



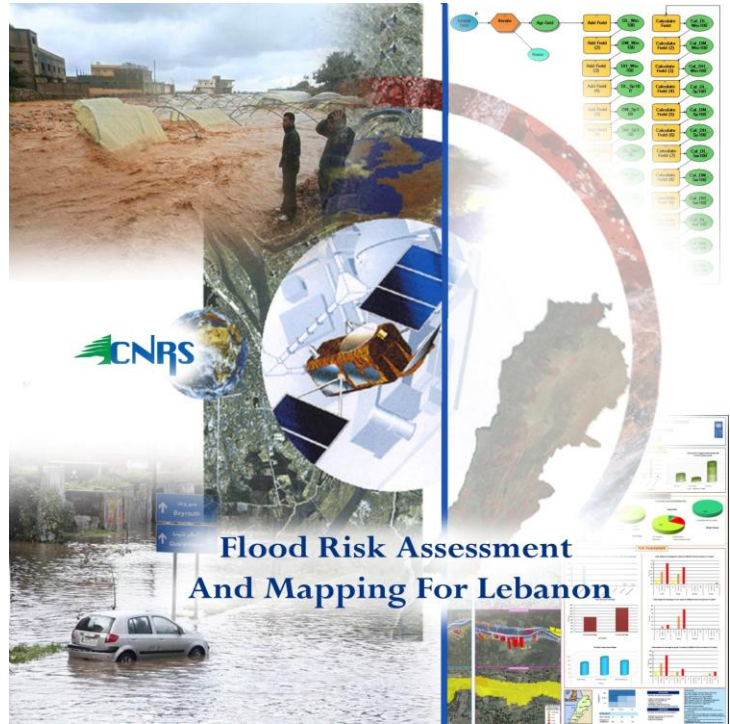
National Council for Scientific Research

