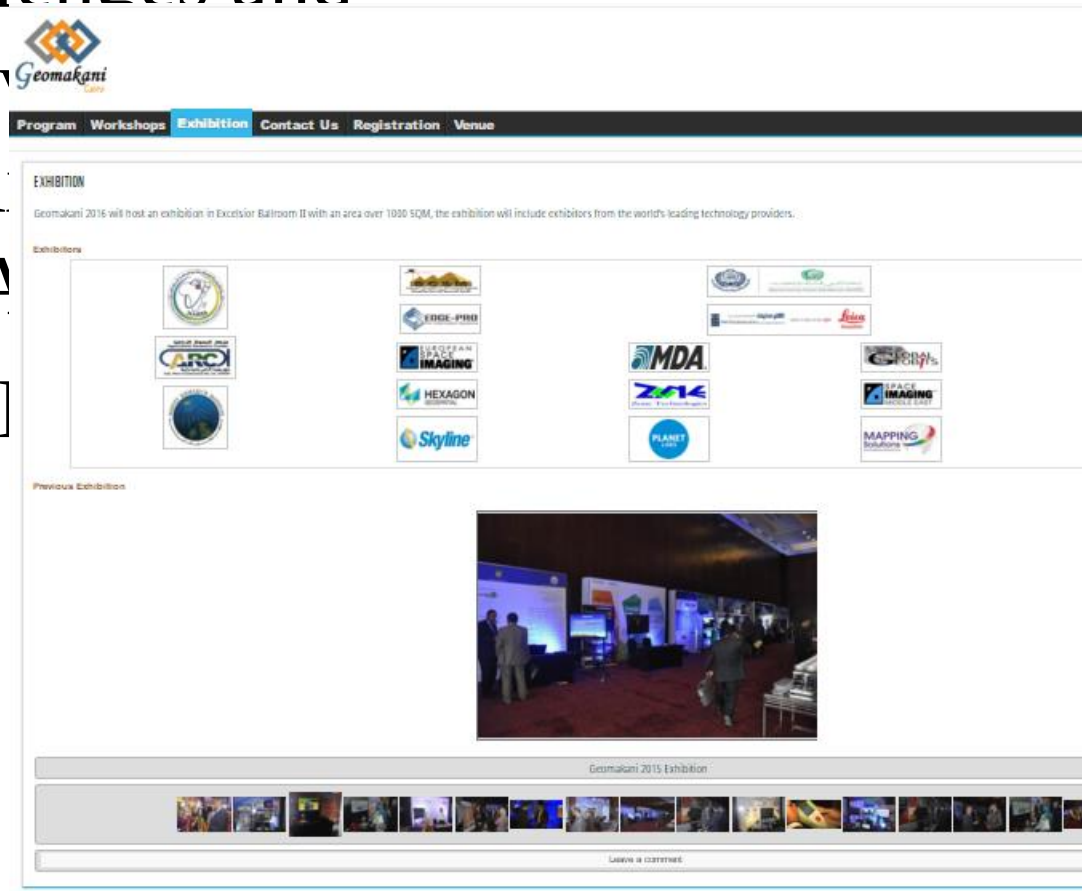
- It is recommended that gauging stations be established on major control points and live-connected to Early Warning System.
- The collection of flood data after an actual flood is very important to improving the floodplain risk management.
- Need to update with high-resolution the DEM based on actual constructions.
- Increase public awareness of the areas at risk from flash flood.
- Implementation of a building code: The design of buildings and choice of building materials should consider the probability and severity of flash floods.
- Reduction of densities in flash flood prone areas
- Build Dams in effective location to mitigate the risk of flood.

Publicity

- GIS & RS
- ArcGis
- ERDAS IMAGINE

Conferences

- Global Climate Change, Biodiversity and Sustainability: Challenges and Opportunities – Univ
  Island Canada + Sm
  USA + AASTMT, A
- Geomakani 2016, E
  Cairo 2016

