Climate Change and Variability

Impact on Water Resources

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Groundwater Level Data

- Groundwater level data provide a direct means of measuring the impacts of climate changes to groundwater resources

- These changes affect recharge to the aquifers

Climate Change Impact on Recharge

- Spatial and temporal changes in temperature and precipitation may act to ultimately cause a shift in the water balance for an aquifer

- For example, variations in the amount of precipitation, the timing of precipitation events, and the form of precipitation are all key factors in determining the amount and timing of recharge to aquifers

Climate Change Impact on Recharge

- Water levels in an aquifer are often observed to respond consistently to precipitation, although the nature of the response can be complex and depends on time of year and prior conditions, etc

- In most instances, the water level response to precipitation is positive, slightly delayed in the aquifer, attenuated with depth, and is more pronounced in unconfined than in semi-confined aquifers

Climate Change Impact on Recharge

- The occurrence of droughts or heavy precipitation can also be expected to impact water levels in aquifers

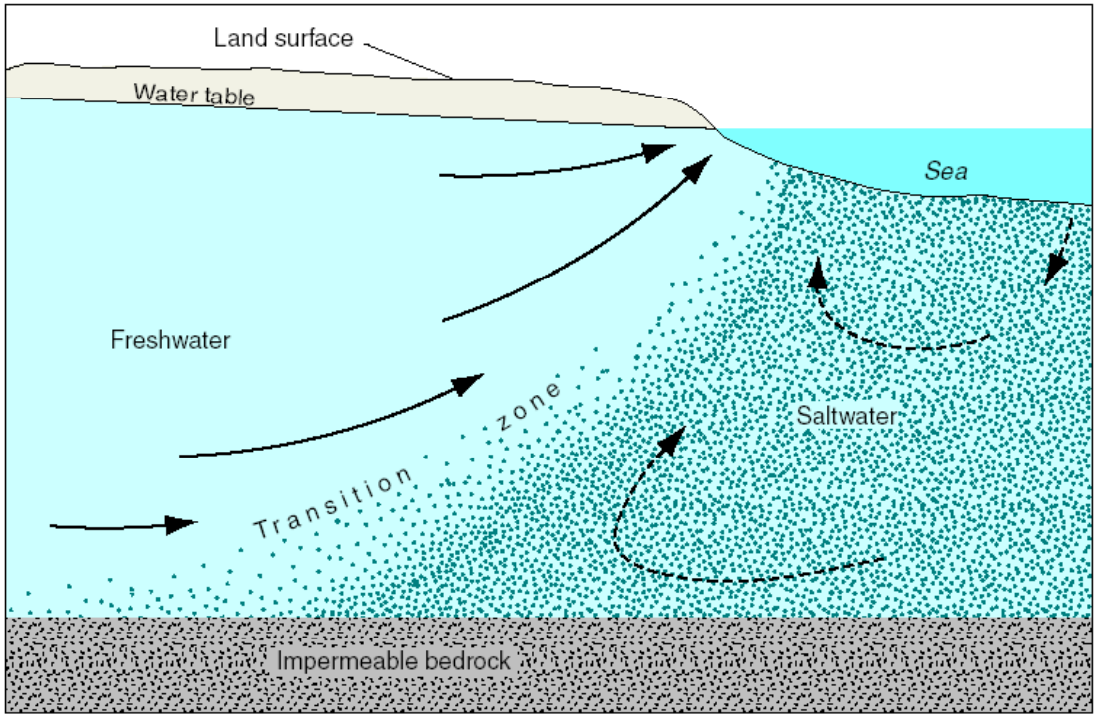
- Droughts result in declining water levels not only because of reduction in rainfall, but also due to increased evaporation and a reduction in infiltration that may accompany the development of dry topsoils

- Extreme precipitation events (e.g., heavy rainfall and storms) may lead to less recharge to groundwater because much of the precipitation is lost as runoff

Climate Change Impact on Flow

- Climate variability and change may be important considerations for overall changes to the groundwater flow

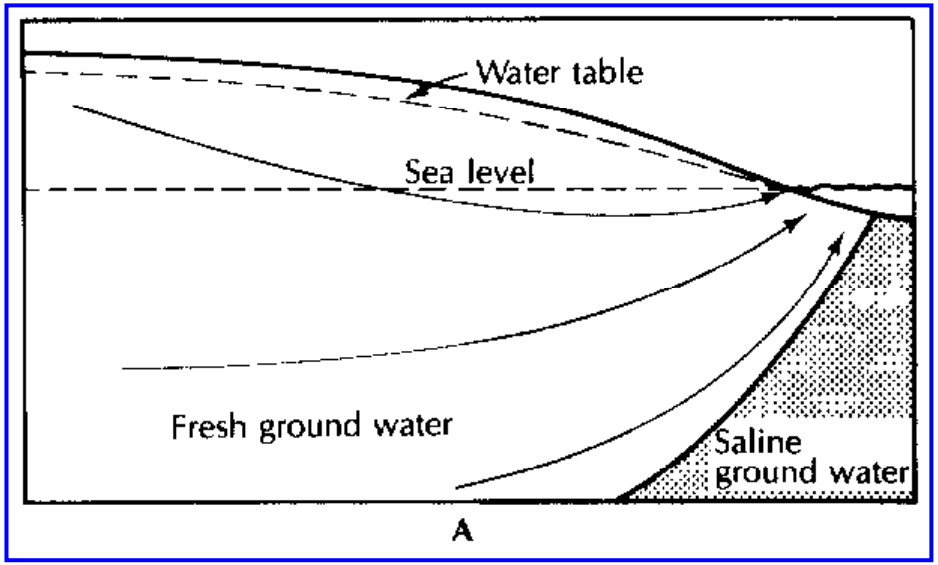
- Coastal aquifers are sensitive to changes in water budget due to the interaction between fresh and salt water in the subsurface along the coast