**MEDSPRING Project  
Science Café and Awareness Raising Event**

# Floods Early Warning System for Lebanon

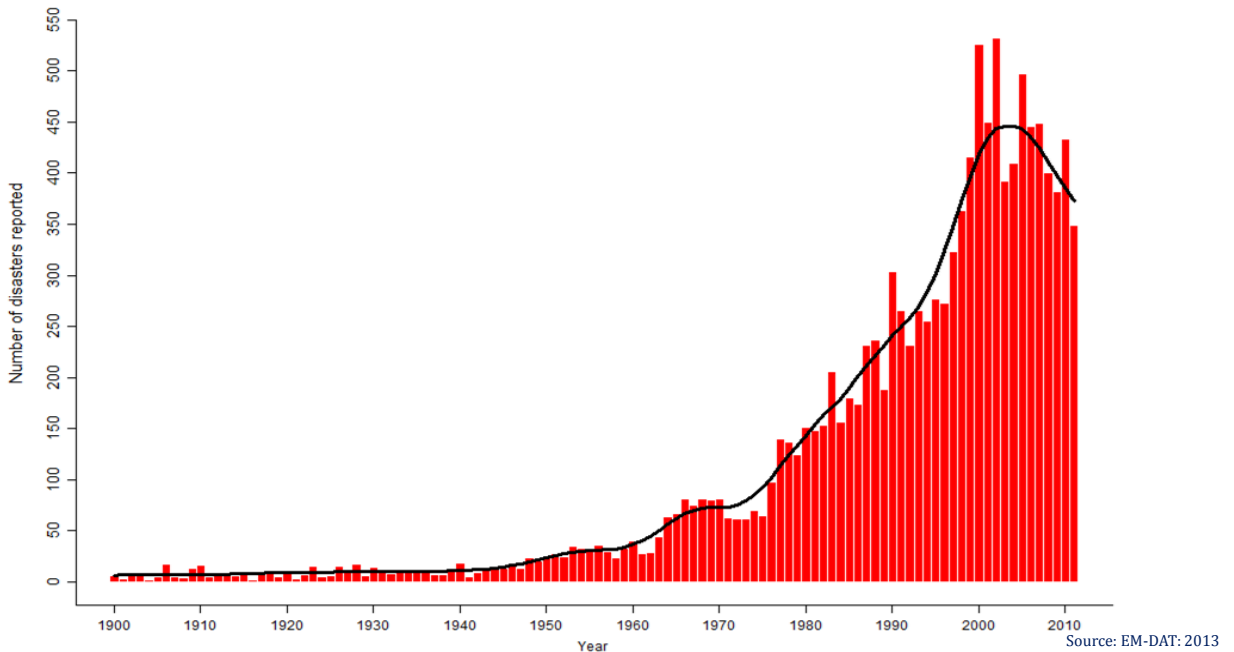
17 February 2017, CNRS-Beirut

Chadi Abdallah, PhD

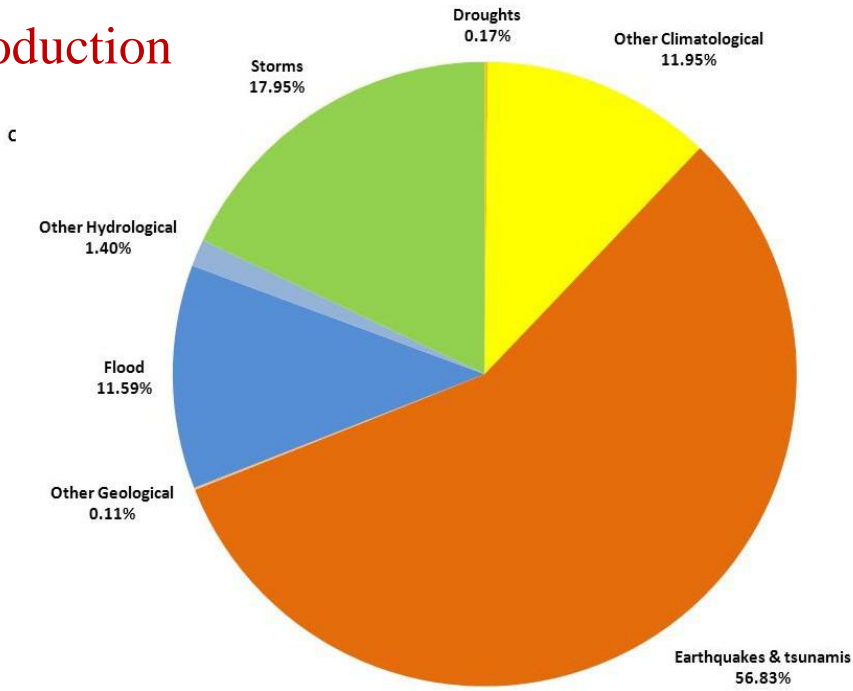


**Flood Risk Assessment  
And Mapping for Lebanon**

Number of Natural Disasters in the last Century



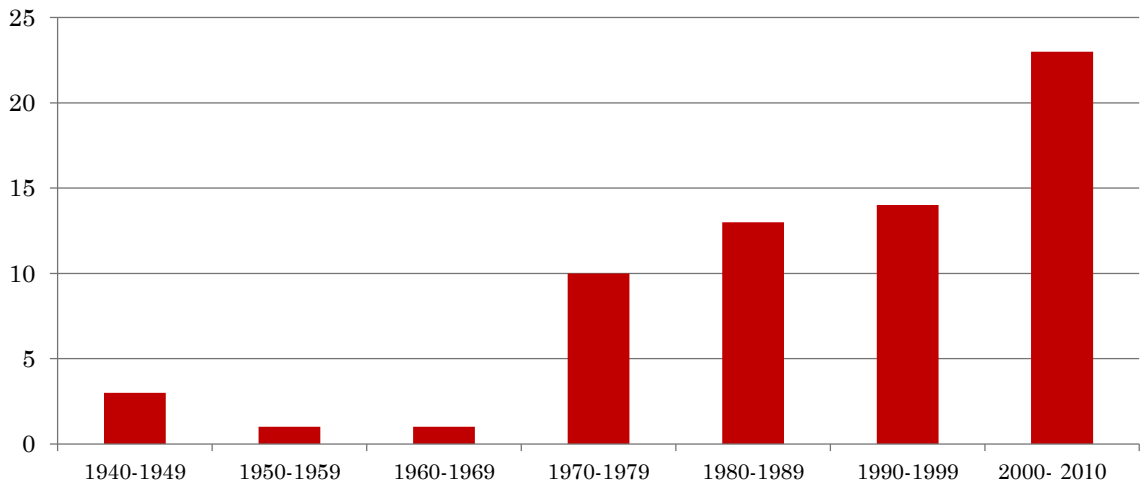
# Introduction

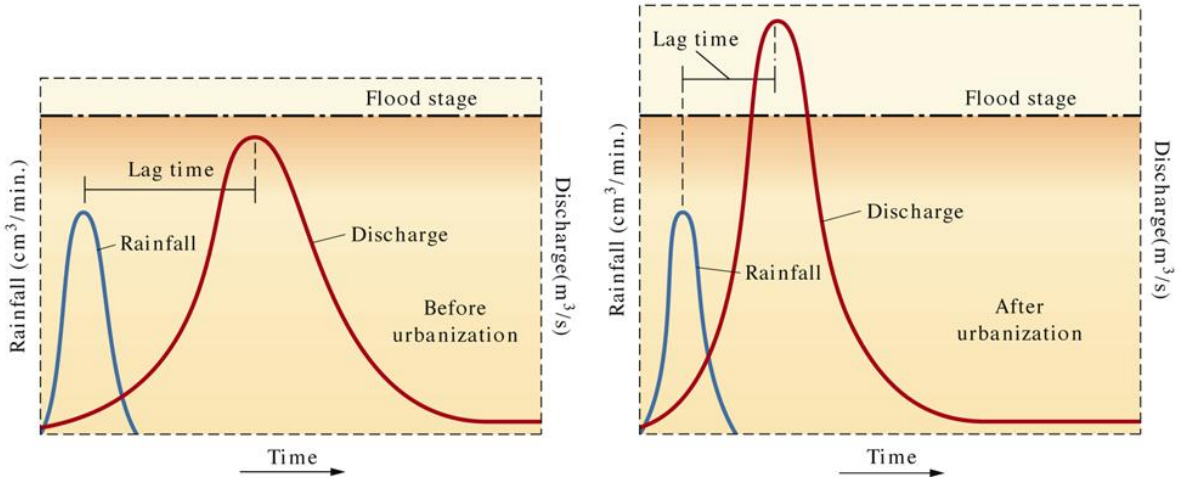


CREDES News 2016

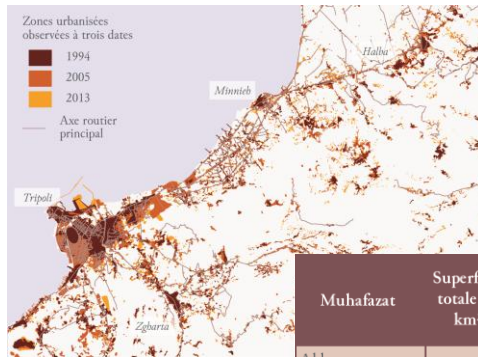
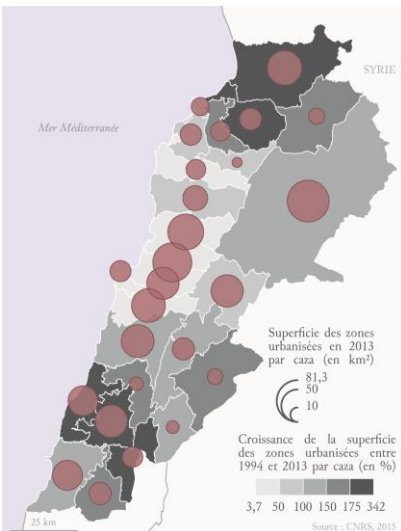


# Introduction





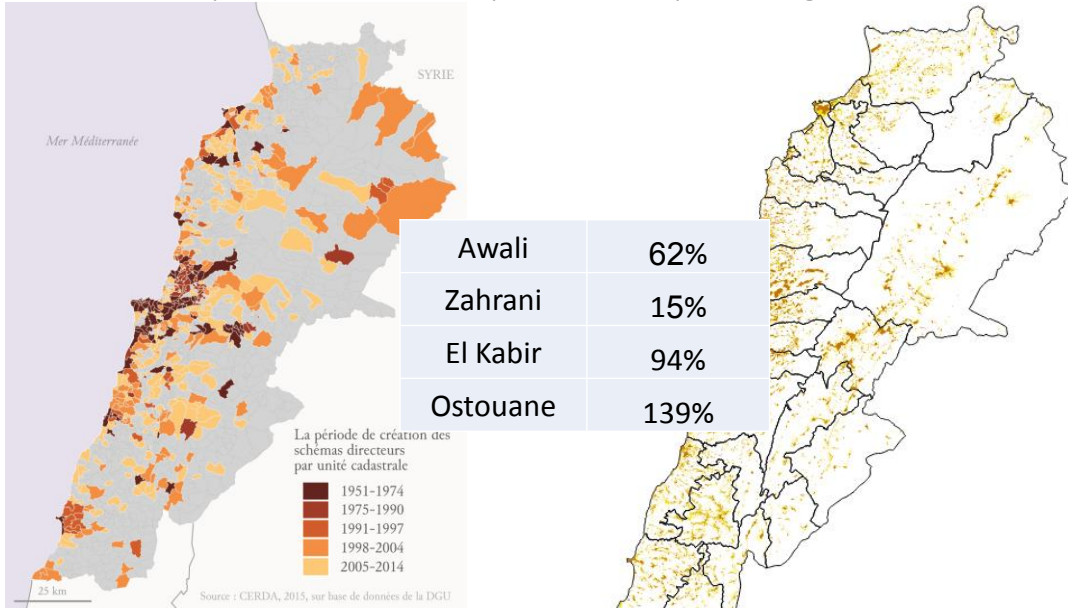
## Uncontrolled urbanization (+80% in 20 years)



Muhafazat	Superficie totale en km <sup>2</sup>	Surperficie urbanisée en km <sup>2</sup> et en pourcentage de la superficie totale					
		1994		2005		2013	
Akkar	790	20	3%	44	6%	55	7%
Baalbek-Hermel	2853	45	2%	73	3%	94	3%
Beyrouth	21	20	95%	21	98%	21	98%
Békaa	1413	46	3%	67	5%	83	6%
Mont Liban	1973	226	11%	281	14%	312	16%
Nabatiyé	1100	30	3%	76	7%	99	9%
Nord	1187	49	4%	89	7%	101	9%
Sud	924	35	4%	68	7%	92	10%
<b>LIBAN</b>	<b>10262</b>	<b>472</b>	<b>5%</b>	<b>719</b>	<b>7%</b>	<b>858</b>	<b>8%</b>

Source : CNRS, 2015

# Insufficiency and inefficiency of urban planning



## Introduction

The semi-arid areas in Baalbeck El Hermel also witness several flash floods especially in 1994, 1999, **2001**, 2003, 2007, 2010 and 2011, 2013, **2015** causing a huge loss in properties, destroying bridges and disrupting the Baalbeck-Syria highway at several occasions and for several hours.





Jadra in the Iqlim al-Kharroub region



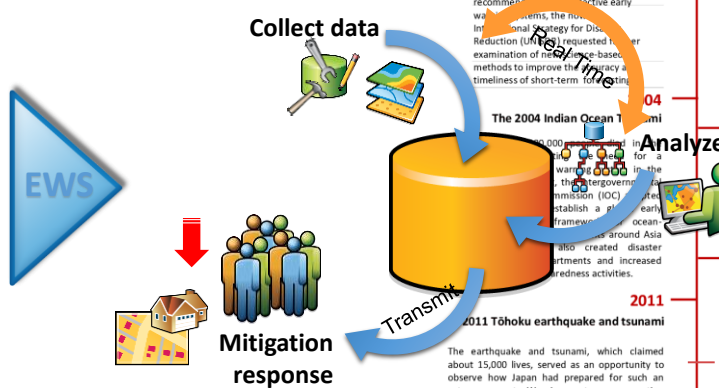
coastal highway Saida





To reduce disasters, international institutional frameworks are being strengthened all over the world.

- Preparedness
- Awareness
- Response,
- Recovery
- Mitigation.



**1984–1985**  
**Famines in Sudan and Ethiopia**  
 The United States created the Famine Early Warning System (FEWS) — now FEWS NET — in response to the widely reported famines, estimated to have caused up to one million deaths. The system aims to anticipate impending famines and advise policymakers on how they might prevent famines.

**1990–1999**  
**The International Decade for Disaster Risk Reduction**  
 Promoted awareness of the potential of early warning systems.