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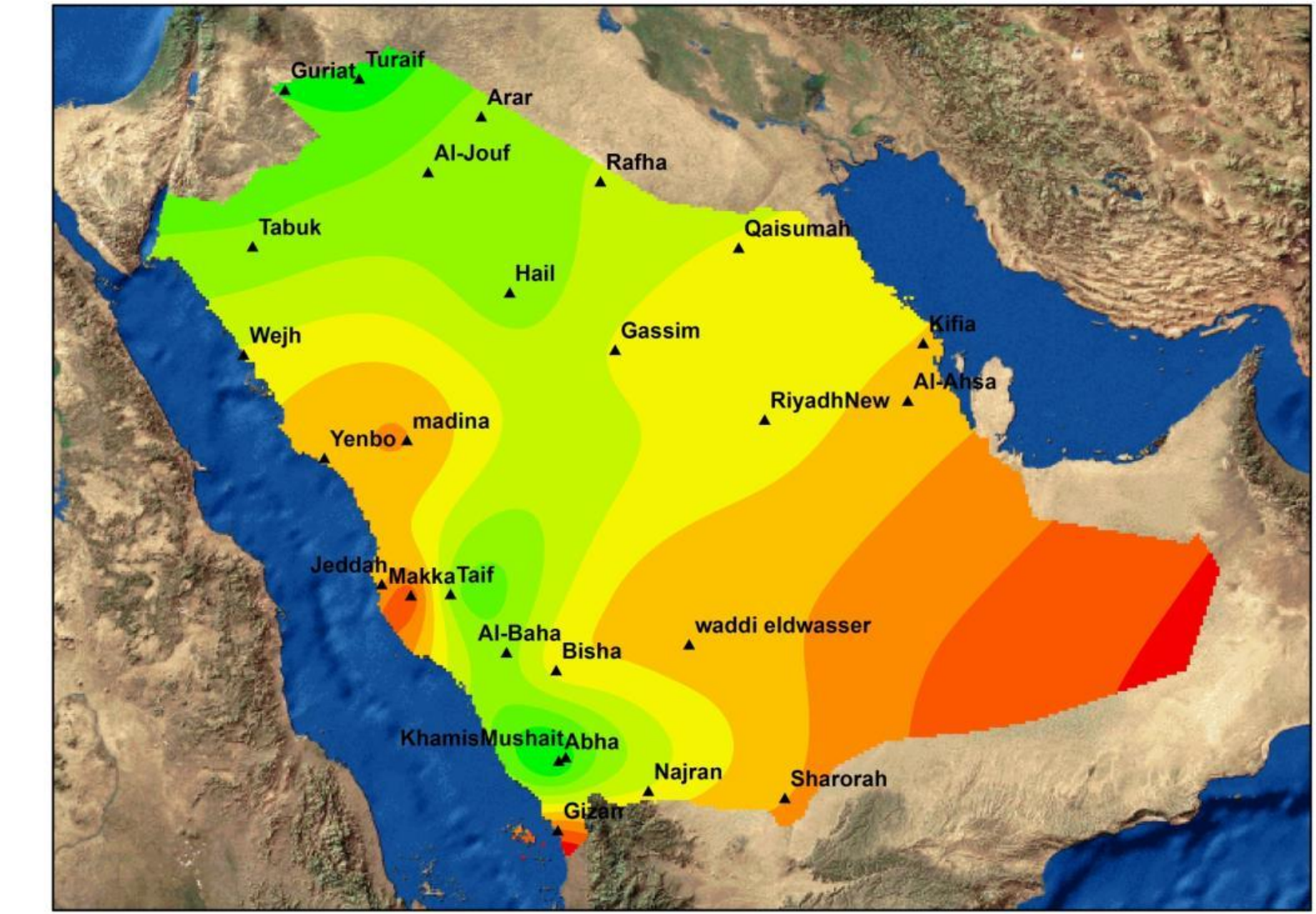
BADEA

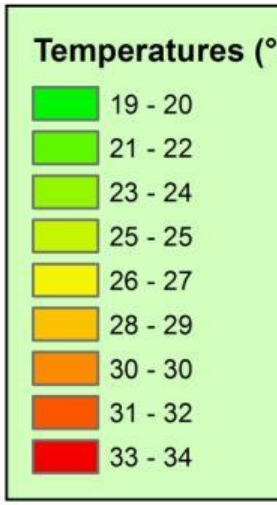
Climate Change Studies:

- KSA:
- Environmental Atlas
- Measured Historical Data 1982-2016
- Projected Climate Data to 2100 - RCP4.5
- Catchment area and streams
- Flood Risk Assessment and High risk zones
- Mitigation Measures
- Training of GAMPE officials on DRR