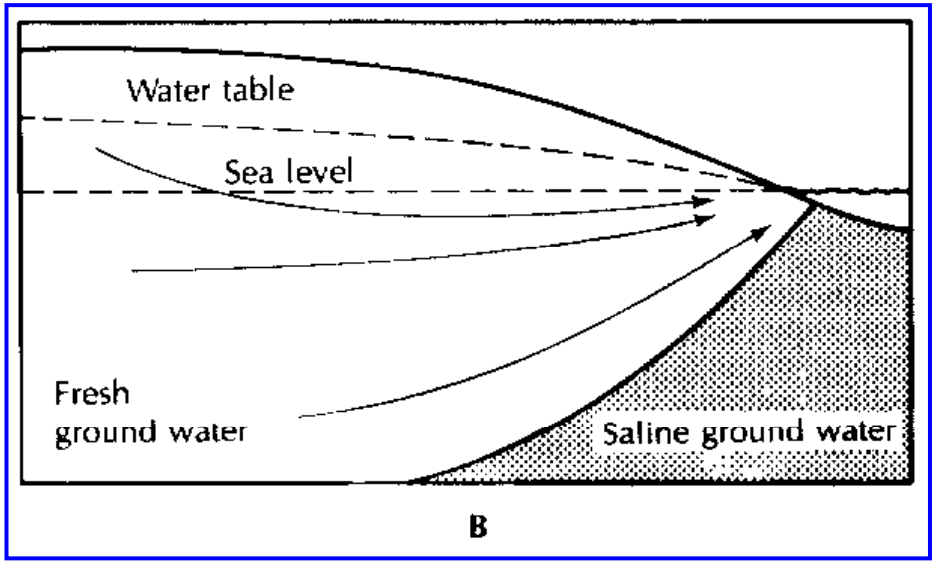


Climate Change Impact on Flow

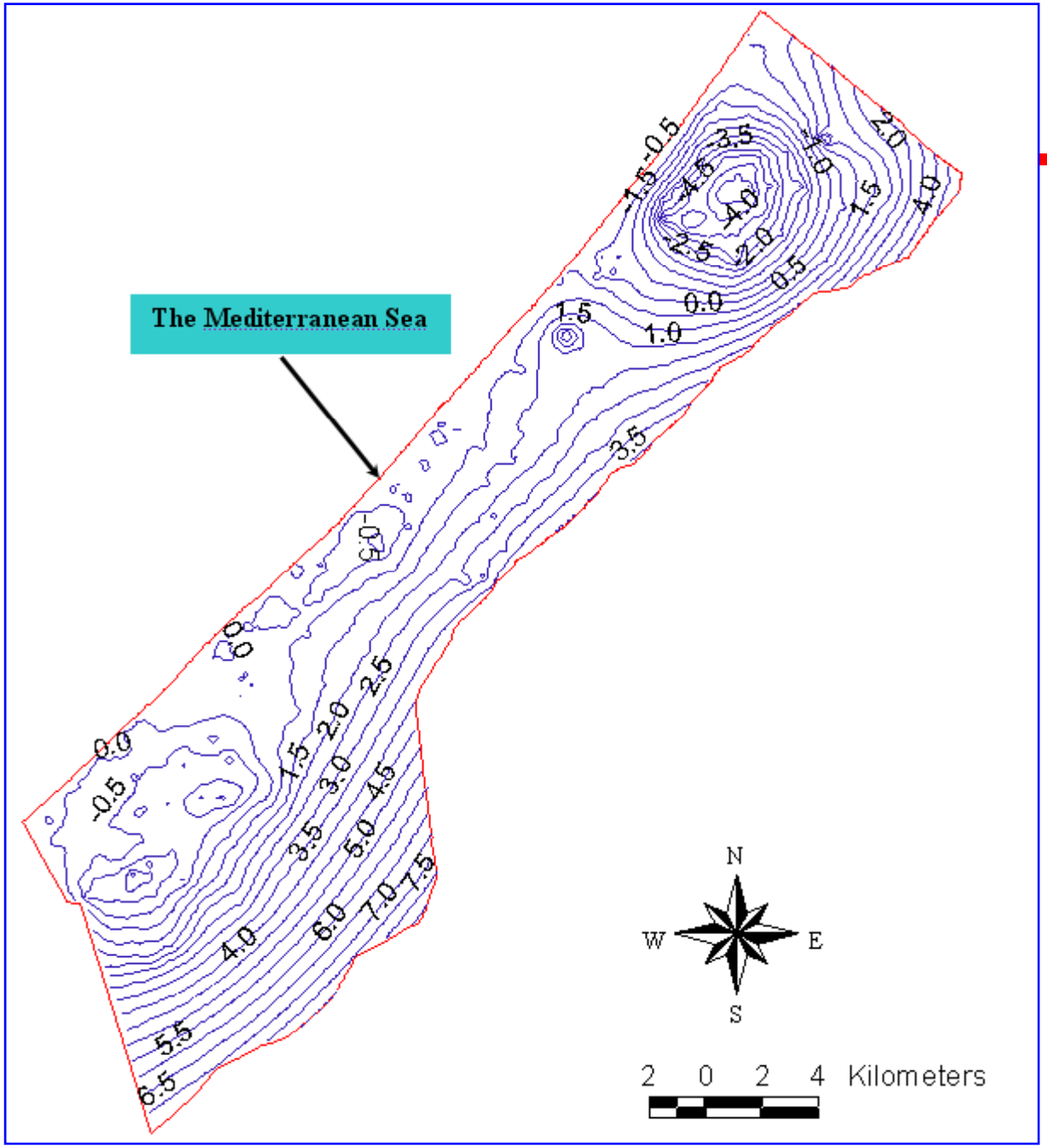
- When recharge is lowered, the position of the freshwater-saltwater interface will move inland

- Similarly, changes in sea level that might accompany climate change affect the position of this interface





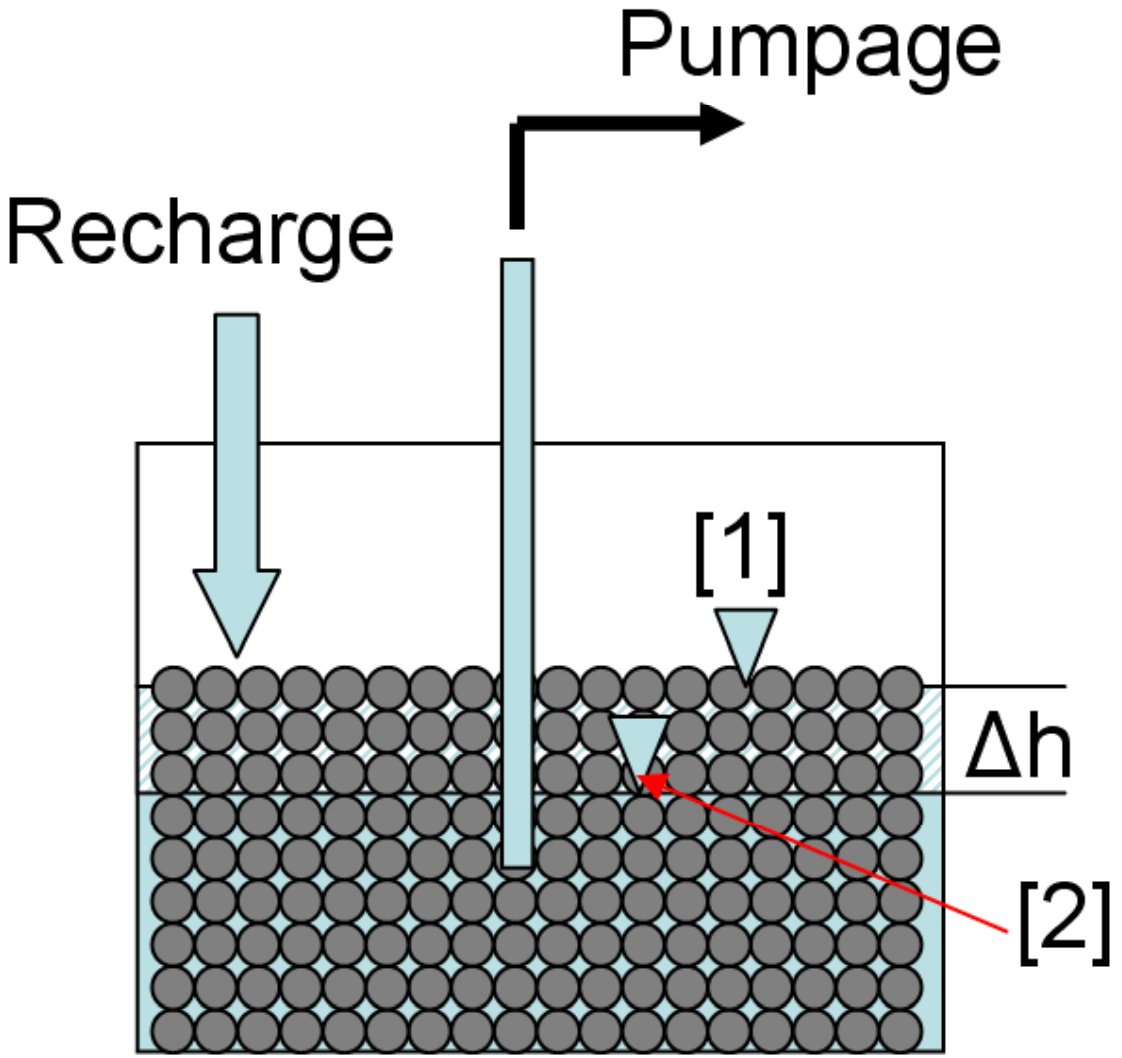
Gaza Coastal Aquifer



Climate Change Impact on GW Storage

- As the various inputs to recharge are affected, so too will be the overall storage of groundwater in an aquifer

- When groundwater is removed from storage, water levels in the aquifer drop, and when water is added to storage, the water levels rise



Impact of Variability in Rainfall on GW

- Greater variability in rainfall could mean more frequent and prolonged periods of high or low water levels