**1995**  
**Request for forecasting research**  
 In the process of preparing recommendations for effective early warning systems, the International Strategy for Disaster Reduction (ISDR) requested further examination of science-based methods to improve the accuracy and timeliness of short-term forecasting.

**1994**  
**World Conference on Natural Disaster Risk Reduction (Yokohama, Japan)**  
 The conference produced the Yokohama Strategy and Plan of Action for a Safer World, which provides guidelines for disaster prevention, preparedness and mitigation, and acknowledges early warning systems as a crucial component.

**2004**  
**The 2004 Indian Ocean Tsunami**  
 The tsunami, which claimed over 200,000 lives, served as an opportunity to observe how Japan had prepared for such an extreme event. Warning systems, evacuation routes and coordination were put to test and proved successful compared to the panic and lack of coordination seen seven years earlier in Asia and the Pacific. It also provided unprecedented opportunities to study how buildings hold up under long periods of shaking and how to build them better.

**2005**  
**2005 World Disaster Reduction Conference (Hyogo, Japan)**  
 The Hyogo Framework for Action was adopted, in which risk assessment and early warning is one of five themes.

**2006**  
**3rd International Conference on Early Warning**  
 Development of a checklist by UNISDR to help governments and communities set up effective early warning systems. [3]

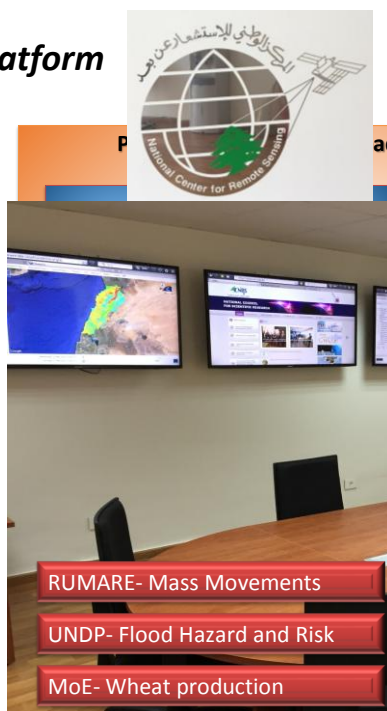
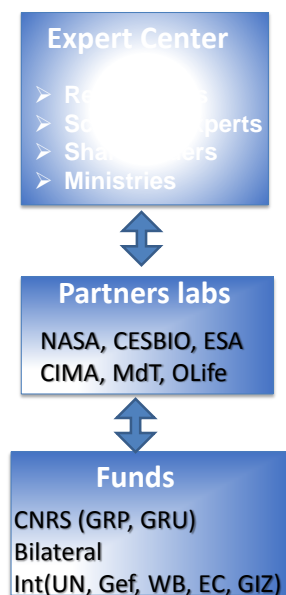
**2011**  
**2011 Tōhoku earthquake and tsunami**  
 The earthquake and tsunami, which claimed about 15,000 lives, served as an opportunity to observe how Japan had prepared for such an extreme event. Warning systems, evacuation routes and coordination were put to test and proved successful compared to the panic and lack of coordination seen seven years earlier in Asia and the Pacific. It also provided unprecedented opportunities to study how buildings hold up under long periods of shaking and how to build them better.

**2015**  
**2015 World Disaster Reduction Conference (Sendai, Japan)**  
 Strengthen technical and scientific capacity to capitalize on and consolidate existing knowledge and to develop and apply methodologies and models to assess disaster risks, vulnerabilities and exposure to all hazards.



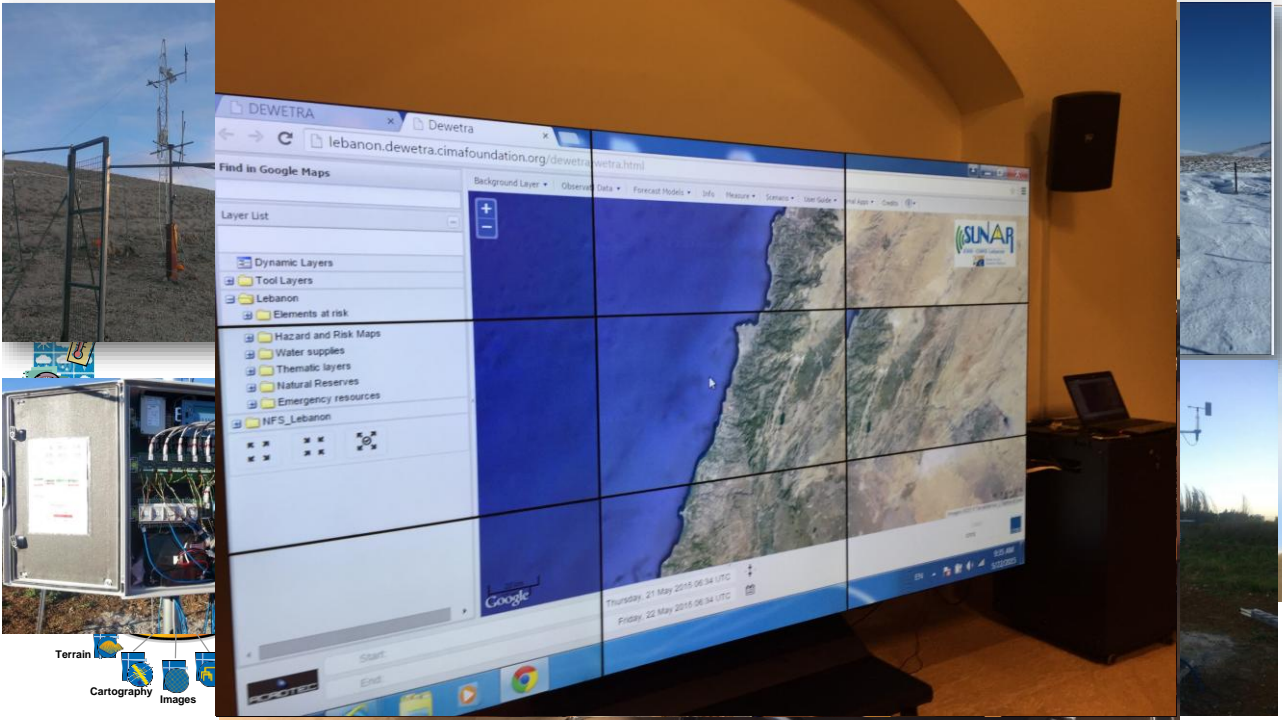
## Sustainable Natural Resources Management Platform and Early warning system (SuNaR)

