

Overview of Technologies for Climate Change Adaptation related to the Water Resources Sector

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Presentation outline

- Introduction (impacts and adaptation)
- Applications of modern technologies in Climate Change (CC) impacts assessments
- Examples of CC adaptation technologies for water resources sector
- Final remarks and recommendations



Climate change impacts on Water Resources in ESCWA region

- Change of precipitation rates, in time and space, particularly on the scale of individual river basins.
- Variability of surface runoff and flow regimes in the rivers.
- Occurrence of extreme events of flooding and drought cycles .
- Deterioration of water quality in the rivers and in coastal areas due to seawater rise and intrusion in groundwater storages.
- Socio-economic impacts as low water in the rivers and droughts would have severe consequences on most sectors such as agriculture, energy and drinking water intakes.



Adaptation to CC

Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC, 2001).



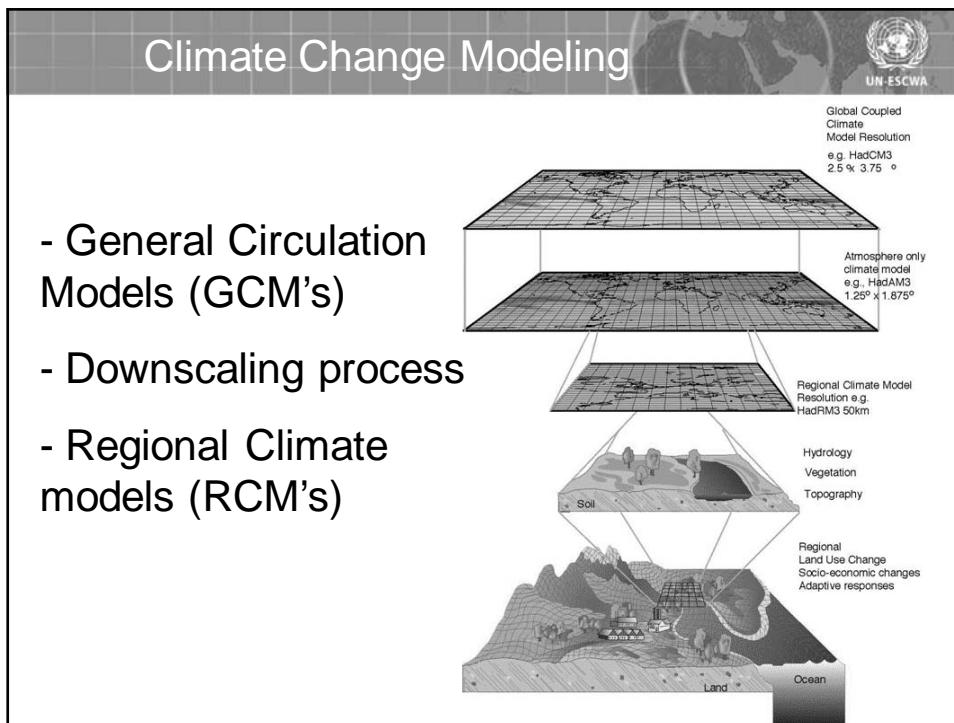
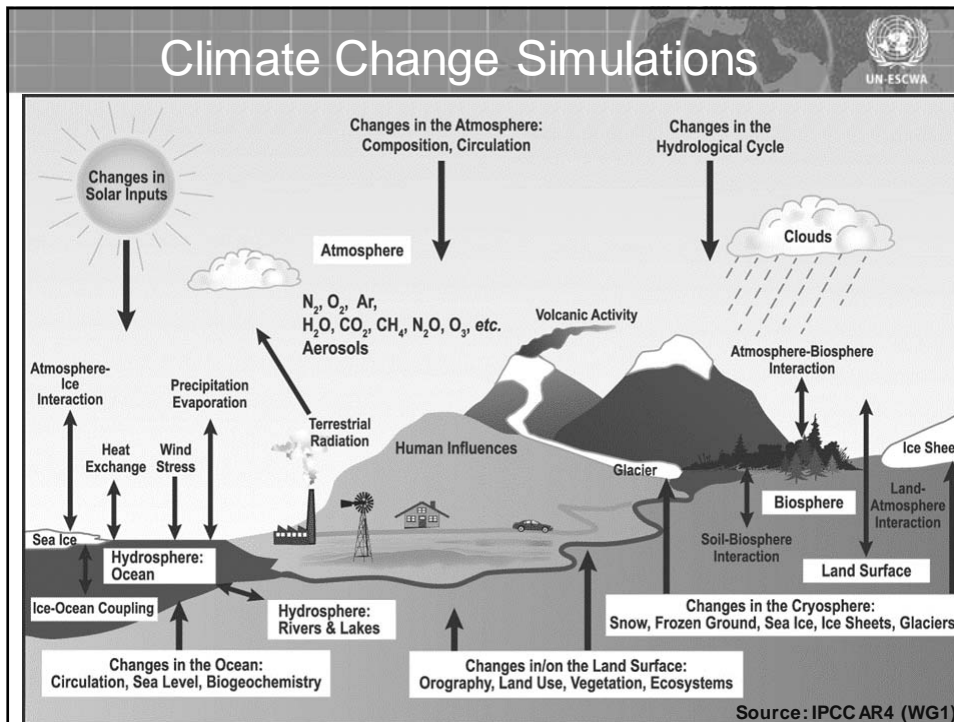
Adaptation technologies