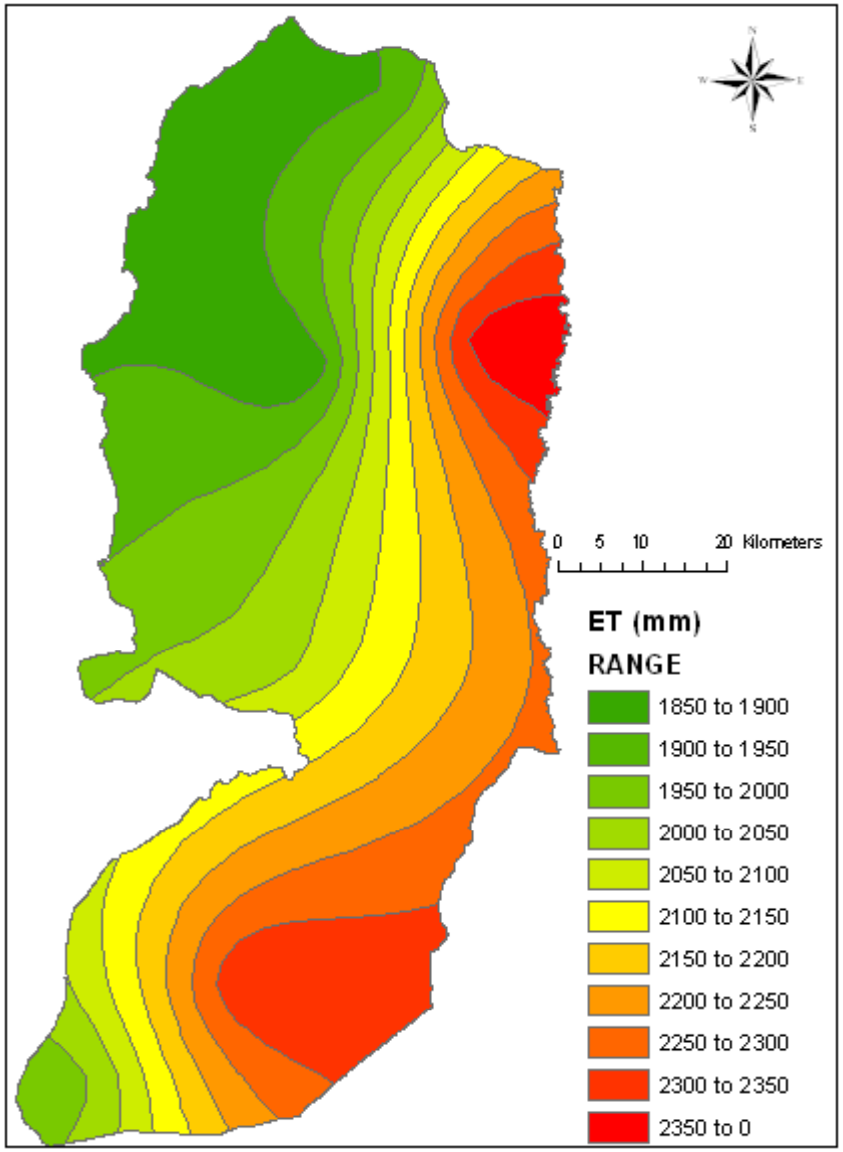
- The effects of climate change on groundwater may include:

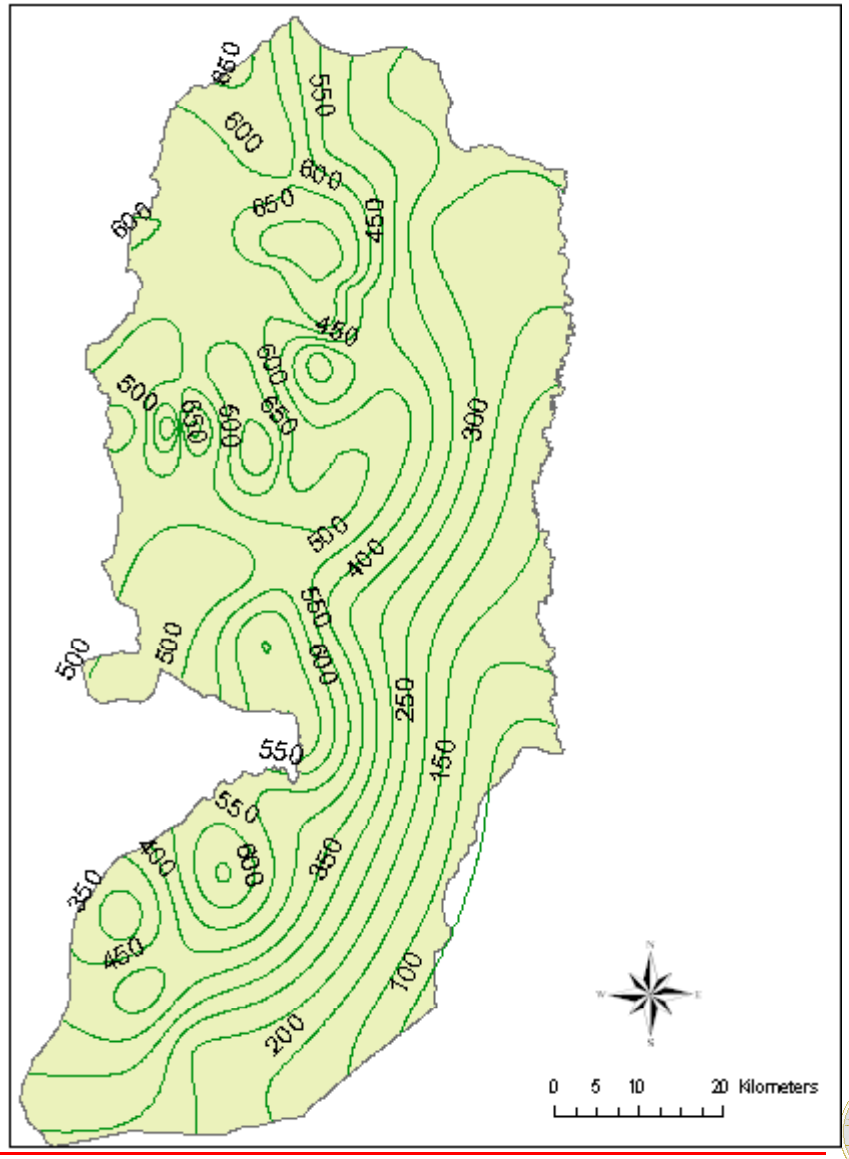
  - A long-term decline in groundwater storage
  - Increased frequency and severity of groundwater droughts
  - Mobilization of pollutants due to seasonally high water tables
  - Saline intrusion in coastal aquifers, due to sea level rise and resource reduction

Impact of Variability in Rainfall on GW

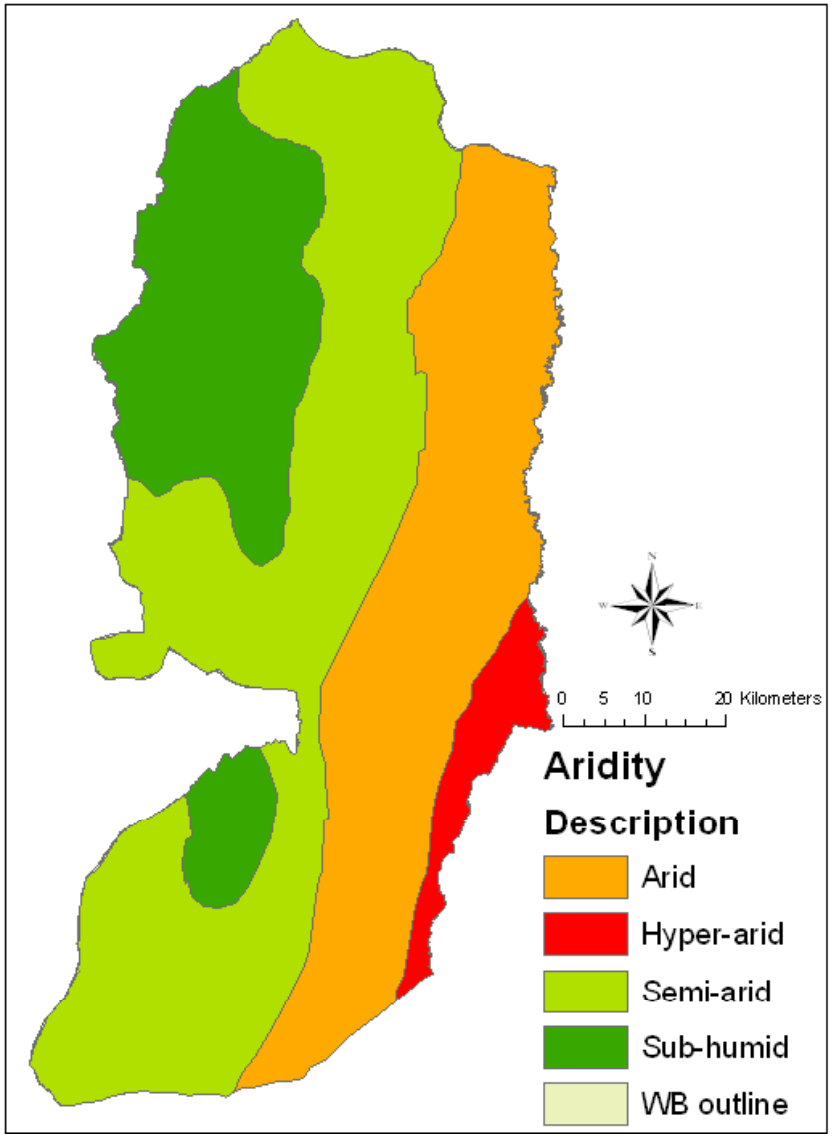
- However, overall, groundwater resources are likely to be relatively robust in the face of climate change compared with surface water, due to the buffering effect of groundwater storage