### CNRS – SuNaR Platform

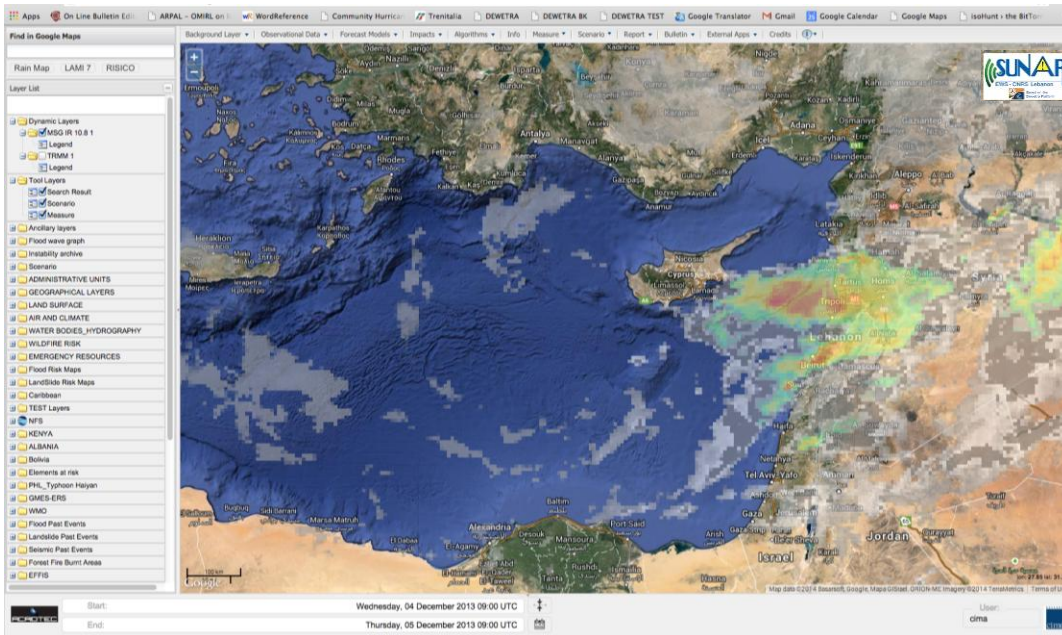


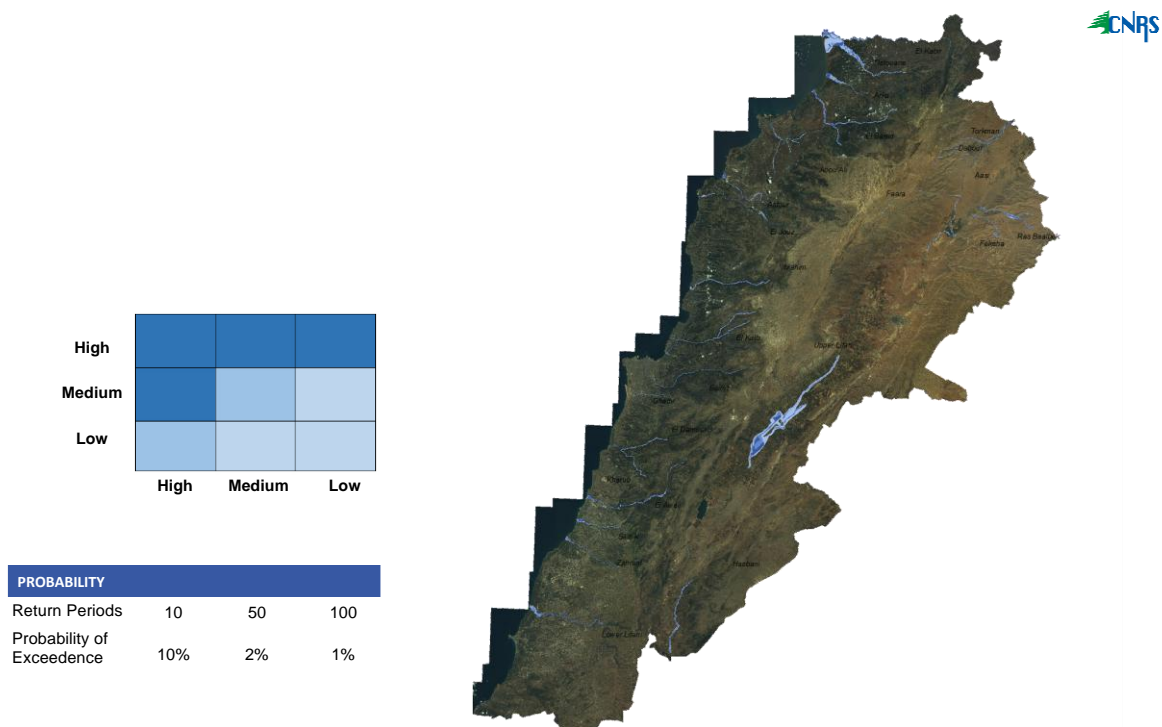
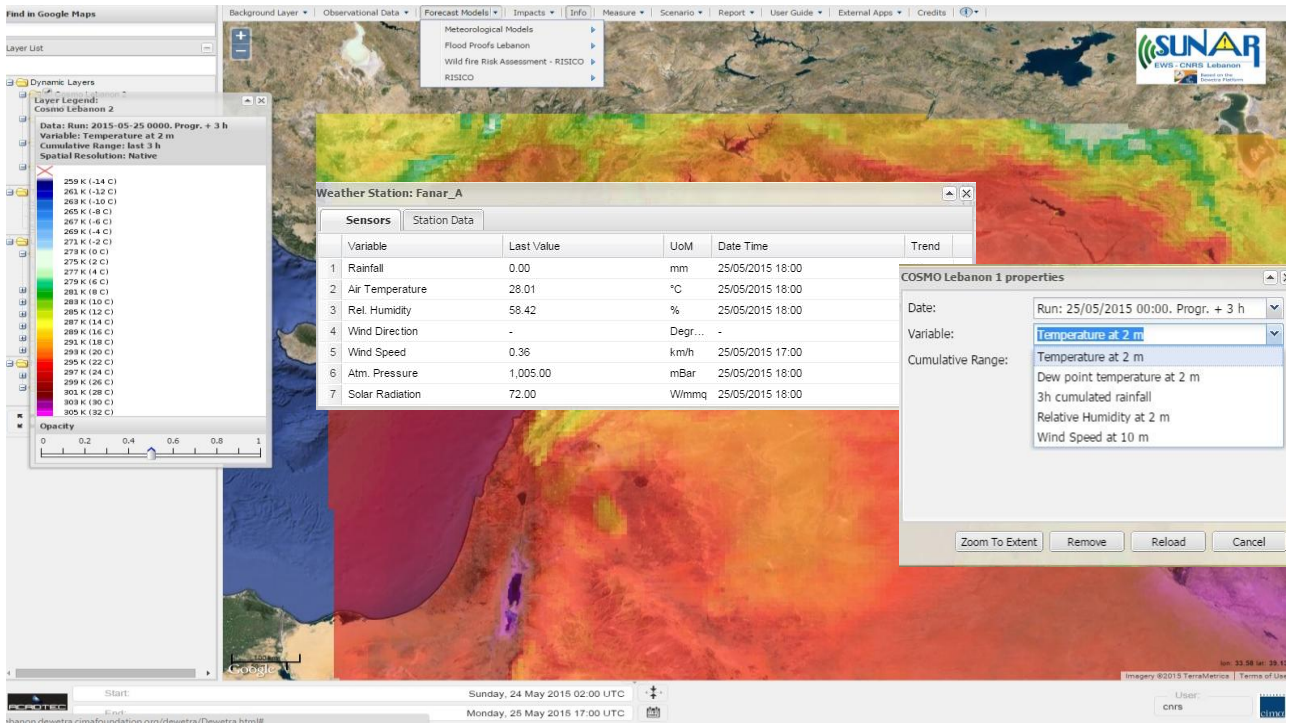
- RUMARE- Mass Movements
- UNDP- Flood Hazard and Risk
- MoE- Wheat production





## Satellite observations





## Flood zone areas

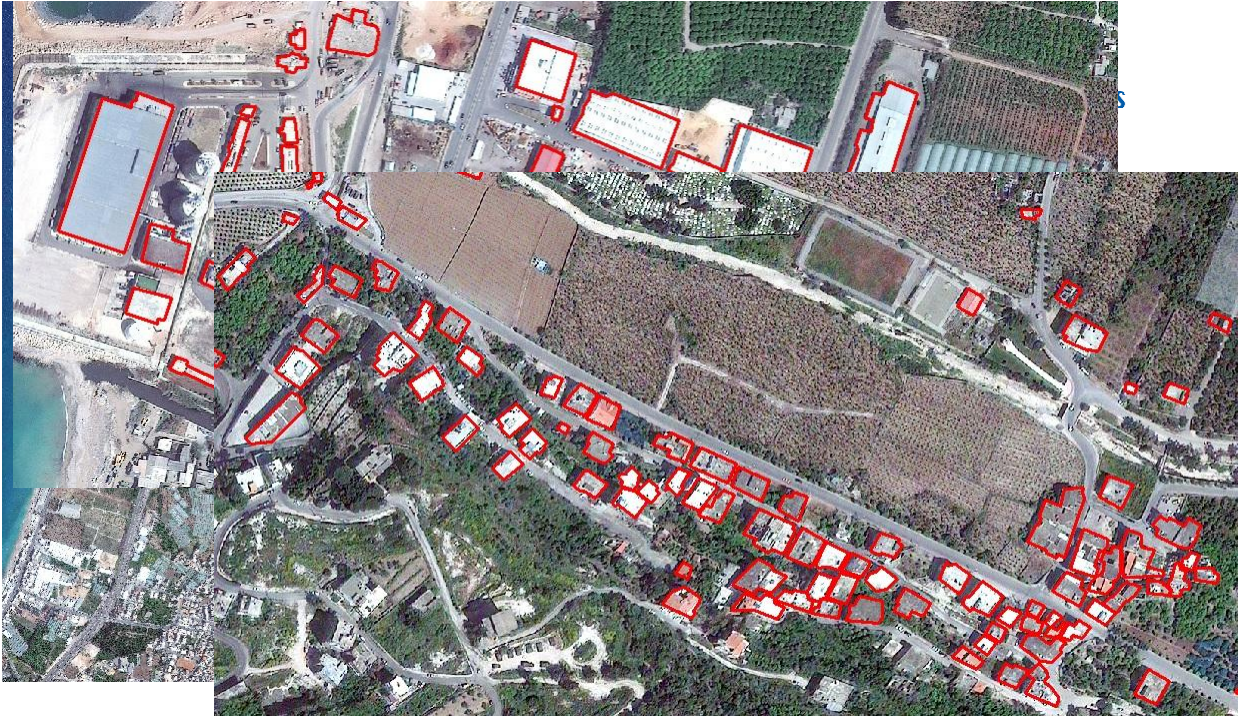
<input type="checkbox"/> Bare land	26 km <sup>2</sup>
<input type="checkbox"/> Crop Land	92 km <sup>2</sup>
<input type="checkbox"/> Fruit trees	18 Km <sup>2</sup>
<input type="checkbox"/> Wooded lands	22 km <sup>2</sup>
<input type="checkbox"/> Urbane zones	10 km <sup>2</sup>

