



FRIEND UNESCO IHP–VII (2008-13)
MED Group, "Extreme events" topic



IV International WORKSHOP on HYDROLOGICAL EXTREMES
**From prediction to prevention of hydrological risk
in Mediterranean countries**

**Climate Change Direct and Induced Effects on the
Hydrological Extremes and their Consequences.**

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We have a great concern about the global climate change and its effects on the various hydrologic components.

Nobody knows exactly what will happen 100 later, but many scenarios are provided, focused mainly on the direct effects on global circulation and extreme temperatures and precipitations.

There are many other parallel secondary effects that will contribute to the probable final dangerous situations: Climate induced fauna and flora changes, human needs and attitudes, land uses and many more.

All that compose a complex dynamic system of interacting components, not yet well known or just defined.

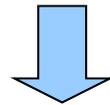


What we do not know yet very well:

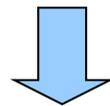
Natural Climate Variation



Man induced greenhouse effect



Change in Global Circulation

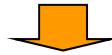


Higher Temperatures → Climate Change



What we suppose, but we do not know for sure!

Change in Global Circulation



Higher Temperatures,
Less Precipitations?

Higher Temperatures,
More
Evapotranspiration?



Less
Evapotranspiration?



More Precipitations?

More extreme events?



Summary of probable direct effects of CC.

Unknown:

1. Actual and final temperature change.
2. More or less precipitations?
3. Increase in precipitations intensity?
4. Increase in precipitations frequency?
5. Alternation of high precipitations periods with drought periods (Interannual)?
6. Alternation of high precipitations periods with drought periods (In the same year)?
7. Increase in drought severity?
8. Increase in drought duration?



Climate change indirect effects:

Change in the duration of the “hot” period:

1. Longer Tourist period.
2. Longer irrigation period
3. Longer Period of intense shower use
4. Cattle transferred to higher altitudes for a longer period.
5. Longer period on intense air conditioning use.

Problems:

Longer period of high water consumption



Climate change indirect effects:

Change in the in the evapotranspiration:

1. More water losses in reservoirs
2. More irrigation.
3. More intense shower use.

Problems:

Higher water consumption



Climate change indirect effects:

Change in the flora:

1. Local species advance to the north.
2. Local species advance to higher altitudes.
3. Some local species perish.
4. New flora species appear.
5. Change in land uses.
6. Change in cultivations.
7. Wild fires increase

Problems:

Direct Change of runoff coefficient and water balance.



Climate change indirect effects:

Change in fauna, change in pests:

1. More favourable environment for some species
2. Local species advance to higher altitudes.
3. Some local species perish.
4. New pest species appear.

Problems:

Changes in the flora.

>> Changes in water balance and runoff coefficient.



Climate change effects on severity and frequency of extreme events :

Change in:

1. Storms
2. Precipitation
3. Snowfall
4. Floods.
5. Droughts



Effects of climate change induced severity and frequency of extreme events :

Change in:

1. Flooding vulnerability of large areas.
2. Landslides.
3. Changes in river beds.
4. Changes in river deltas and coastal areas.



Related to but independent from Climate Change factors

Land use change:

1. Population attitudes
2. Economic reasons
3. Political decisions
4. Bad land management concepts



Summary of CC induced threats

Direct change in global circulation and meteorological effects.

Indirect changes on Earth surface affecting water balance and extreme hydrological phenomena.

Indirect changes on human needs, conceptions and attitudes, that affect the risk and problems from extreme hydrological phenomena.



Thank you for your attention!