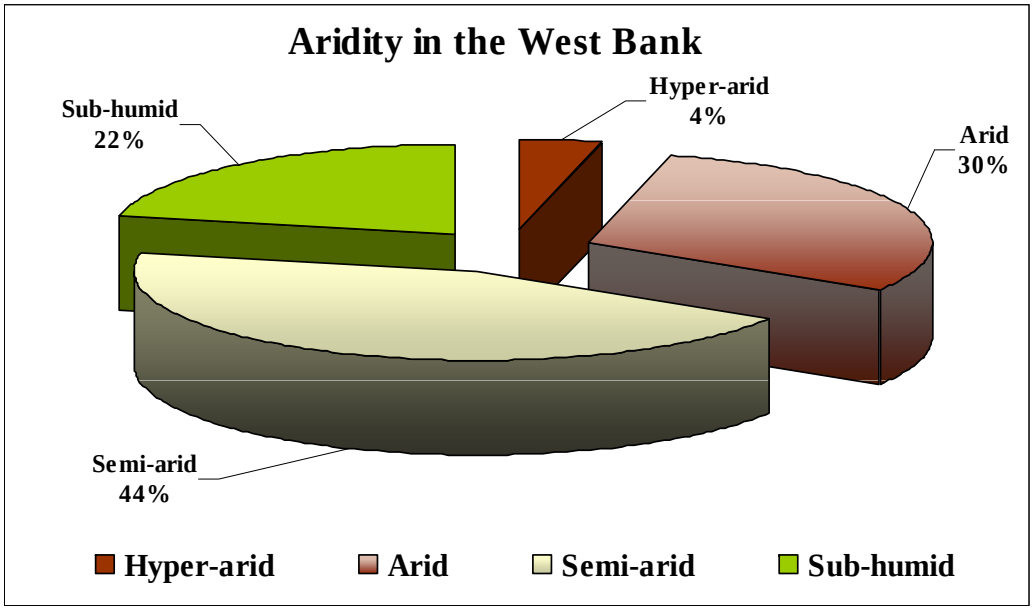
Rainfall and ET of the WB



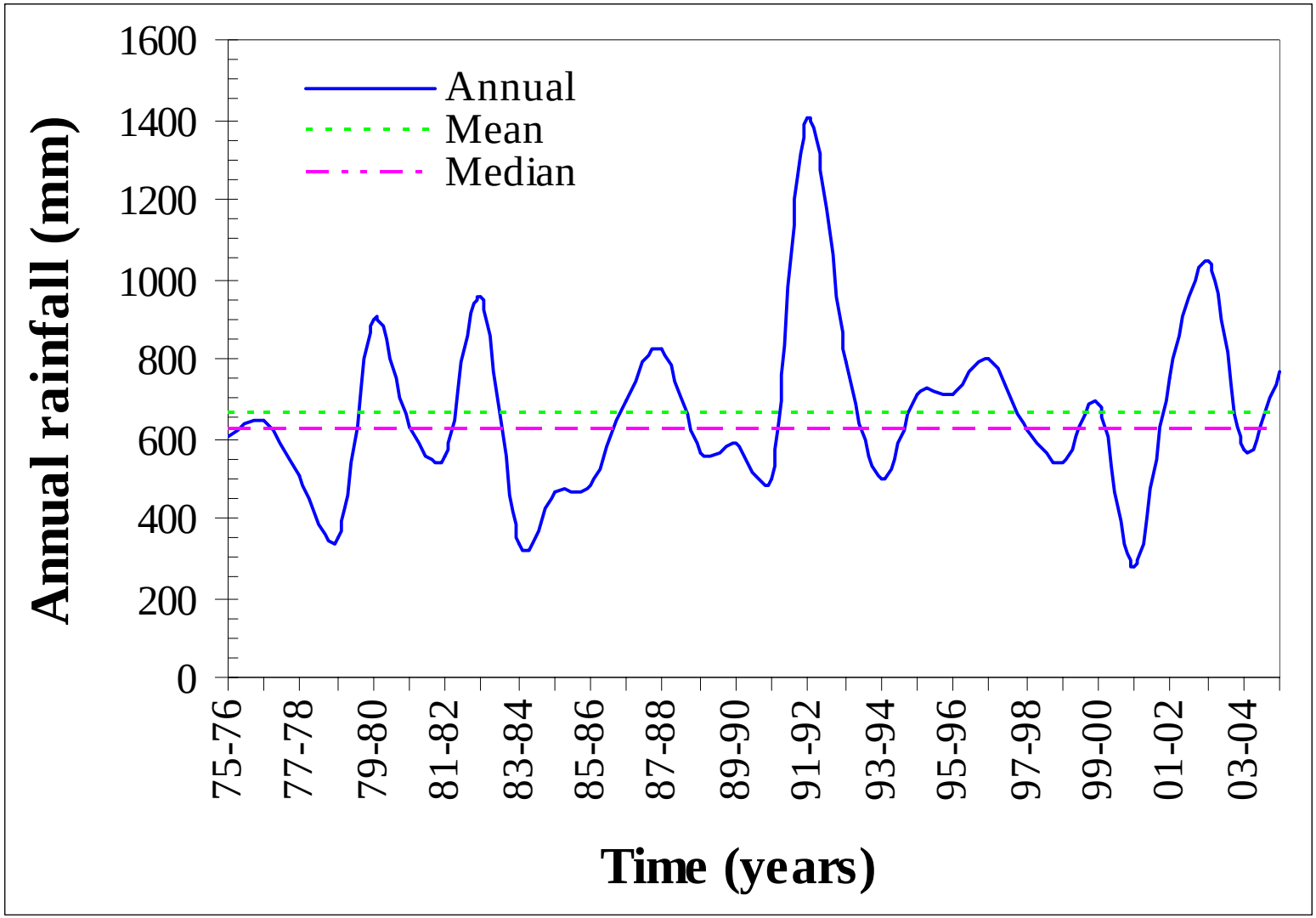


Aridity Map for the West Bank

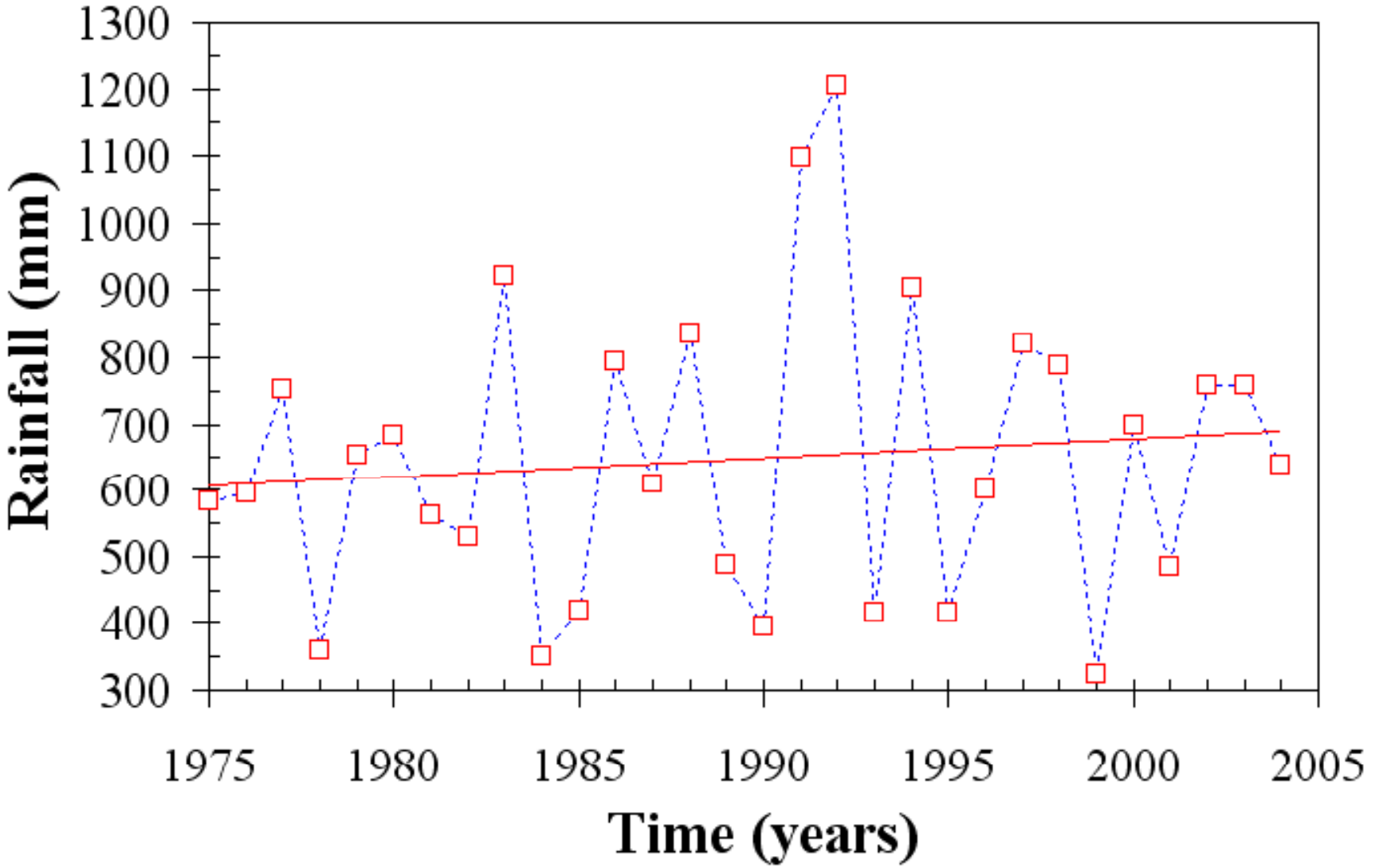




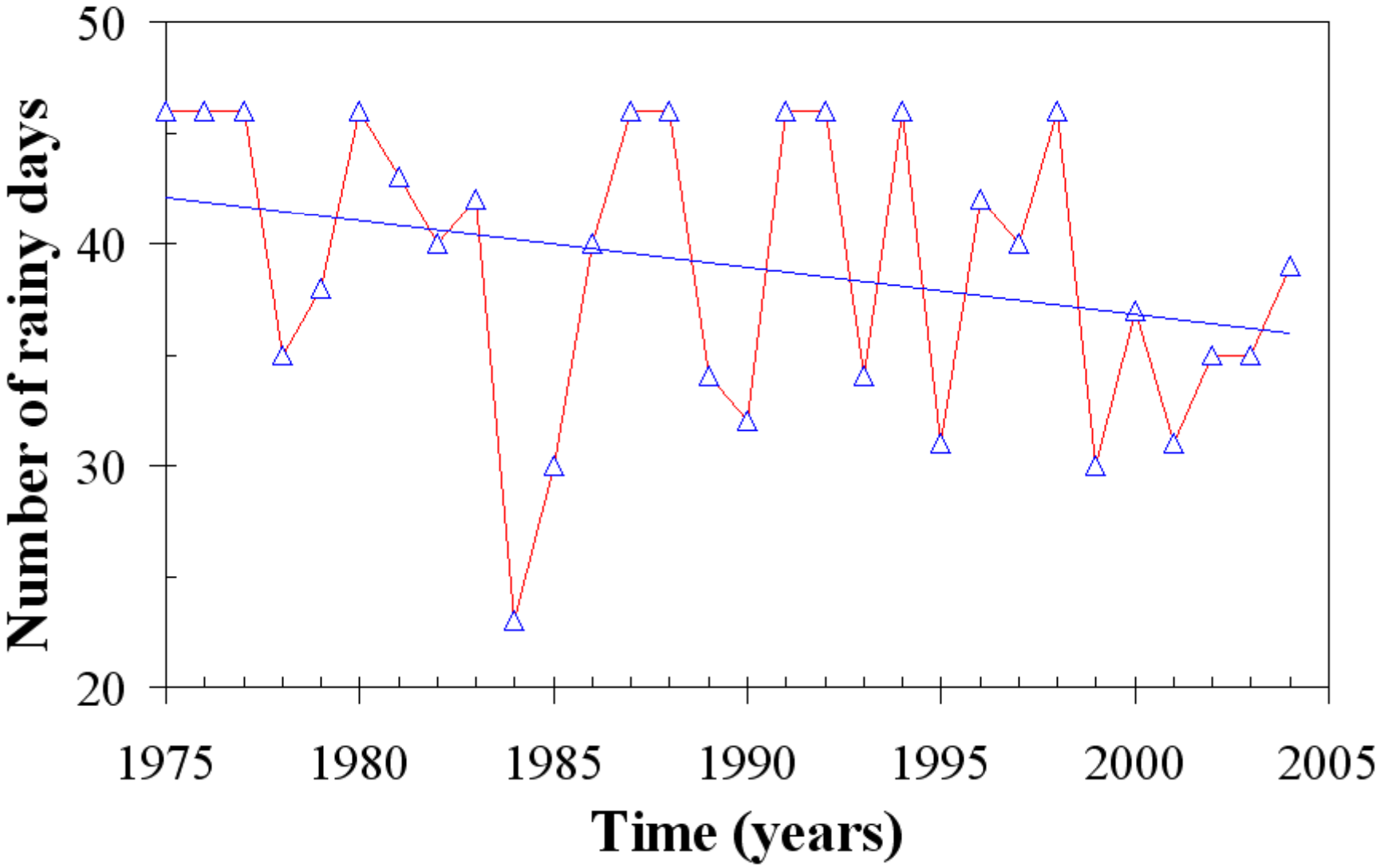