## Assets @

Satellite Image  
GeoEye (2013)  
Ikonos (2008)

	Crop Land
	Bare Land
	Green House
	Farm
	Fruit Trees
	Industry
	Wooded Land
	Road
	River
	Urban Zone
	Building





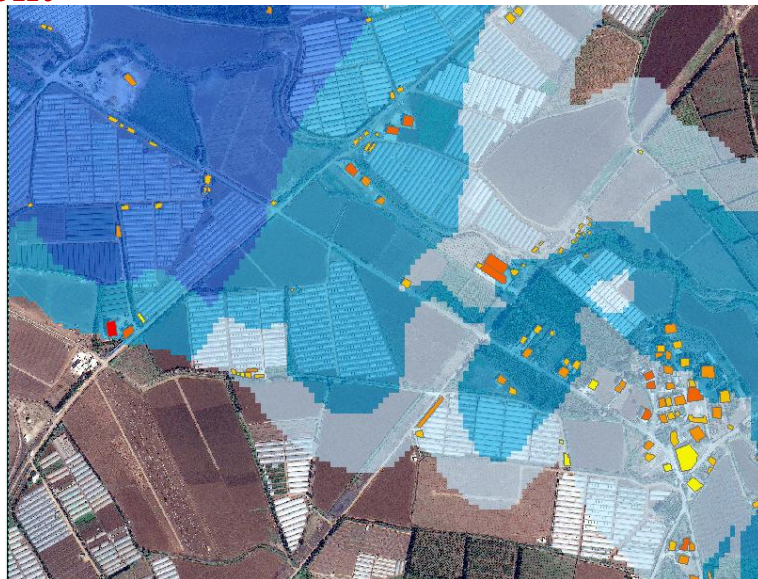
تقييم مخاطر واطار الفيضانات وضع مخططاتها



# Risk Assessment

## 2- Estimating Damage to

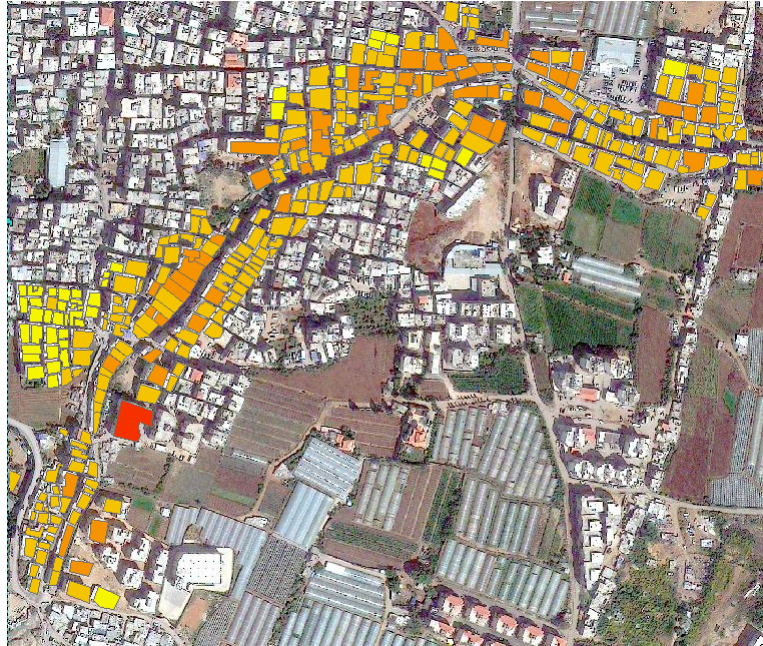
- Legend**
- Damage to Structures**
- Type of Structure**
- No Damage
  - Single House
  - Building
  - Industry
  - Farms
  - Hazardous
  - Refugee Tent
  - Low
  - River, Path
  - Medium
  - High



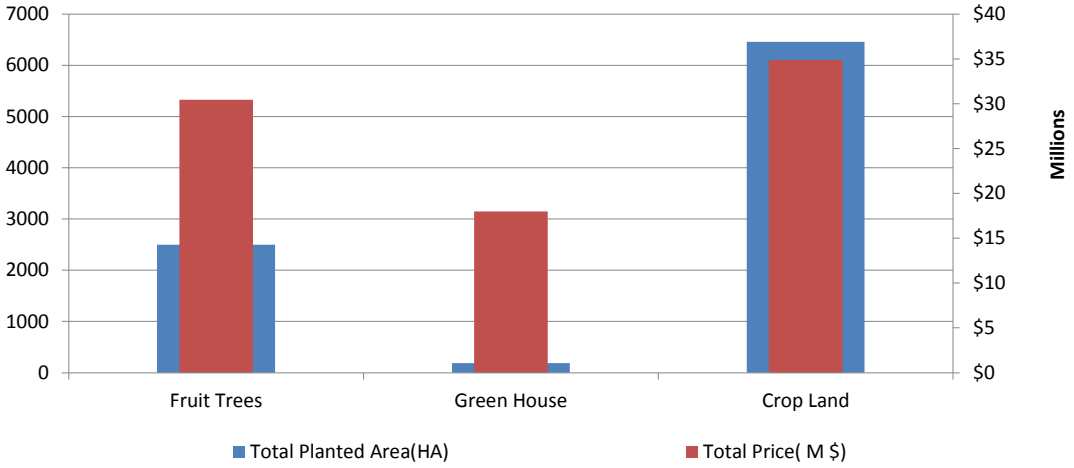
تقييم مخاطر واطار الفيضانات ووضع مخططاتها



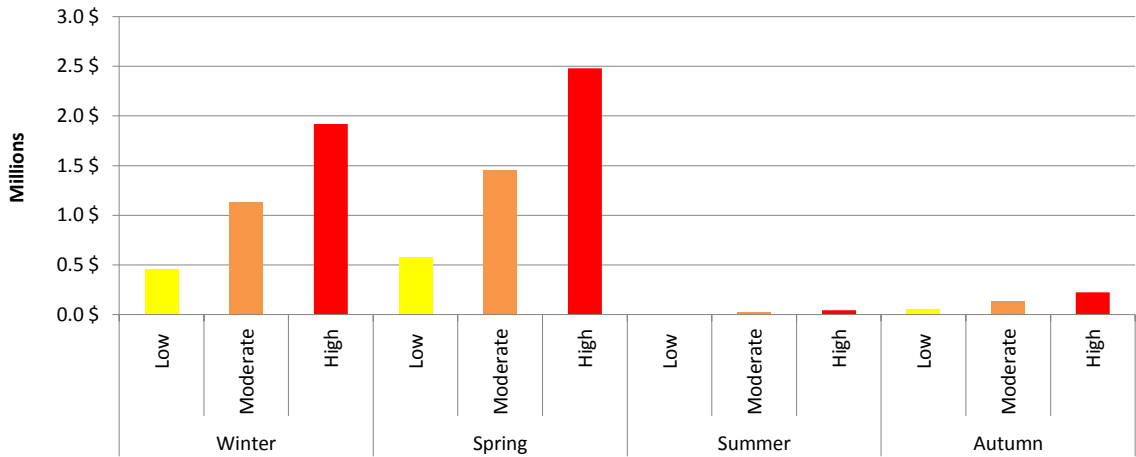
- No Damage
- <10000
- 10000 - 25000
- 25000 - 50000
- 50000 - 75000
- >75000