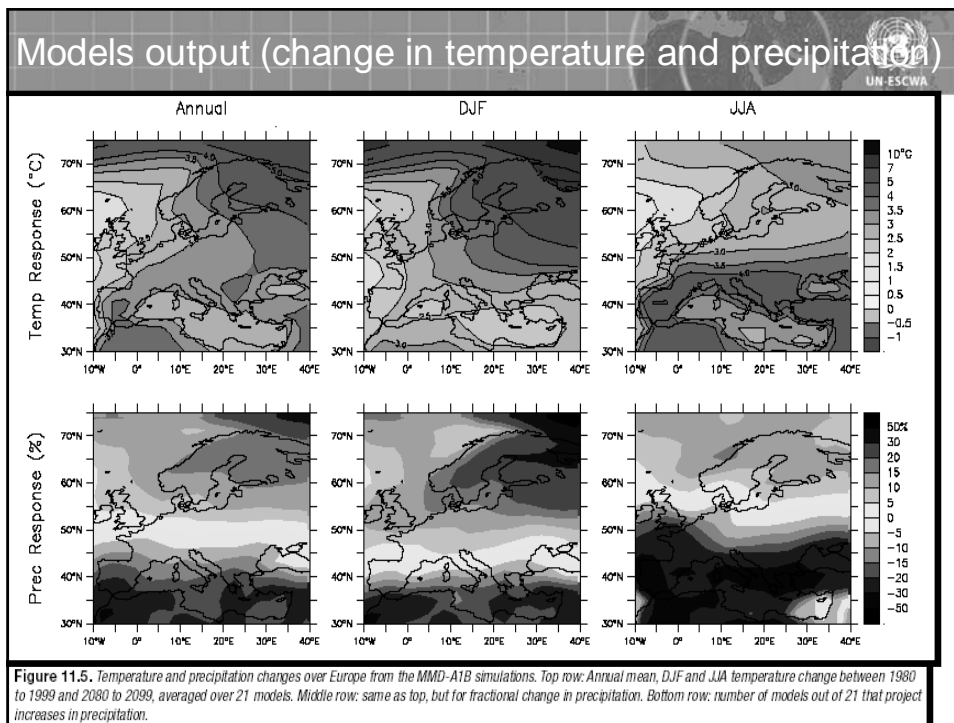
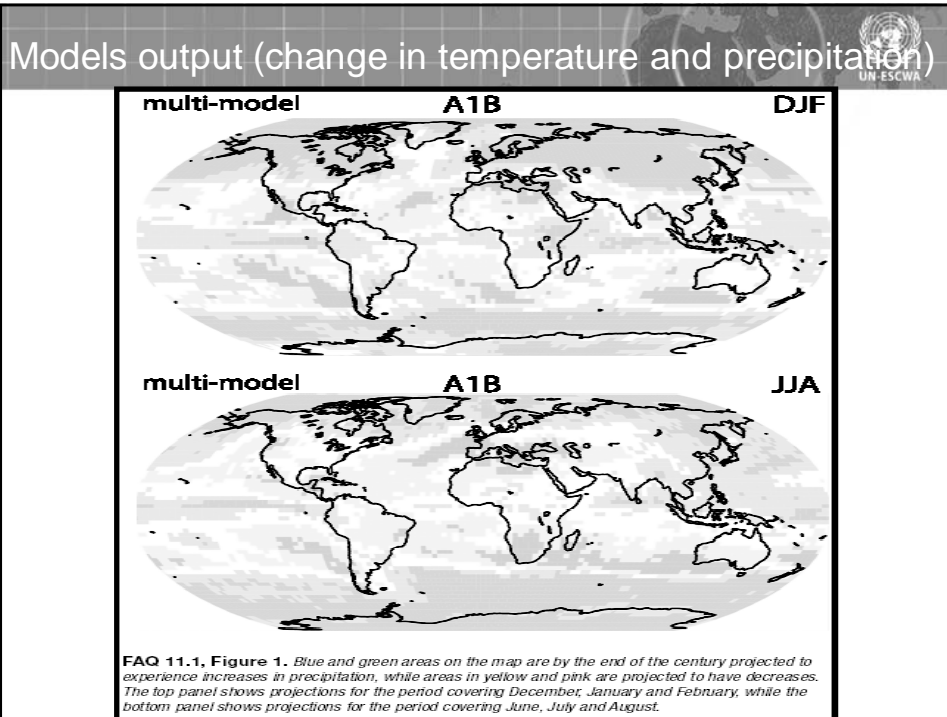
- Most adaptation measures involve the use of technology which include not only infrastructure and equipment but also knowledge and practices.
- Adaptation technologies can be defined as “the application of technology in order to reduce the vulnerability, or enhance the resilience, of a natural or human system to the impacts of climate change” (UNFCCC, 2005)