Rainfall of Nablus City



Rainfall of Nablus City – Annual amount



Rainfall of Nablus City – Number of Rainy Days



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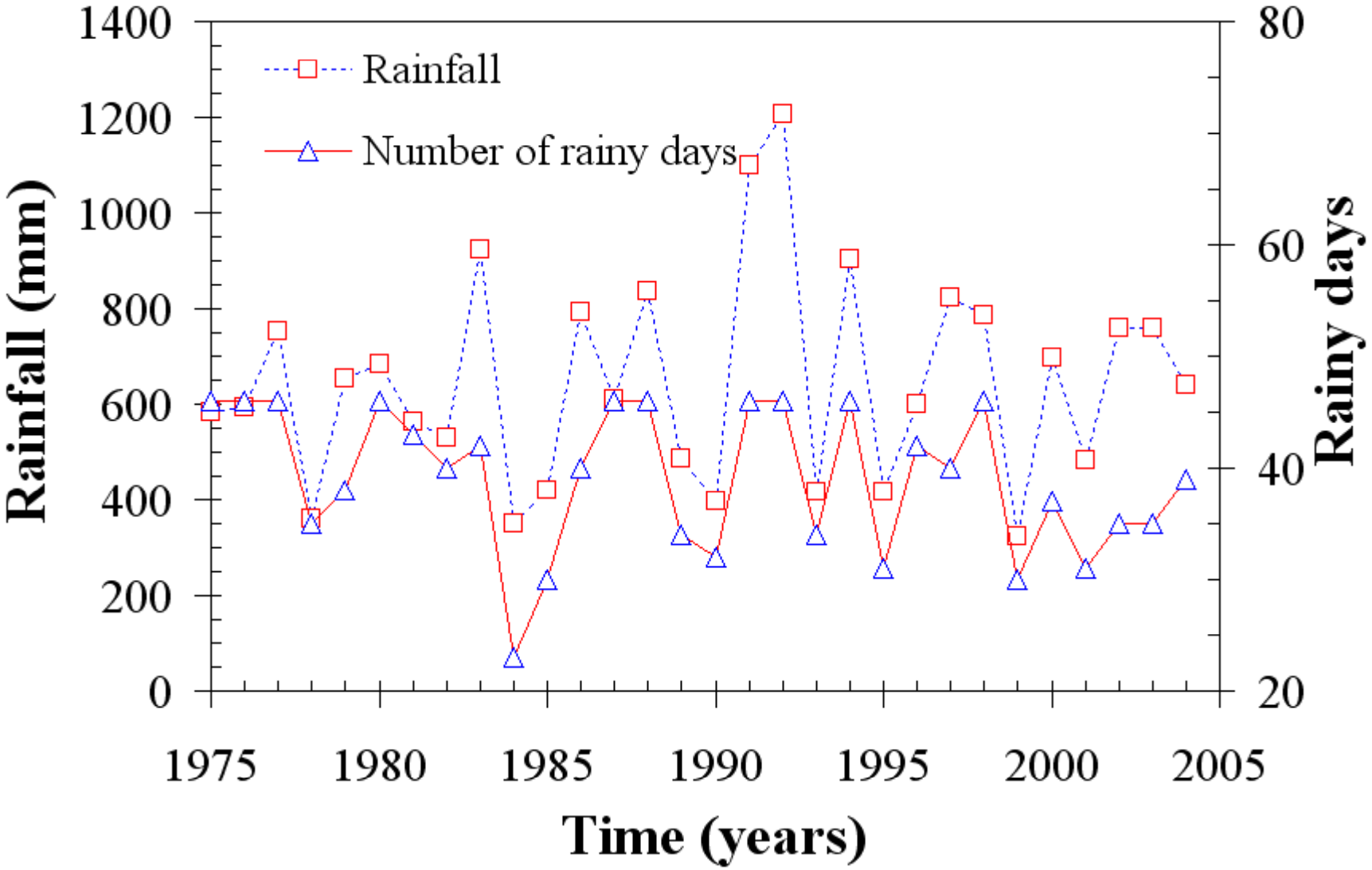
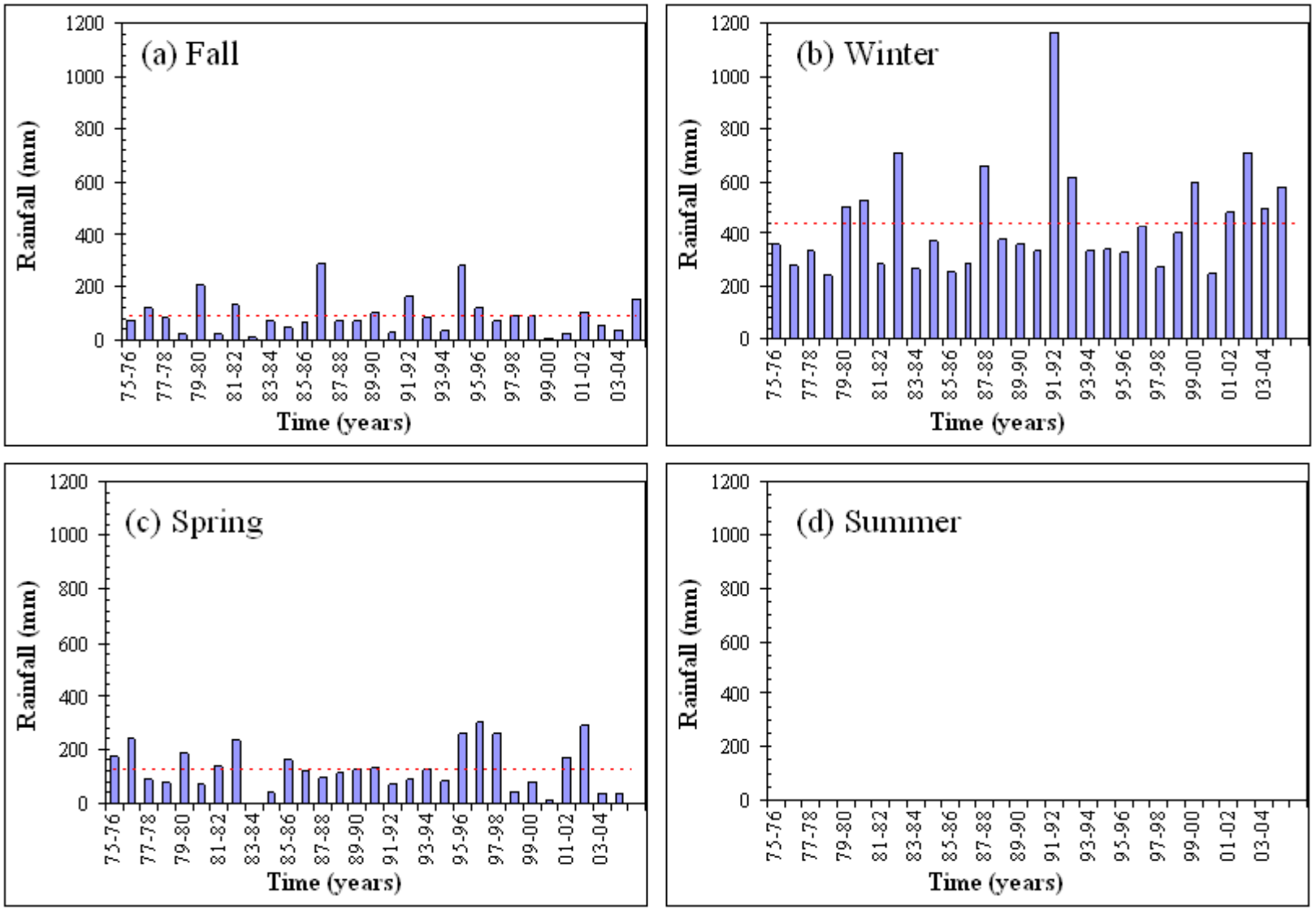