### Agriculture sector



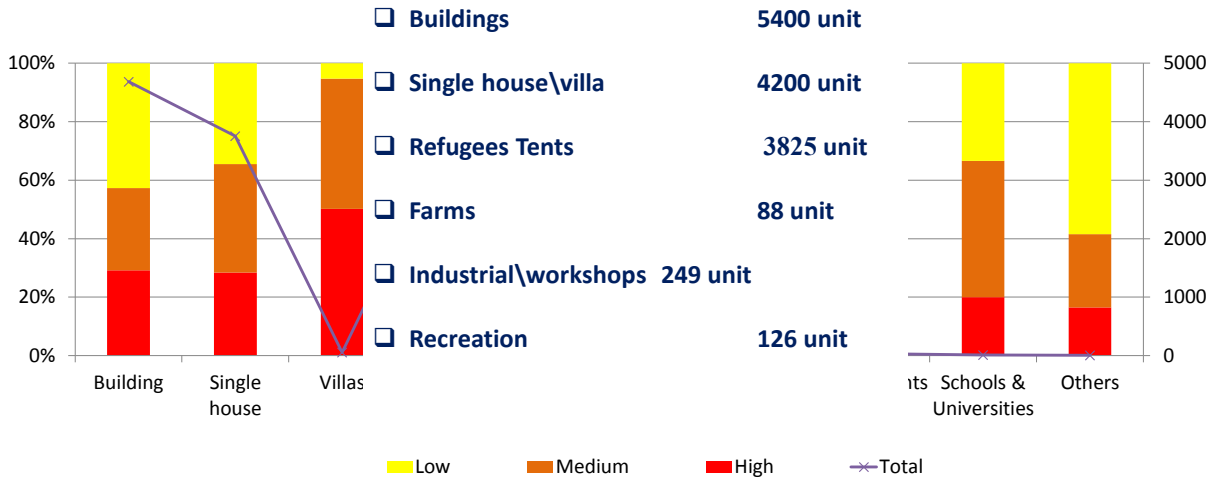
### Agriculture sector



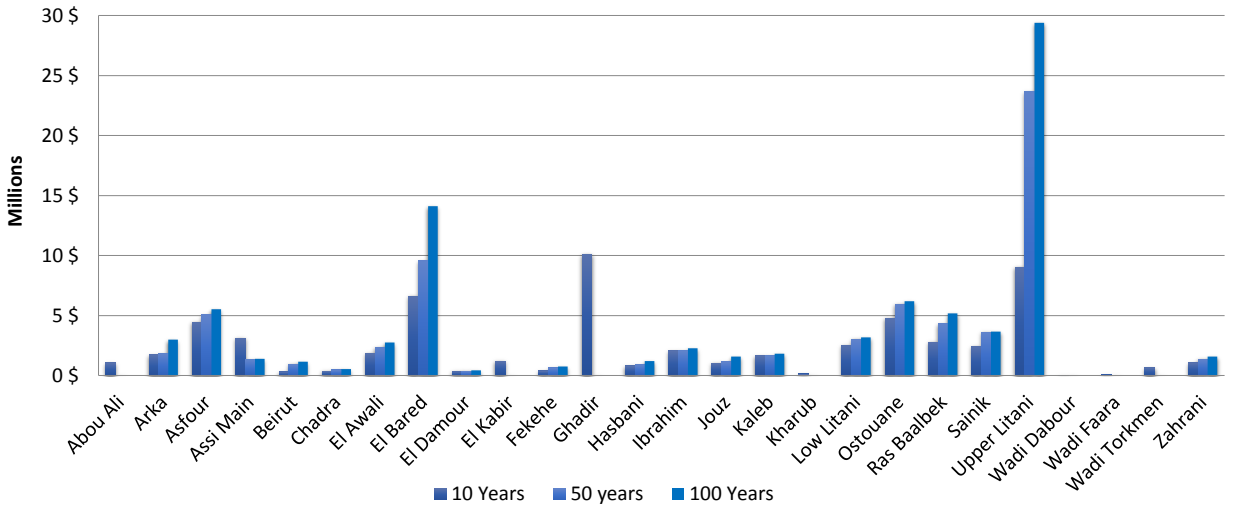
Damage estimates (\$) for crop land in different cultivated seasons