Kingdom of Saudi Arabia

Yearly Average Temperatures in KSA



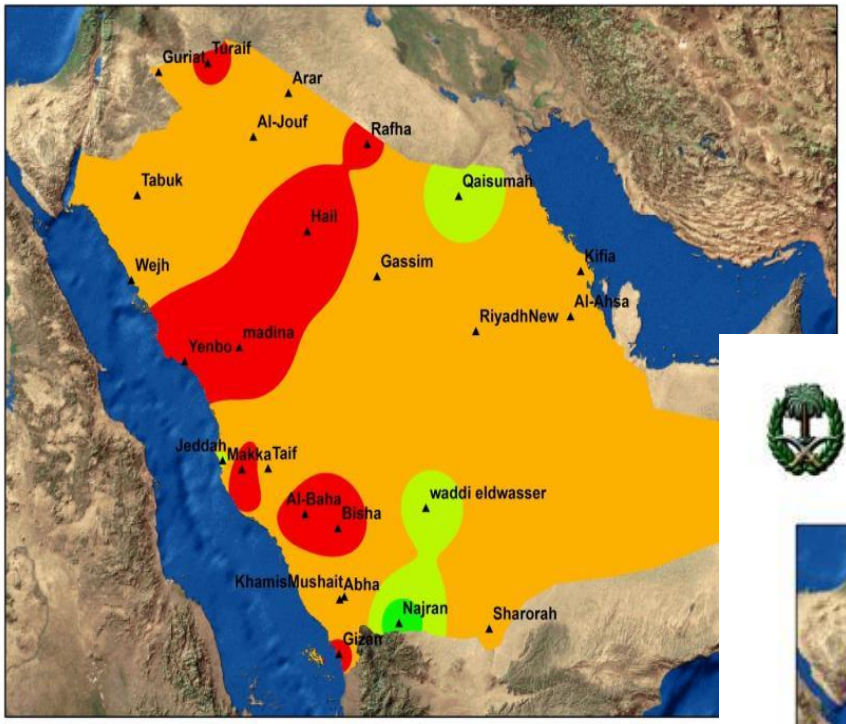


منذ عام 1985م و حتى عام 2014

0 140 280 560 840 1

Kingdom of Saudi Arabia

Yearly Average of Wind Speed in KSA

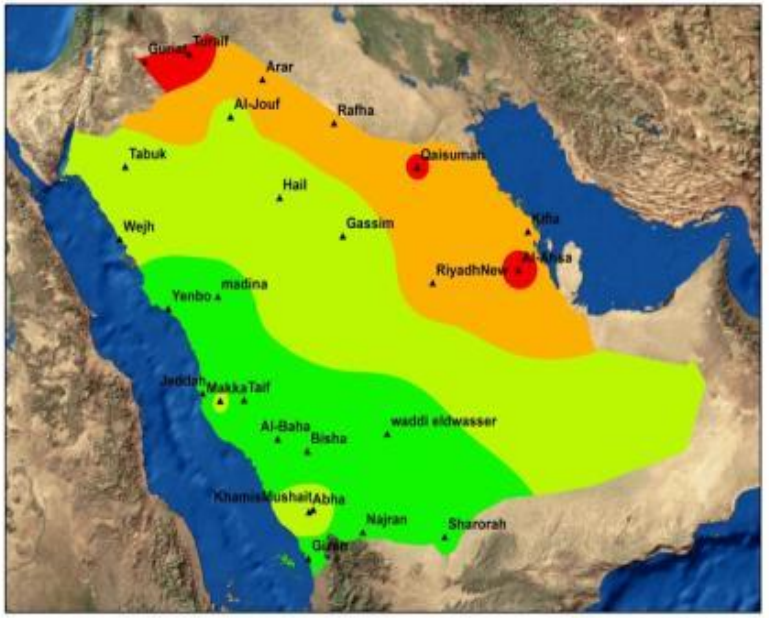


Wind Speed (m/s)

- 1.4 - 2.2
- 2.3 - 2.9
- 3 - 3.7

Kingdom of Saudi Arabia

Number of Days of Precipitation in Winter



Number of Days

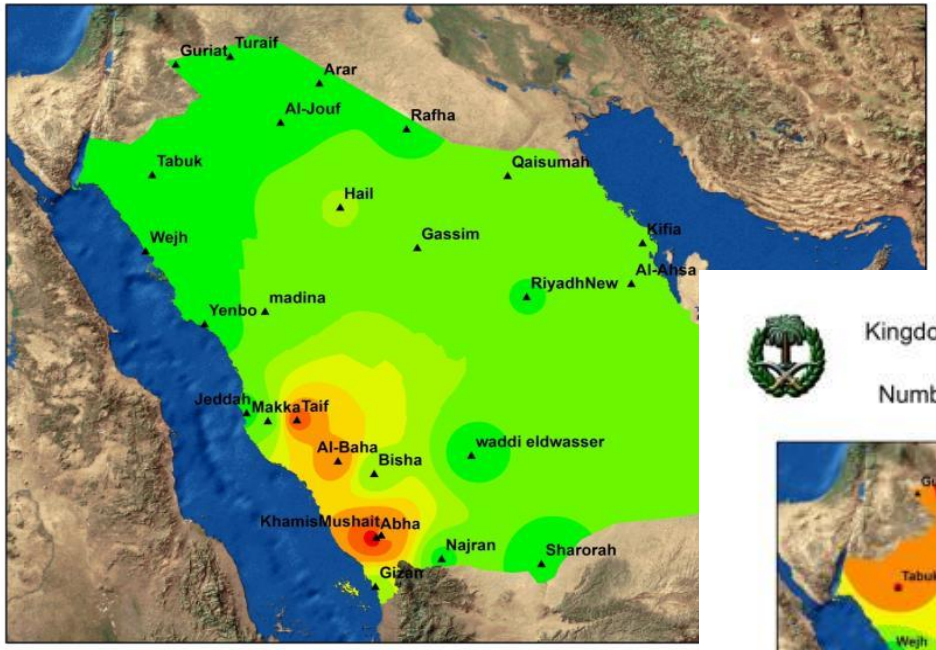
- 1 - 7
- 8 - 13
- 14 - 19
- 20 - 25

0 140 280 560 840 1,120 Kilometers

Climate Change Studies:

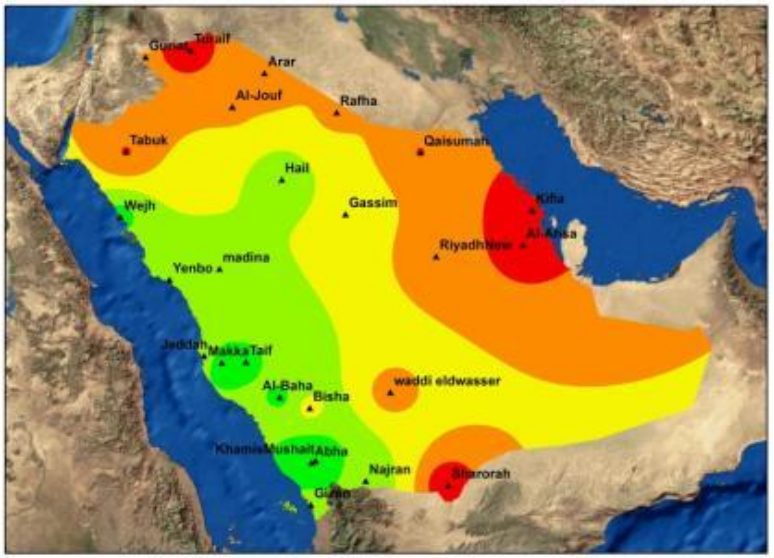
Kingdom of Saudi Arabia

Total Days of Thunder Storm in KSA