Minimum and Maximum Numbers of Rainy Days

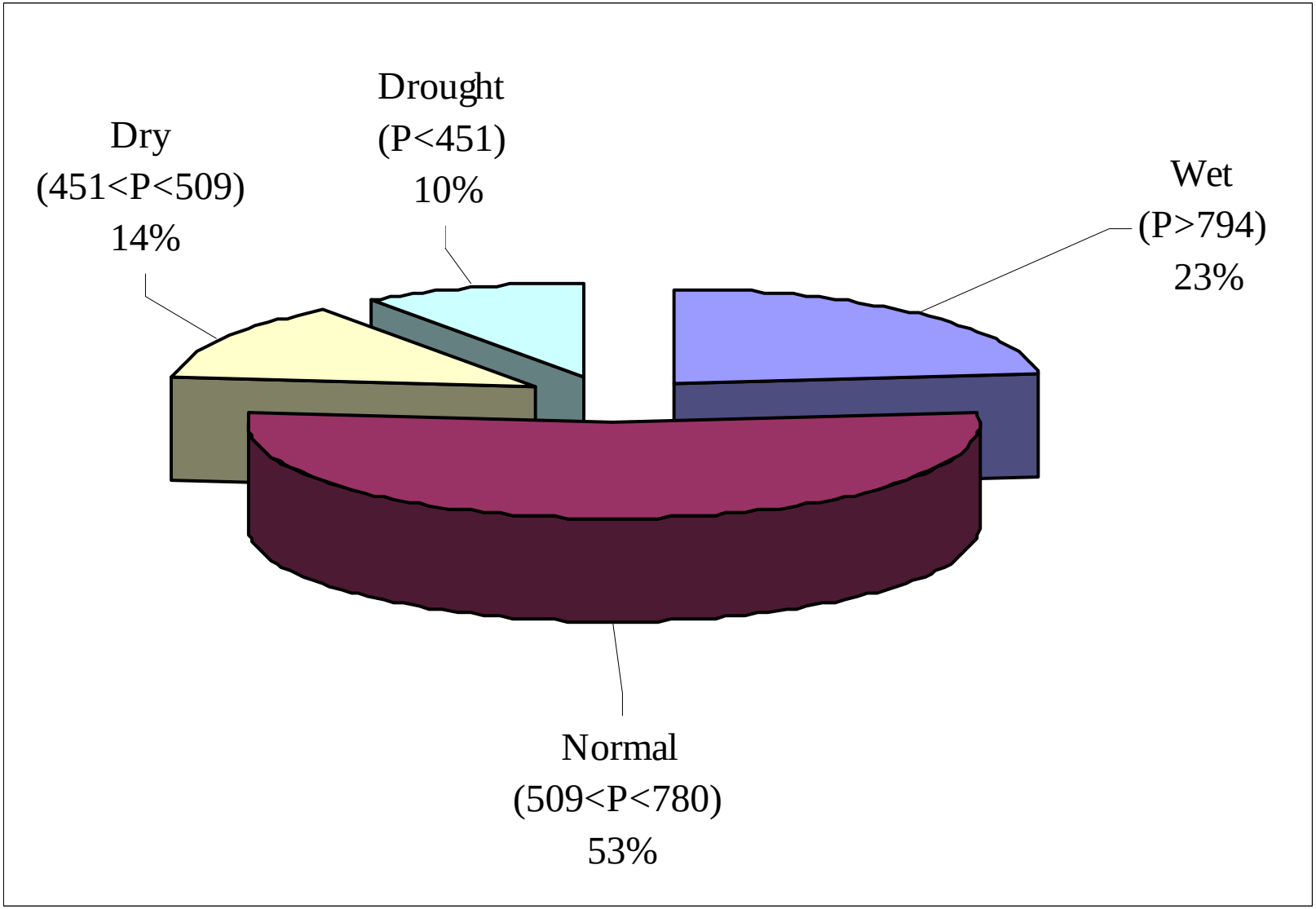
- The minimum and maximum numbers of rainy days for the past 30 years are 23 and 46 days, respectively with an average of 39 days

- It can be inferred that the rainfall amount per a rainy day is increasing while the frequency of rainy days is decreasing