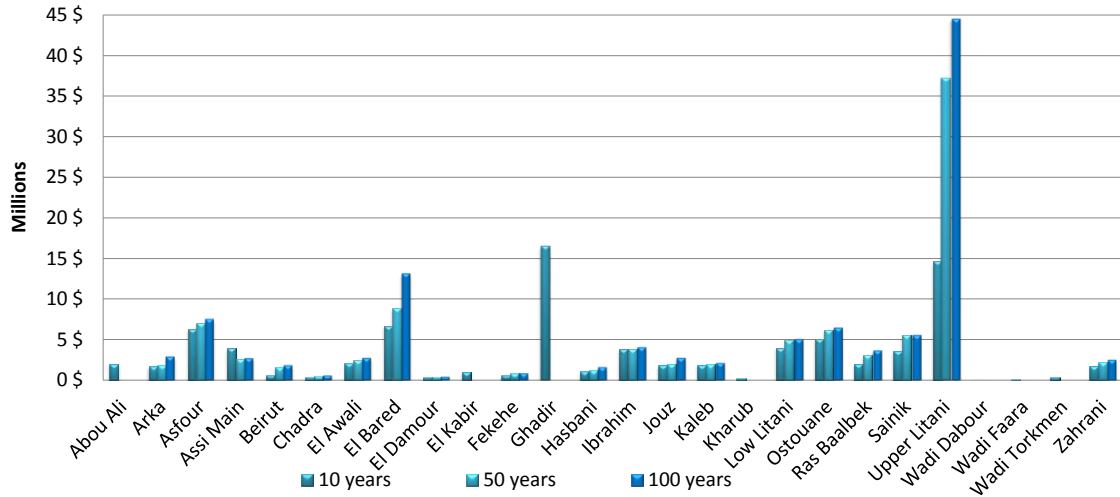
## Assets



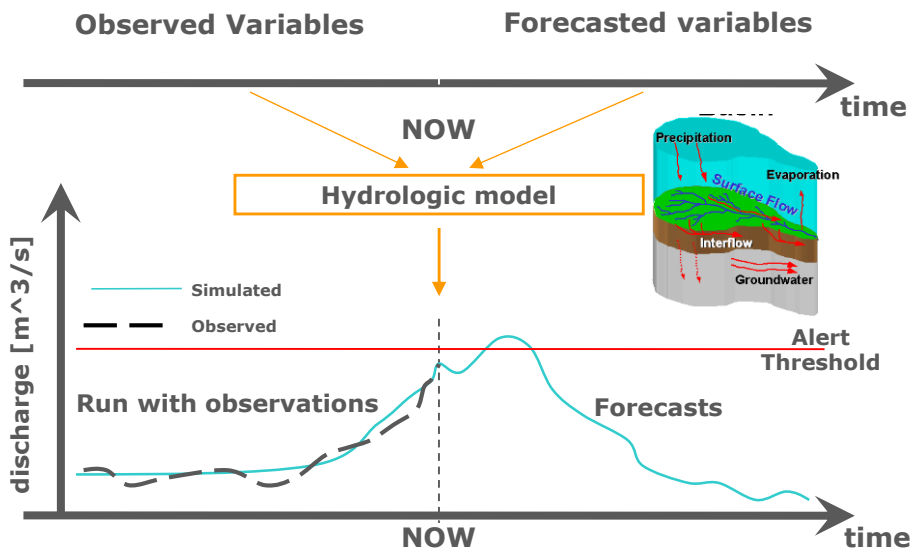
## 2-Damage to structures



2-Damage to Structure Content

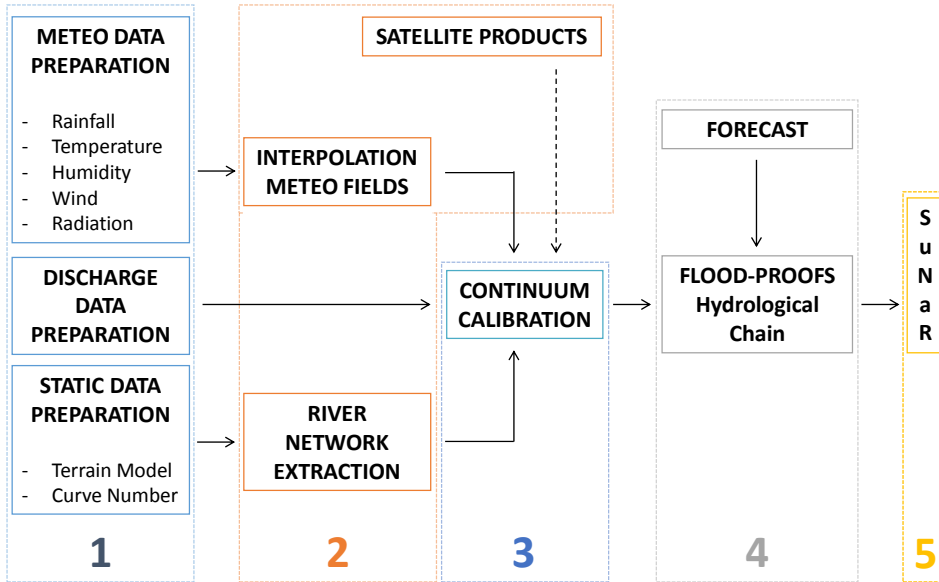


Flood forecasts

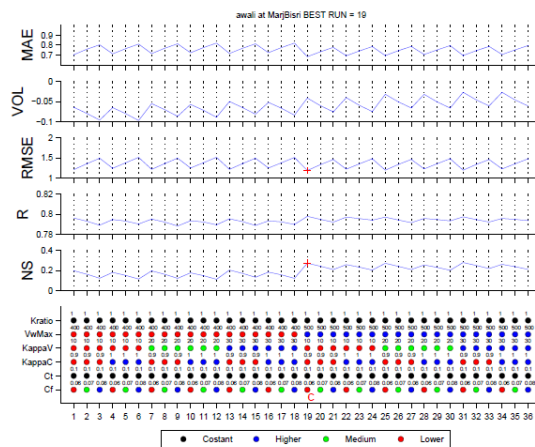




## WORK STEPS

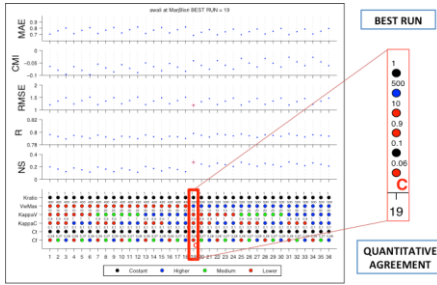


Continuum is a complete and distributed model that allows the simulation of the main hydrological processes

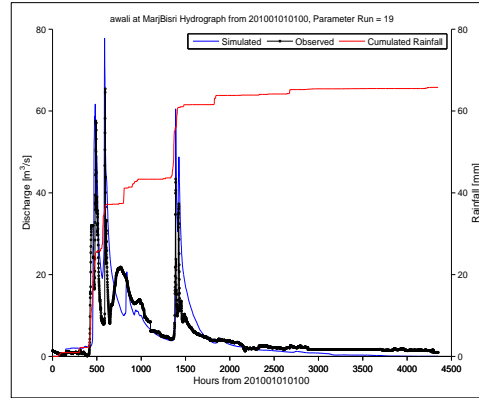


performs hydrological processes calculations from river network extraction, and meteorological data preparation, to the rainfall-

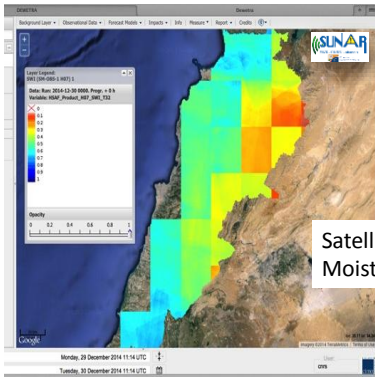
# CALIBRATION - AWALI



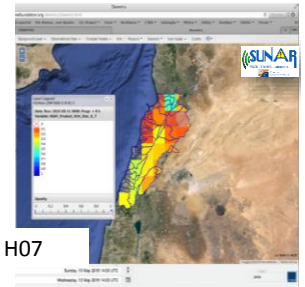
Calibration period:  
2010.01.01 – 2010-07.01



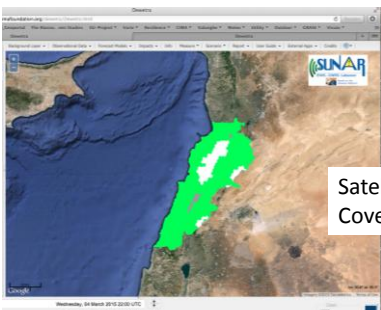
## Satellite Observations



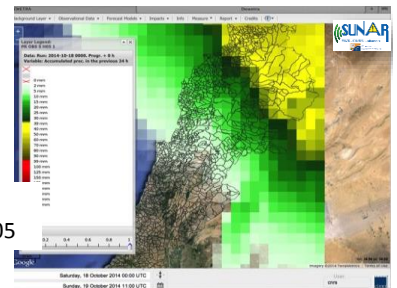
Satellite Soil Moisture H14



Satellite Soil Moisture H07

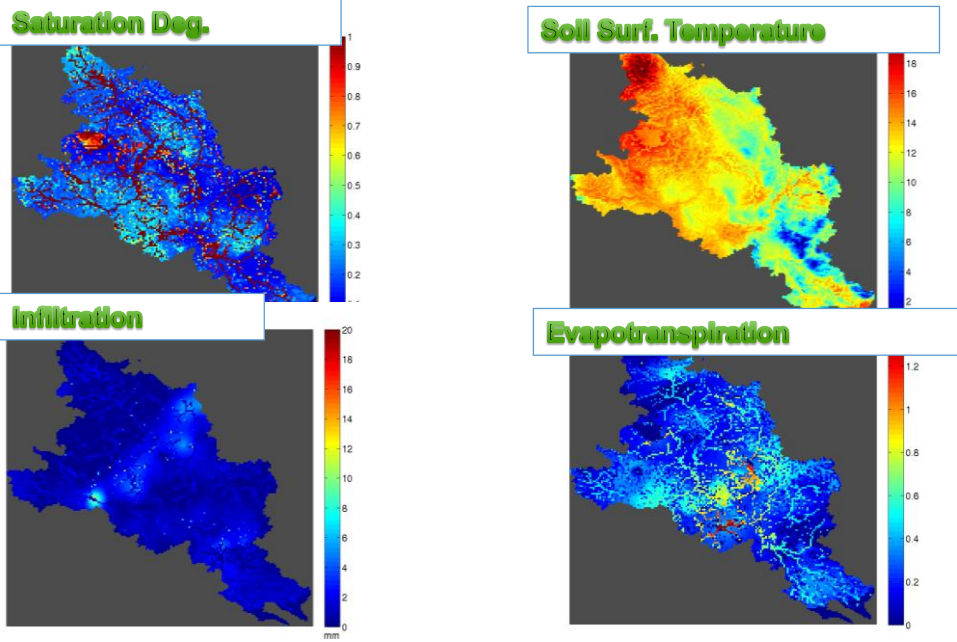


Satellite Snow Cover Area H10

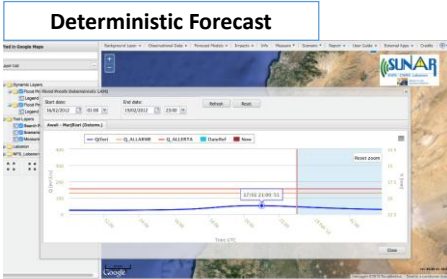


Satellite Precipitation H05

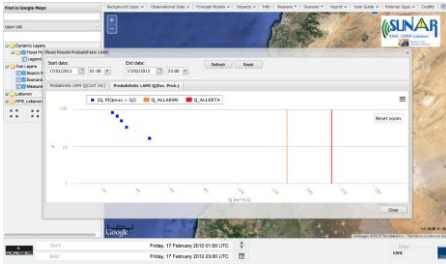
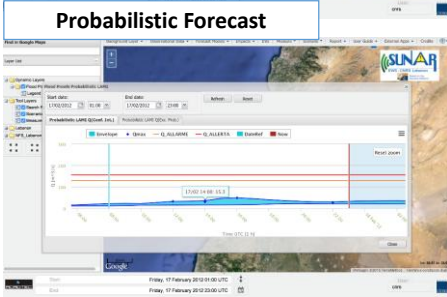
### Continuum: Output