Applications of modern technologies in Climate Change impacts assessments

- Climate change simulation and modelling (climate models)
- Impact assessment of CC on water resources and related sectors (model applications, use of GIS and remote sensing, etc.)
- Data and information management (databases)



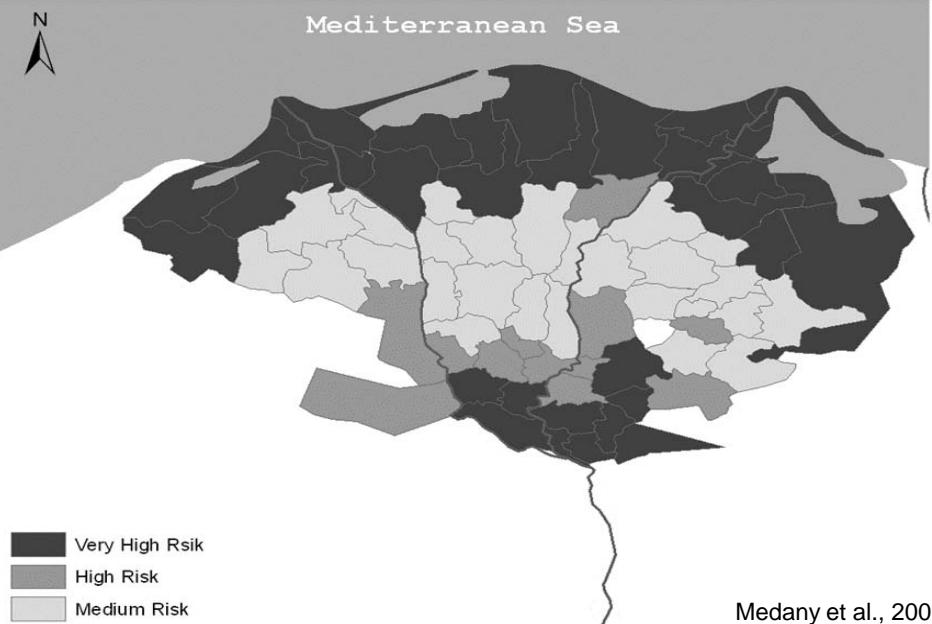


CC impact on sea-level rise in Middle East



Exposed population to the negative impacts of 5m SLR. (Dasgupta et al., 2007)

Vulnerability Index for Nile Delta - Egypt



Medany et al., 2009

- Adaptation Measures technologies can be classified as:
 - Hard technologies (e.g. new constructions, different types of equipments, seawalls and drip irrigation techniques, etc.)
 - Soft technologies (e.g. more concerned with management options, knowledge, know-how, organizational capacity, etc.)
 - A combination of both e.g. Early warning systems that combine hard technologies such as measuring devices and information technology and soft technologies like strengthening awareness and promoting evacuation.

Examples of CC Adaptation Technologies for Water Resources

Vulnerable Water management	Adaptation at supply side	Adaptation at Demand Side
Municipal water supplies	<ul style="list-style-type: none"> •Increase reservoir capacity •Desalinate •Inter-basin transfer •Rain harvest 	<ul style="list-style-type: none"> •Use Grey water •Improve water efficiency •Reduce leakages •Conserve •Use economic instruments •Enforce water legislations
Pollution protection (Degradation of Water Quality)	<ul style="list-style-type: none"> •Enhance treatment works •Reuse and reclaim •Upgrade water protection 	<ul style="list-style-type: none"> •Reduce effluent volume of waste •Promote alternatives to chemicals
<u>Irrigation systems</u> <ul style="list-style-type: none"> •Rain fed •Irrigated 	<ul style="list-style-type: none"> •Improve soil conservation •Supplement from other sources as needed •Develop bio-saline agriculture technology 	<ul style="list-style-type: none"> •Use drought tolerant crops.
	<ul style="list-style-type: none"> •Improve tilling practices. •Harvest rainwater •Reuse adequately treated domestic wastewater 	<ul style="list-style-type: none"> •Increase irrigation efficiency •Empower local water users associations •Activate economic instruments
Flood Management	<ul style="list-style-type: none"> •Build reservoirs and levees •Protect and restore wetlands 	<ul style="list-style-type: none"> •Upgrade flood warnings •Reduce floodplain development

Type of various technologies for water resources adaptation measures - Traditional, High and Modern - (UNFCCC, 2009)



Category	Technology
Traditional/ indigenous technology	Water harvesting
	Spate irrigation
	Maintenance and construction of reservoirs and wells
	Gravity irrigation systems
Modern technology	Drip irrigation
	Groundwater recharge of wells
	Wastewater treatment
	Water transfer
	Water quality control
High technology	Desalination
	Early warning flood systems
	Real time flood forecasting using modeling and computer simulation

Modern Irrigation technologies



Increase irrigation efficiency:

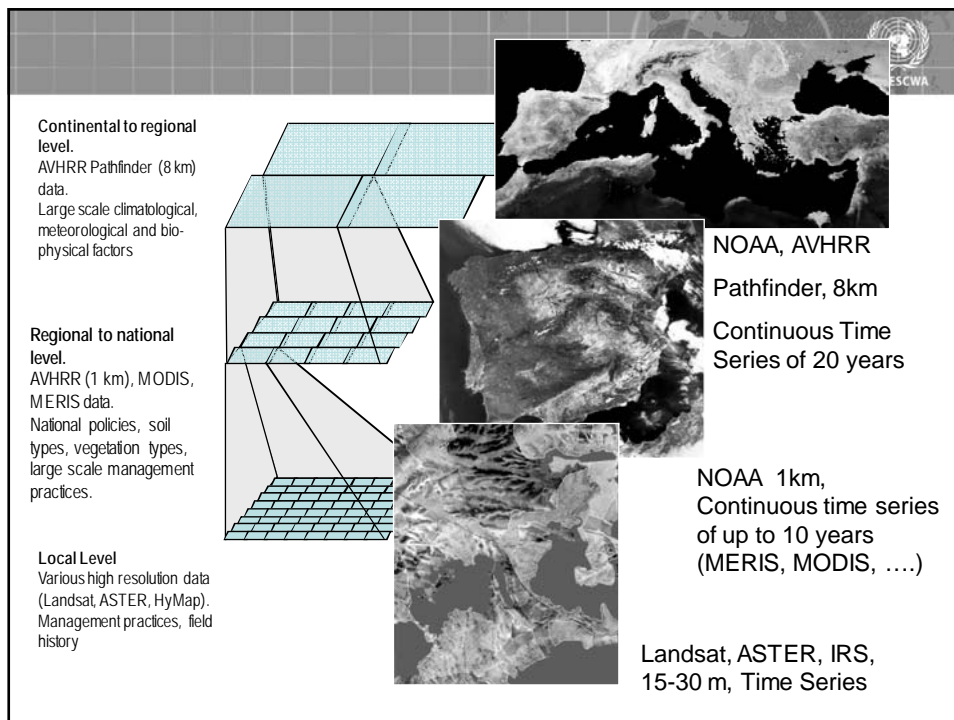
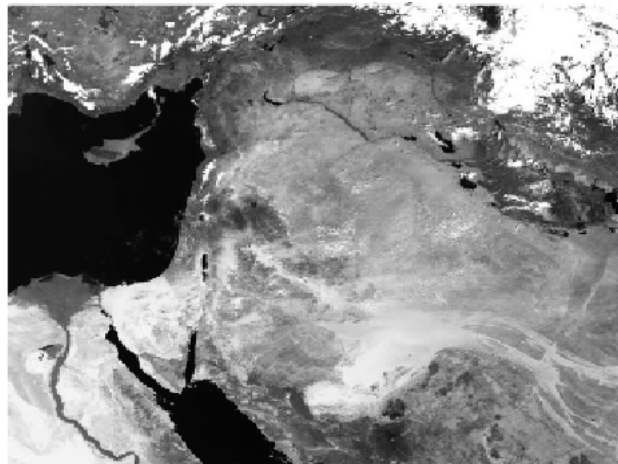
- Drip Irrigation
- Sprinkler (Spray) Irrigation
- Low-energy spray irrigation



Drip (trickle) irrigation waters crops efficiently.
Credit: Nova Scotia Agriculture and Fisheries



Regional Land Degradation monitoring System (ACSAD, 2009)

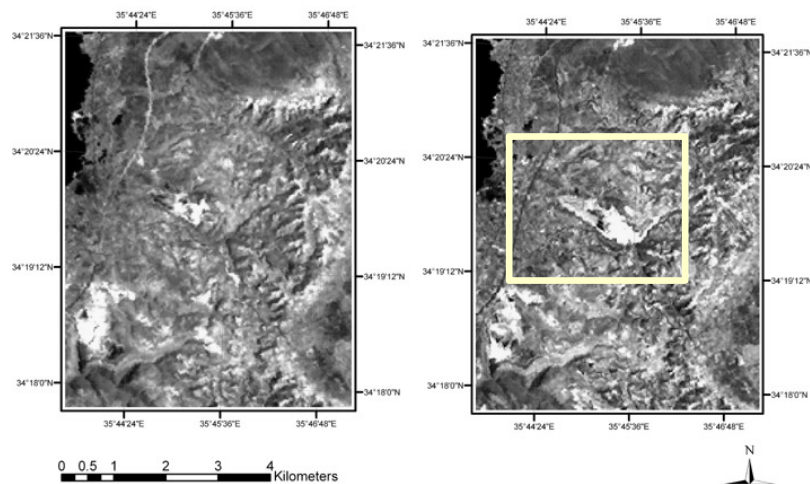


Regional approach -Lebanon



1987 Local deforestation?

2000



Landsat TM (5-4-3) sub-scenes from 26.5.87 (left) and 26.5.2000 (right) showing the foothills of the Lebanon Mountains