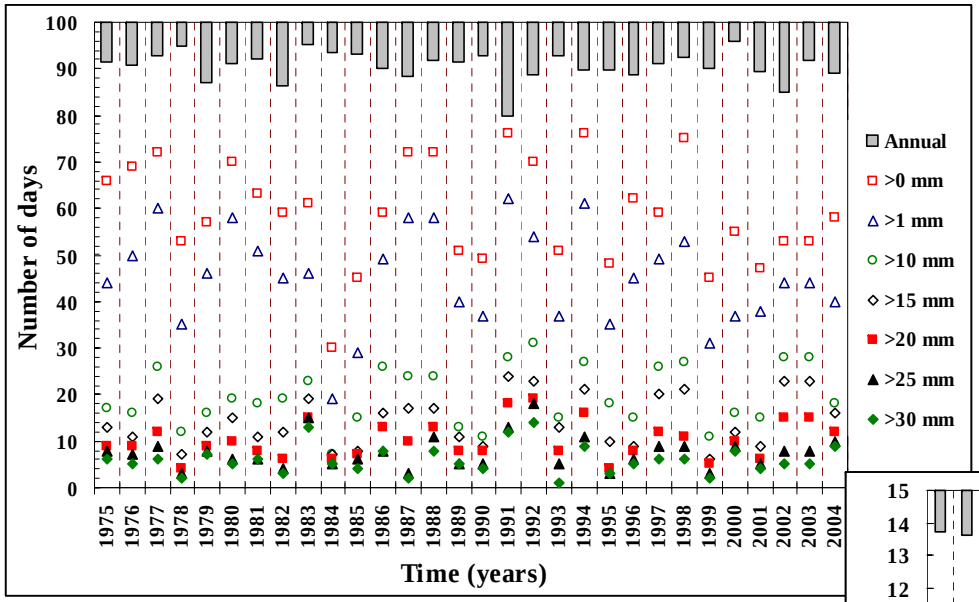
Rainfall Seasonality for Nablus City

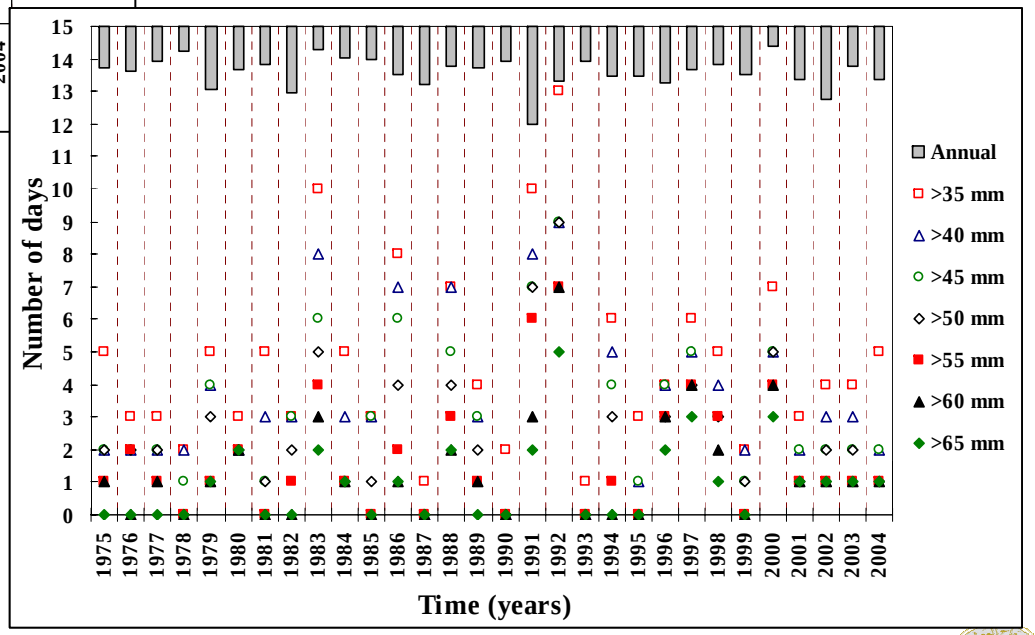


Distribution of drought, dry, normal and wet years



Frequency Distribution of Daily Rainfall





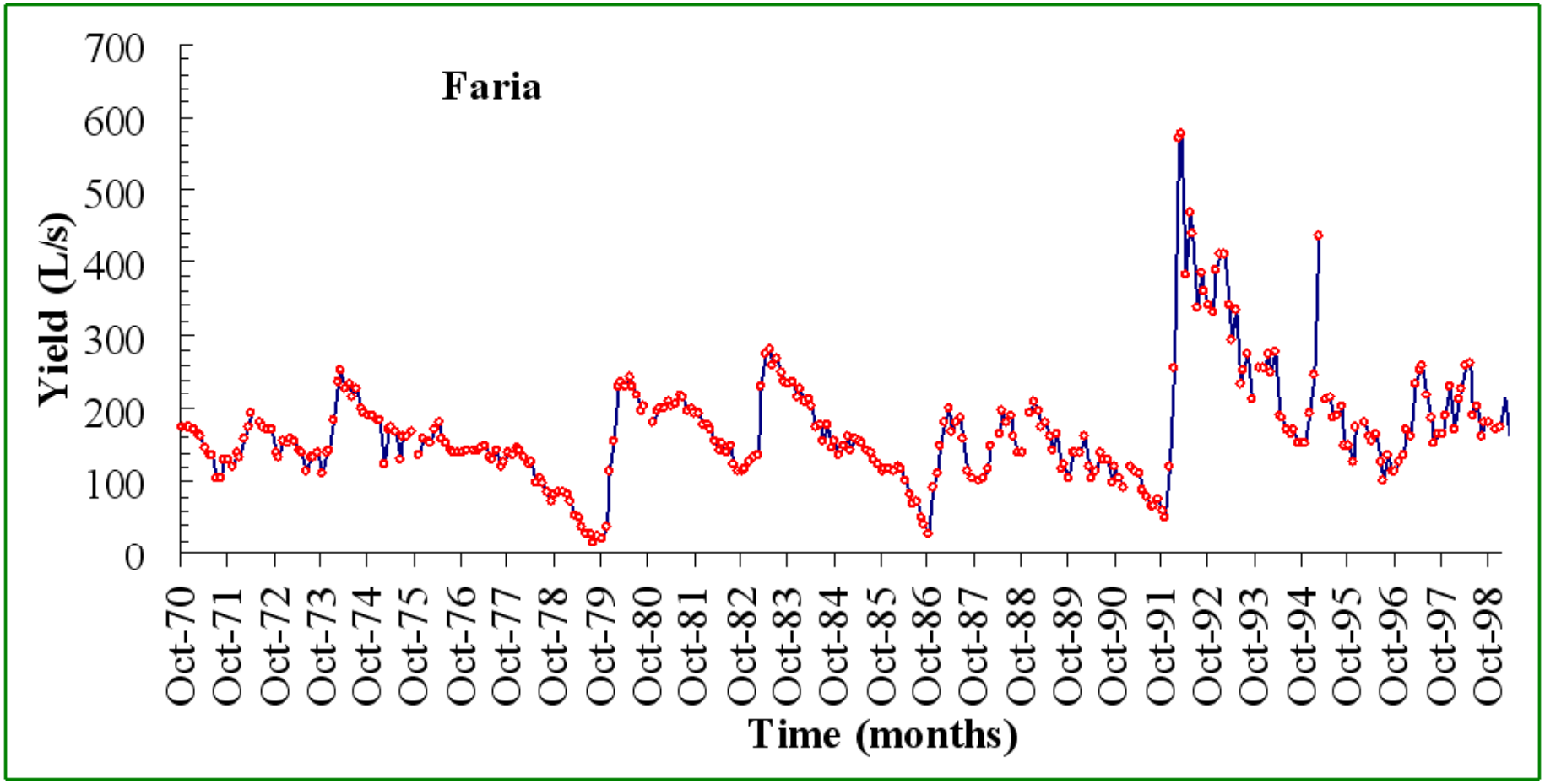
Impact of Rainfall Intensity on Surface Runoff

Badan Flume – January 9, 2006 – 8:30 am

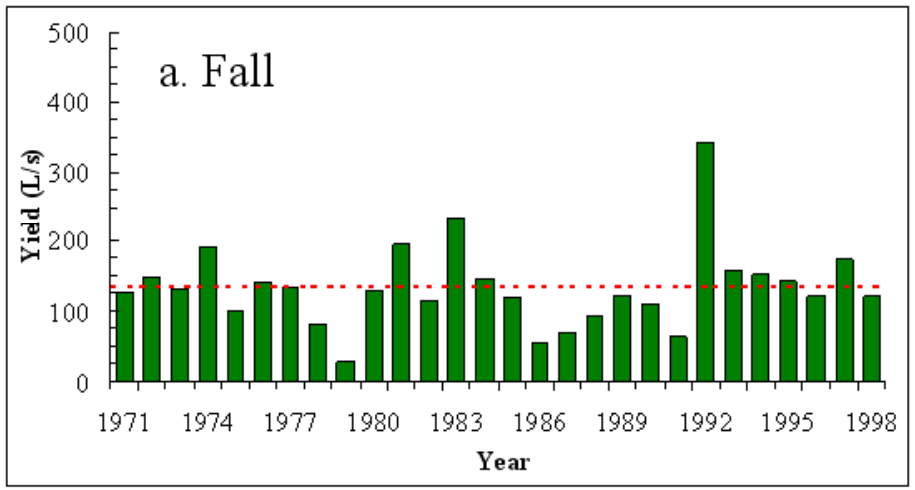
Impact of Rainfall Intensity on Surface Runoff