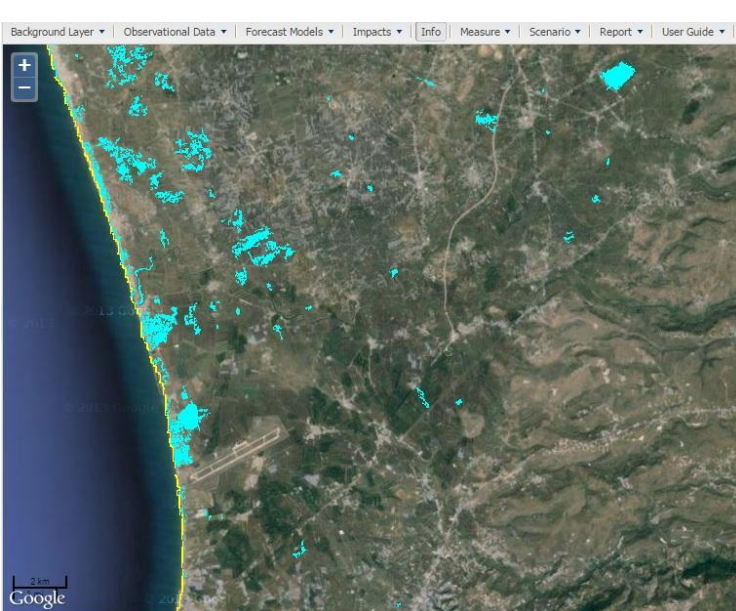


### Hydrological FORECAST



COSMO-I7- forecast for 16 February 2017





18 Oct 2014



**NATIONAL CENTER FOR REMOTE SENSING**  
**GEOSPATIAL PORTAL**

http://rsensing.cnrs.edu.lb

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- Training on Water Accounting and Water productivity
- Co-Sismic Landslide Hazard Maps
- Flood Hazard Digital Elevation Model
- Flood Hazard Drainage Network & Watersheds

Latest Metadata:

- Natural Protected Reserves
- Watersheds
- Erosion Risk: Arsen

Popular Metadata:

- Landslides 2005\_Land4
- Watersheds
- Natural Protected Reserves

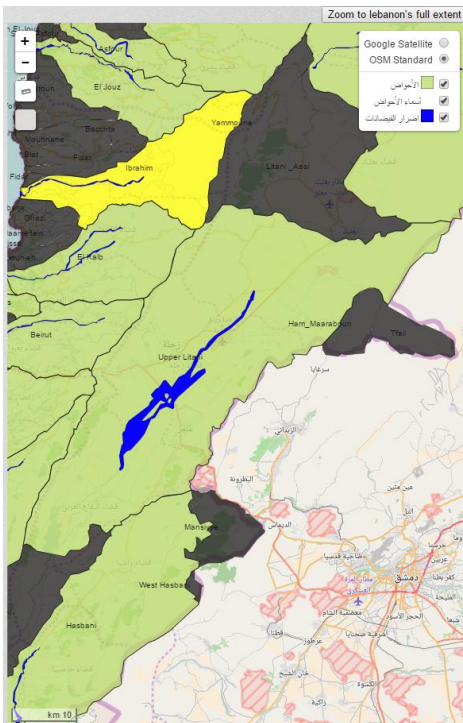
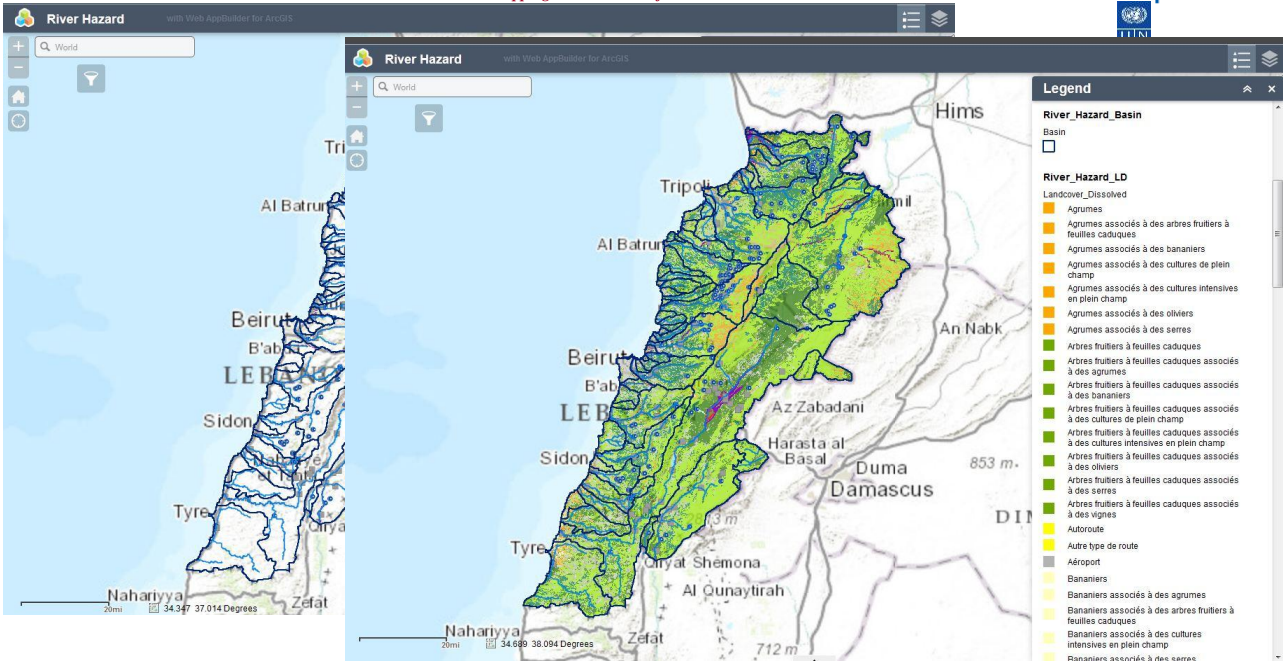
Gallery:

- Flood hazard mapping assessment for Lebanon
- Co-Sismic Landslide Hazard Maps
- Flood Hazard Digital Elevation Model
- Flood Hazard Drainage Network & Watersheds

Events:

- Présentation à Paris du livre "Atlas du Liban: Les nouveaux défis"
- Salon du Livre: Atlas du Liban - Les nouveaux défis

Floods Risk Mapping & Assessment for Lebanon



تقييم مخاطر الفيضانات

English version الصفحة الرسمية About All

السناء الحوض المائي

معلومات عن Upper Litani

معلومات عامة:	50235754	مساحة خطر الفيضانات:	1427513310
إجمالي المساحة:	3543	النسبة المئوية المساحة المعرضة للخطر:	4

تقدير المحاصيل الزراعية في المناطق المعفورة بالمياه

المساحة المزروعة:	19835025	إجمالي المحصول (كغ):	64832072	إجمالي السنر (دولار أمريكي):	40709359
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التحيز العنوية لفئة استخدام الأراضي التي تغطي كامل الحوض المائي

أراضي زراعية:	87	أراضي عشبية:	0%	أراضي مساحية/عمرانية:	11	أراضي غير متلحقة:	1	أراضي حرجية:	0%
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الأضرار الزراعية (دولار أمريكي)

خطر	محاصيل:	فلكية:	نفقة:
10 سنوات:	31973	0	3825
متوسط:	79934	0	9563
قوي:	135888	0	16258
50 سنة:	116071	0	11840
متوسط:	290179	0	29602
قوي:	493304	0	50324
100 سنة:	142365	0	16322
متوسط:	355912	0	40805
قوي:	605051	0	69369

الأضرار على الأبنية (دولار أمريكي)

10 سنوات:	28876123	100 سنوات:	18712223
50 سنوات:	7575546		

الأضرار على المحتويات (دولار أمريكي)

10 سنوات:	43403066	100 سنوات:	30536268
50 سنوات:	12952055		

خيم الأجنين

الحد:	2385	إجمالي الأضرار (دولار أمريكي):	3291451
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*Thank You for your attention*