Technologies for adaptation in coastal zones

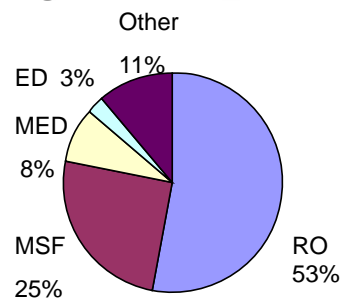
- According to the UNFCCC (2006) coastal zones are addressed through three different adaptation strategies:
 - ✓ For protection:
 - Hard structures: dykes, sea-walls, tidal barriers and detached breakwaters
 - Soft structures: wetland restoration or creation and beach nourishment and indigenous approaches such as afforestation.
 - ✓ For re-treatment:
 - Creating upland buffers, establishing set-back zones and phasing out development in exposed areas.
 - ✓ For accommodation:
 - Early warning systems for extreme weather events, new building codes, improving drainage systems and agricultural practices, etc.



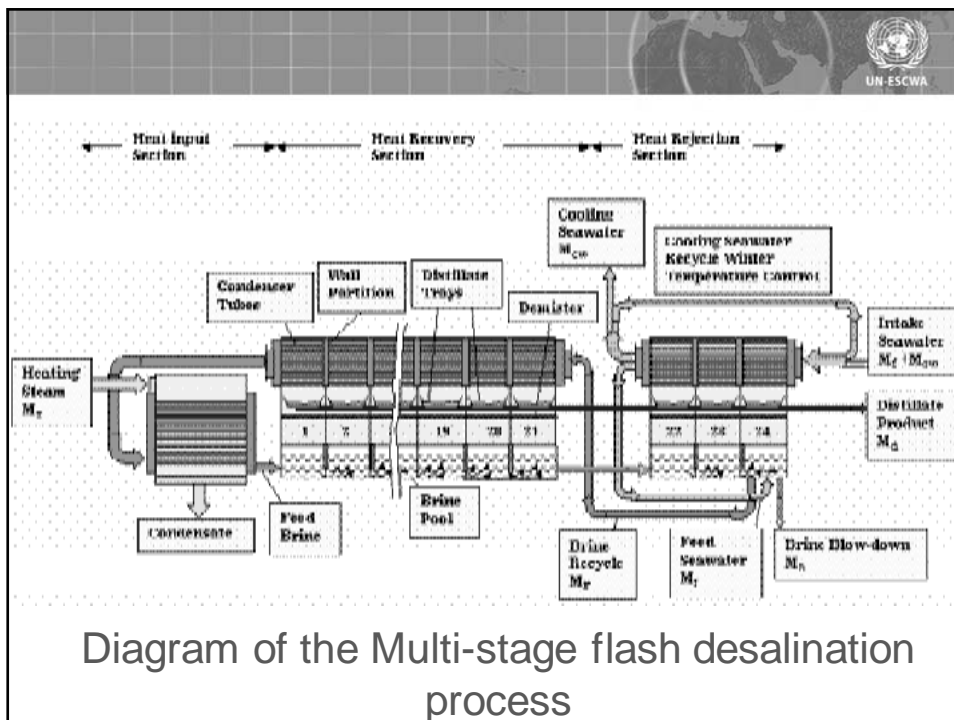
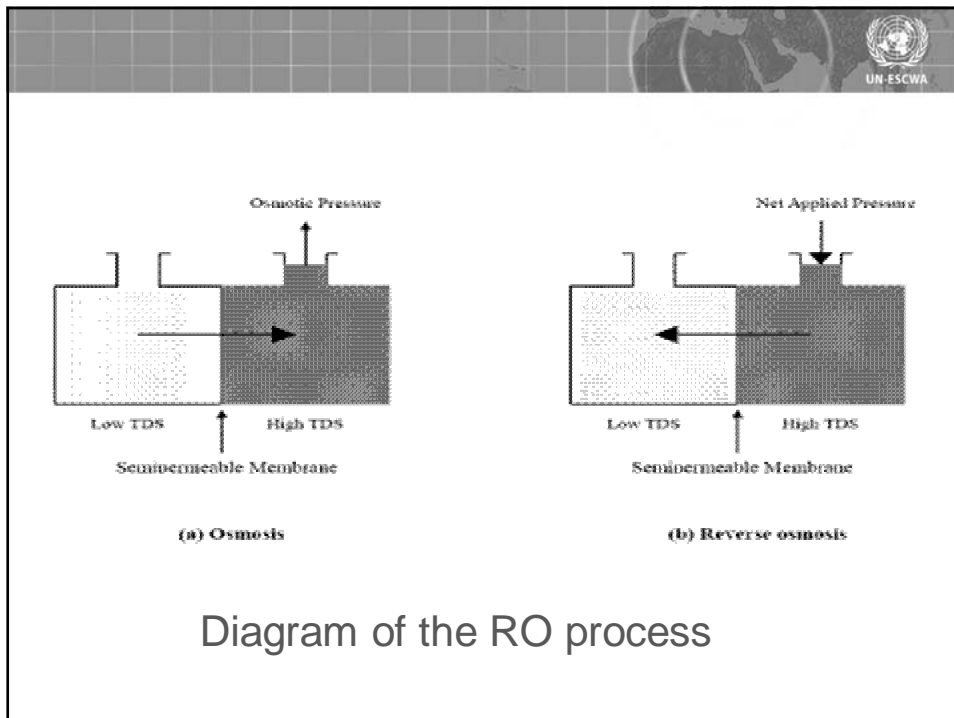
Developing a touristic area and reducing currents and possibly future risks due to sea water rise off shore of Alexandria, Egypt (Al-Raey, 2009)