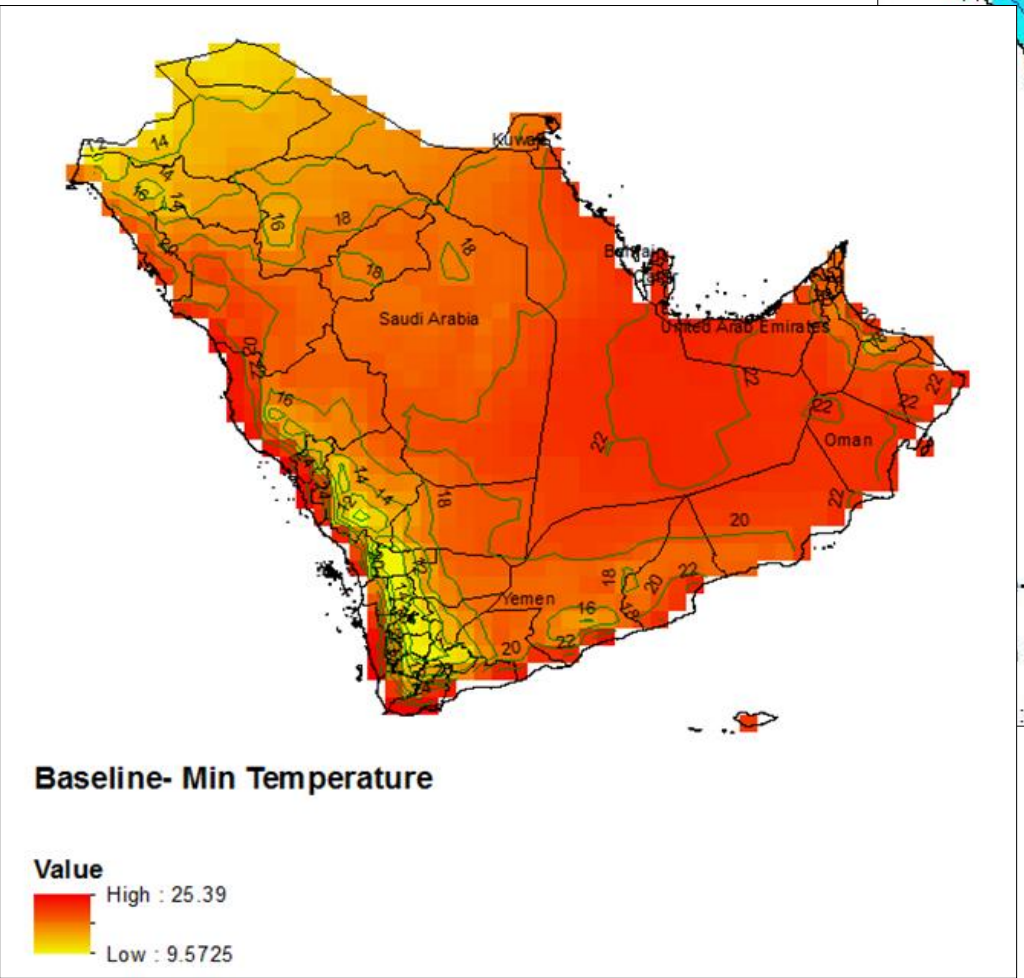


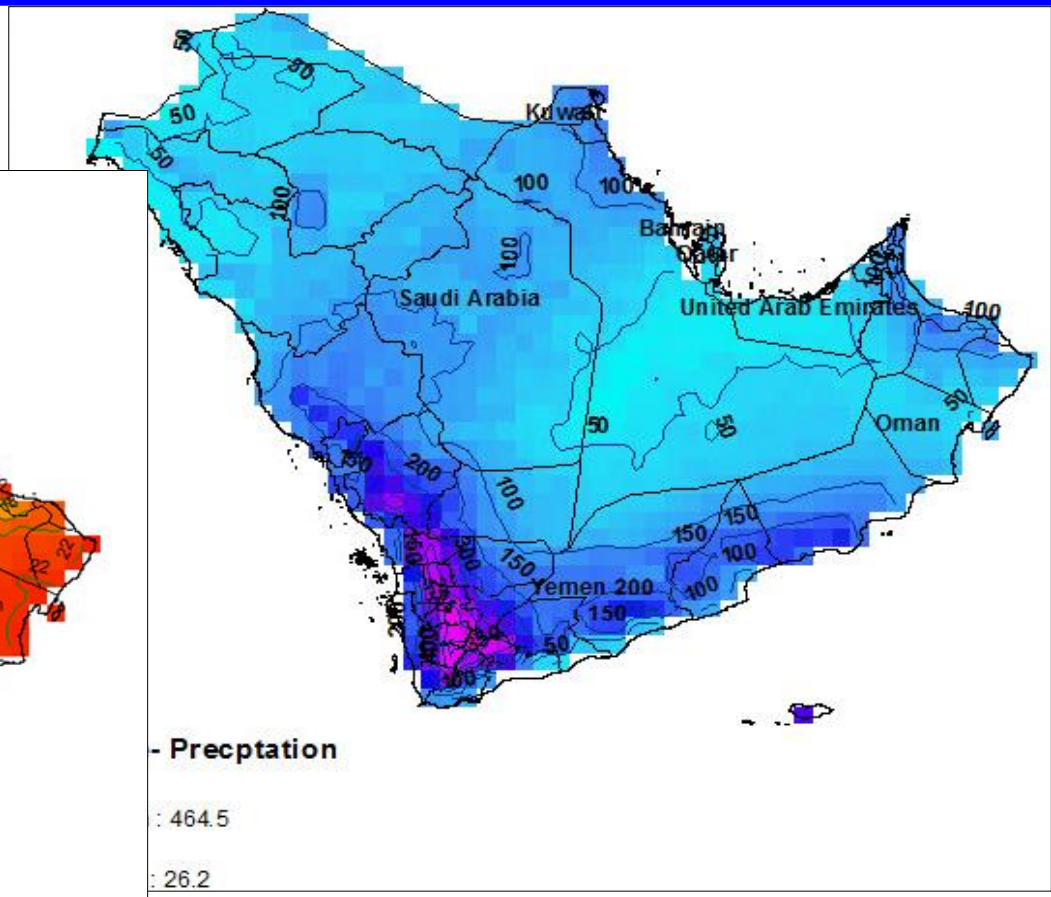
Kingdom of Saudi Arabia

Number of Days of Blowing Dust in Spring