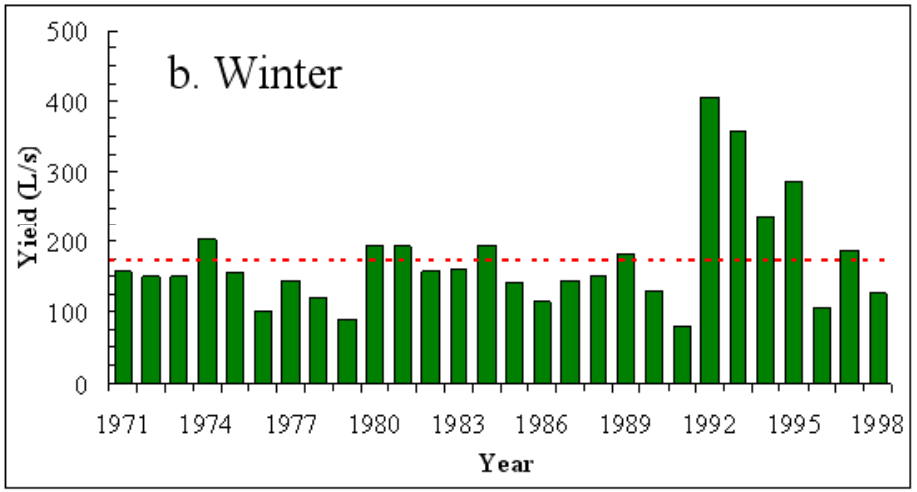
Badan Flume – January 9, 2006 – 5 pm

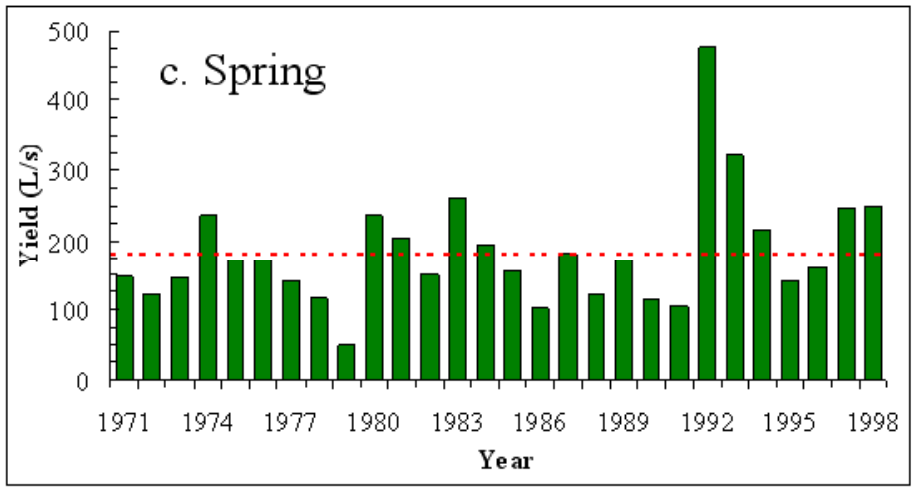
Variability of Faria Spring Yield

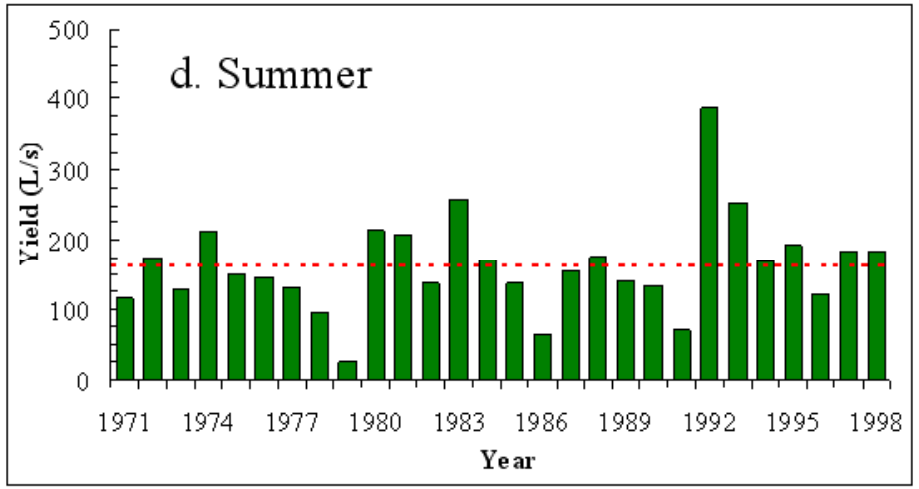


Seasonality of Faria Spring Yield

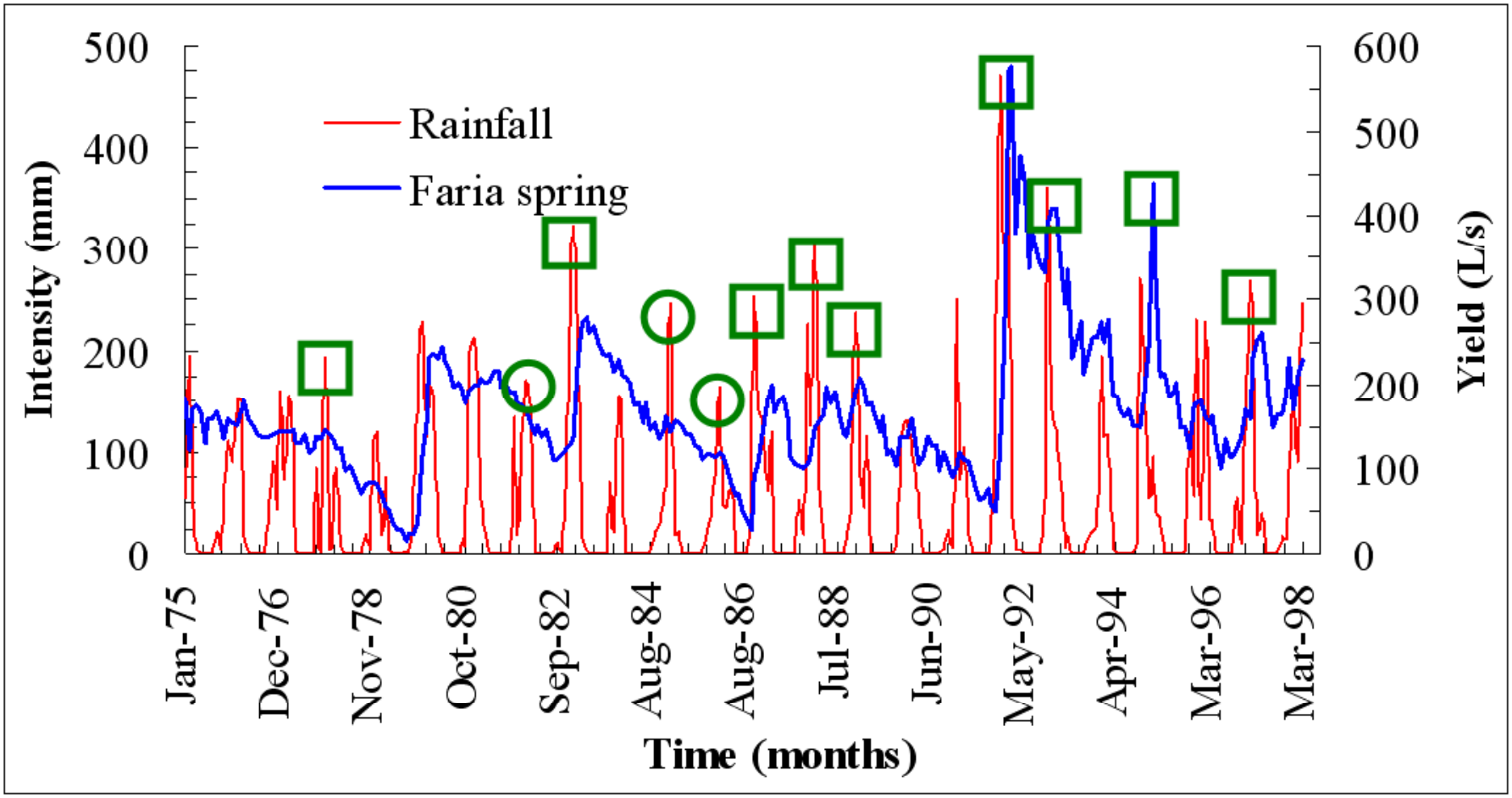








Rainfall Spring-Yield Relationship



Apparently, there is a good correlation between rainfall and spring yield for Faria spring

Water Table Elevation