Desalination Technologies

- Thermal (distillation)
 - Multi-stage flash (MSF)
 - Multi-effect distillation (MED)
- Electric (membranes)
 - Reverse osmosis (RO)
 - Electrodialysis (ED)
- Other processes include freezing and solar or wind-driven mechanisms.

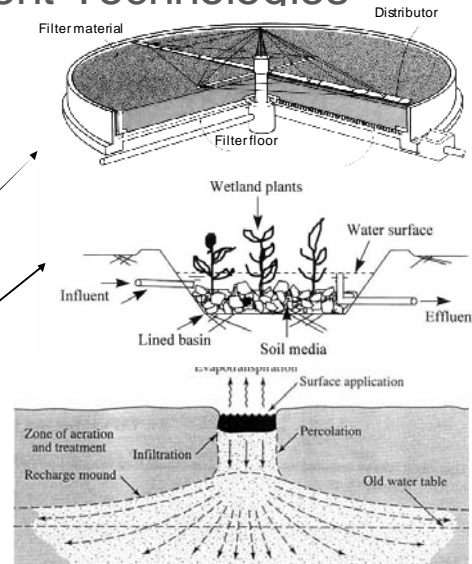


Global Desalination plant capacity by technology, 2008



Wastewater Treatment Technologies

- **Mechanical**
 - Oxidation ditch
 - Extended aeration
 - Sequencing batch reactor
 - Trickling filter solids contact process - SCP
- **Aquatic (Lagoon)**
 - Free water surface
 - Subsurface flow
 - Sand filter
- **Terrestrial**
 - Slow-rate
 - Overland flow
 - Rapid infiltration
 - Subsurface infiltration



Final remarks and recommendations

- There is a need to strengthen regional and international cooperation on adaptation technologies.
- Improve access to best available information on the likely impacts of climate change
- Enhance access to financial resources and adequate funding mechanisms for developing countries to improve national and local capacities on adaptation technologies
- Enhance research, development and access to technologies for adaptation taking into account the needs and specificities of the region.