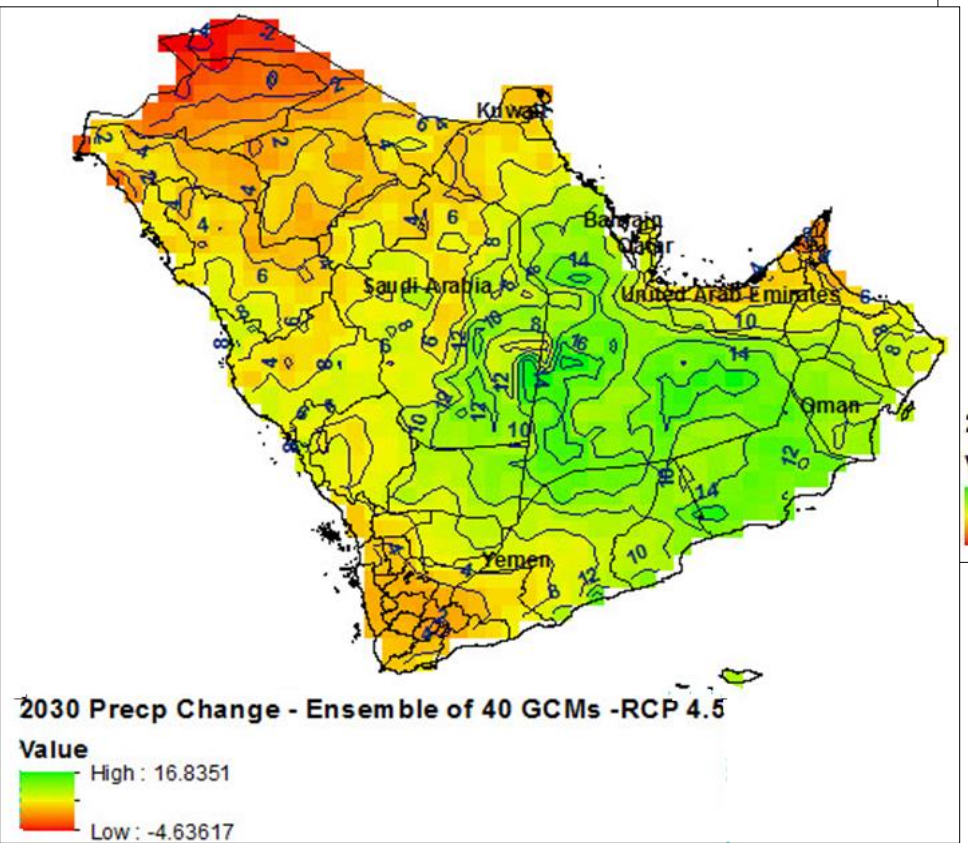


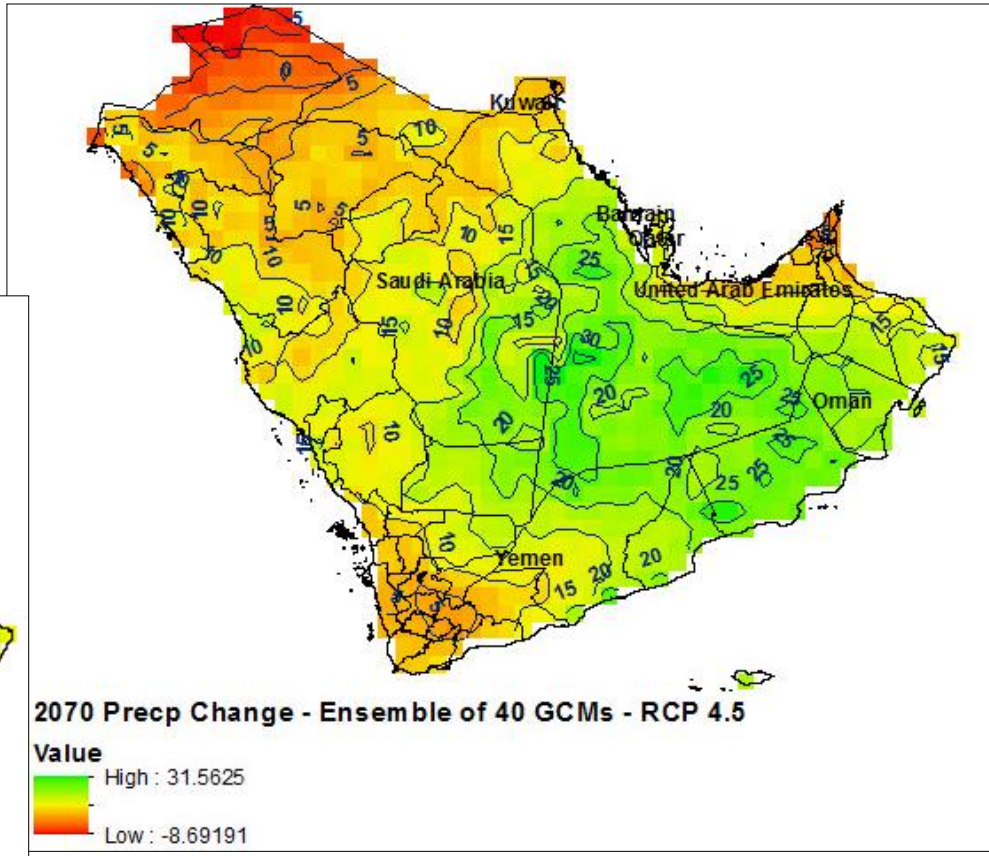
Climate Change Studies:



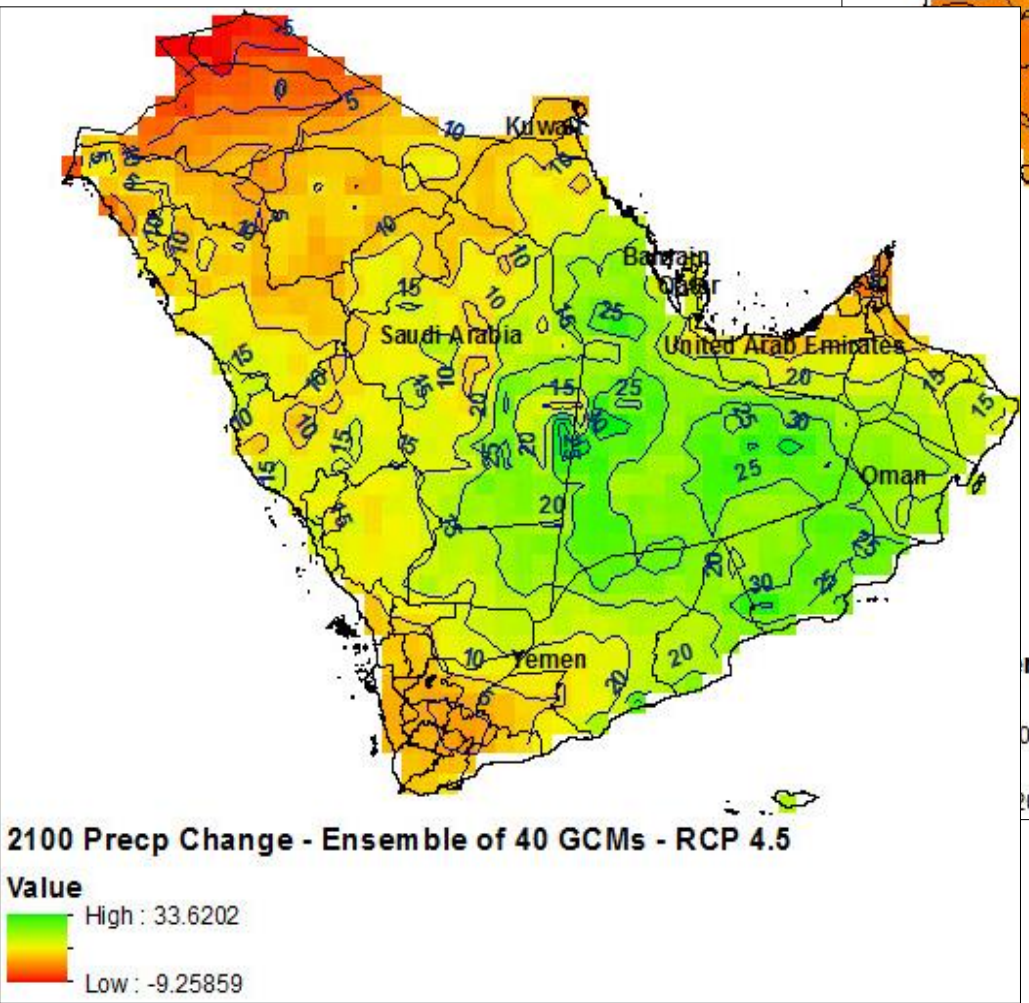


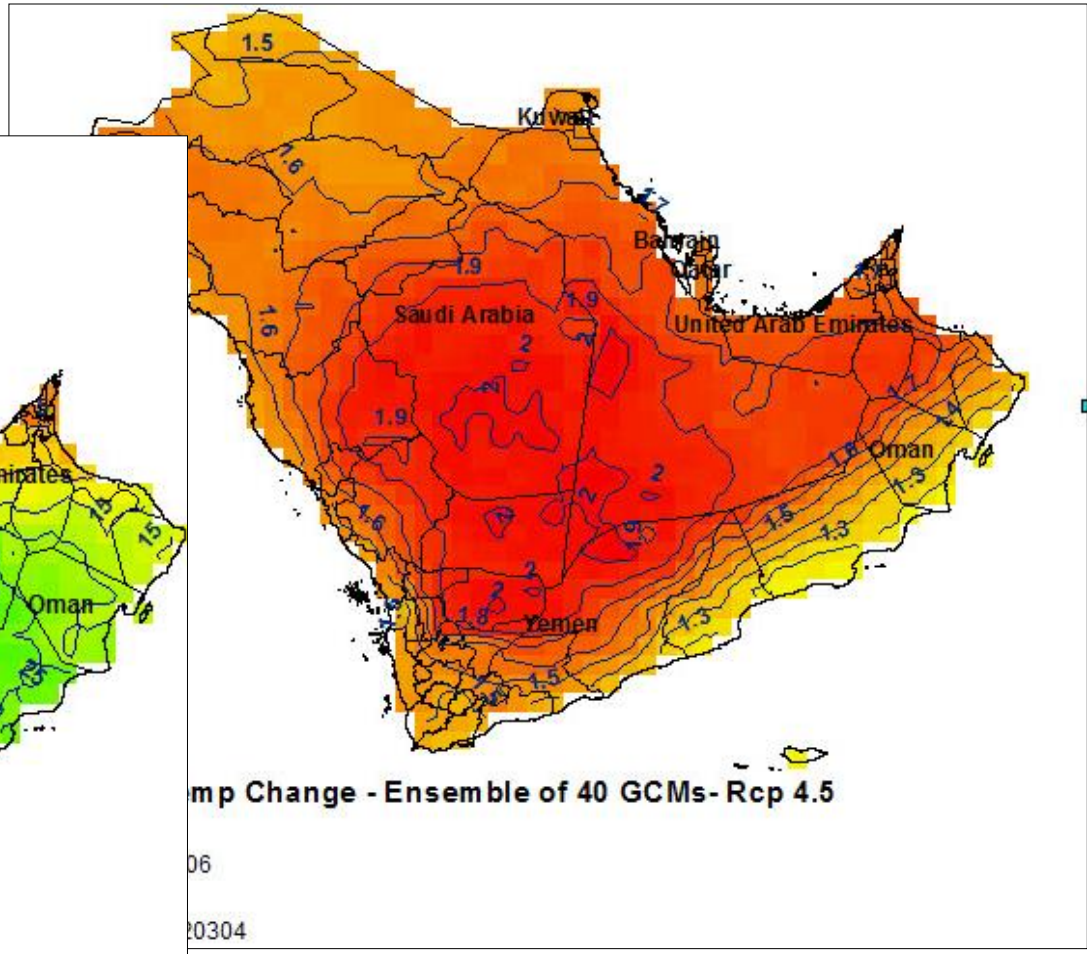
Climate Change Studies:





Climate Change Studies:

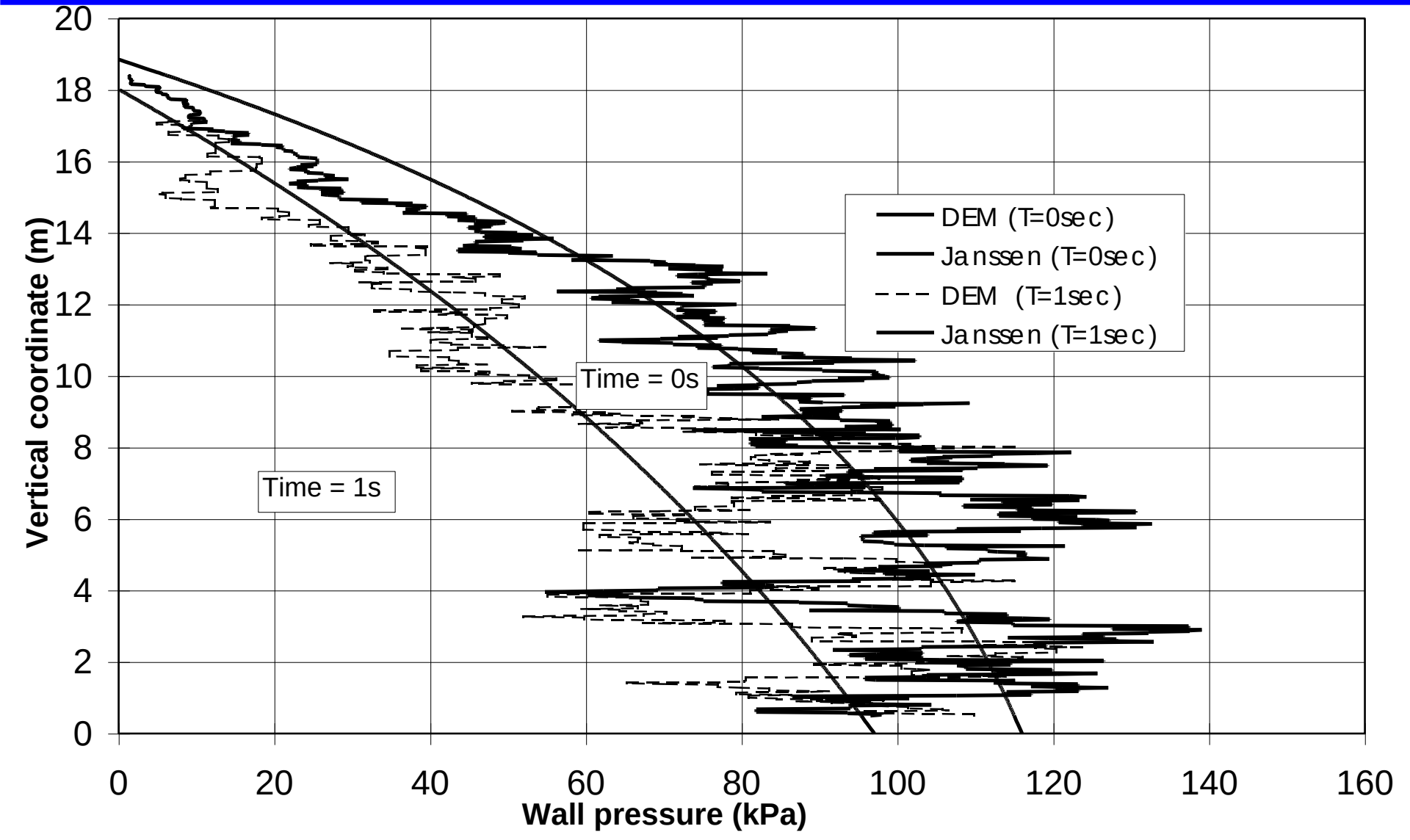




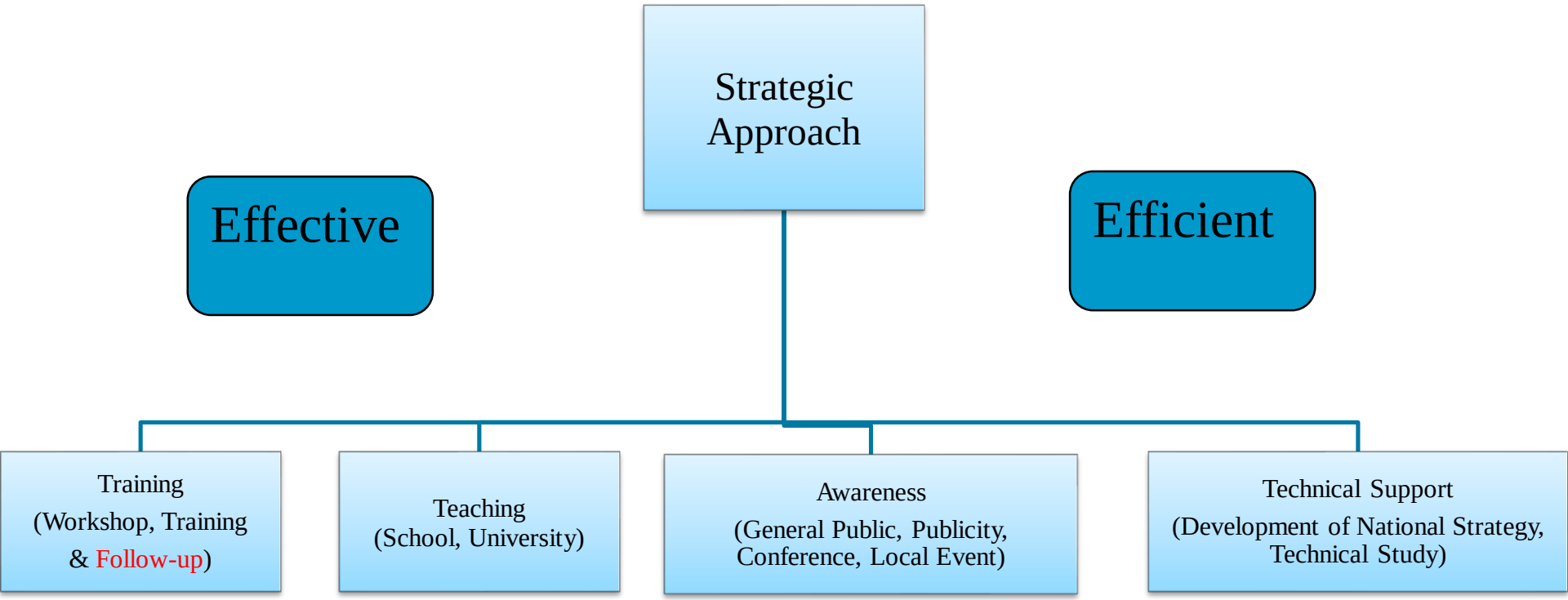
Climate Change Studies:

- Egypt:
- - Down Scaling for cell 10kmx10km using REGCM for Egypt
- - Study of impact on Flood

DEM prediction & Example of best fit



Capacity Building to Support Policymakers



Priority Training

WHAT

Financial / Feasibility for Mitigation:

- *Loss & Damage due to Disaster*
- *Investment Opportunities in DRR*

GIS & Remote Sensing:

- *Prediction of Hazard Impact*
- *Early Warning System*

WHO

Cross-Cutting Ministries
Multi-country / Experienced & New

HOW

Training with:

- *Projects*
- *Outcomes*
- *Follow-up*

Thank you for your attention

Merry Christmas &
Happy new Year