Trends in total and extreme precipitation in Turkish Black Sea coast

Mutlu Özdoğan
University of Wisconsin - Madison

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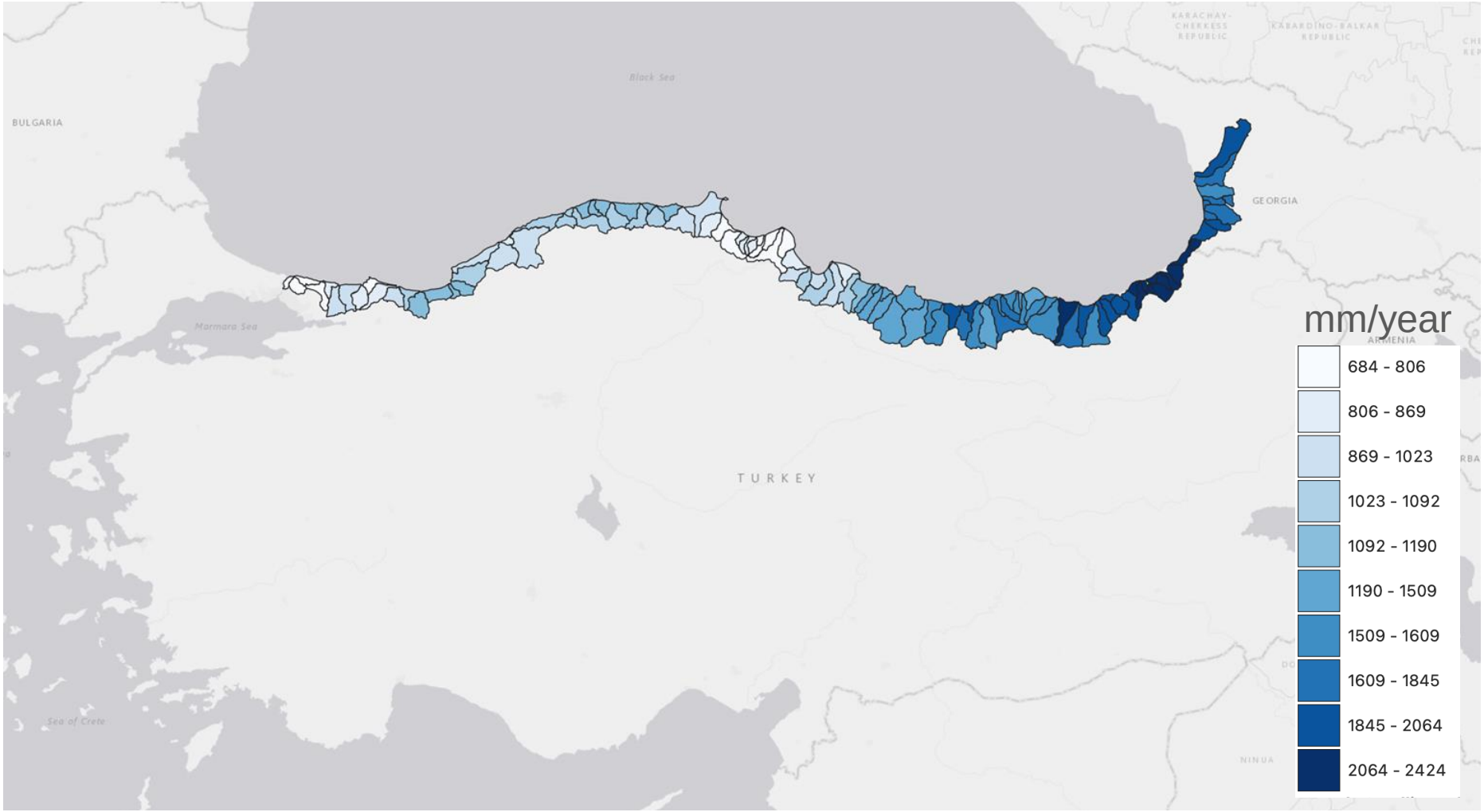
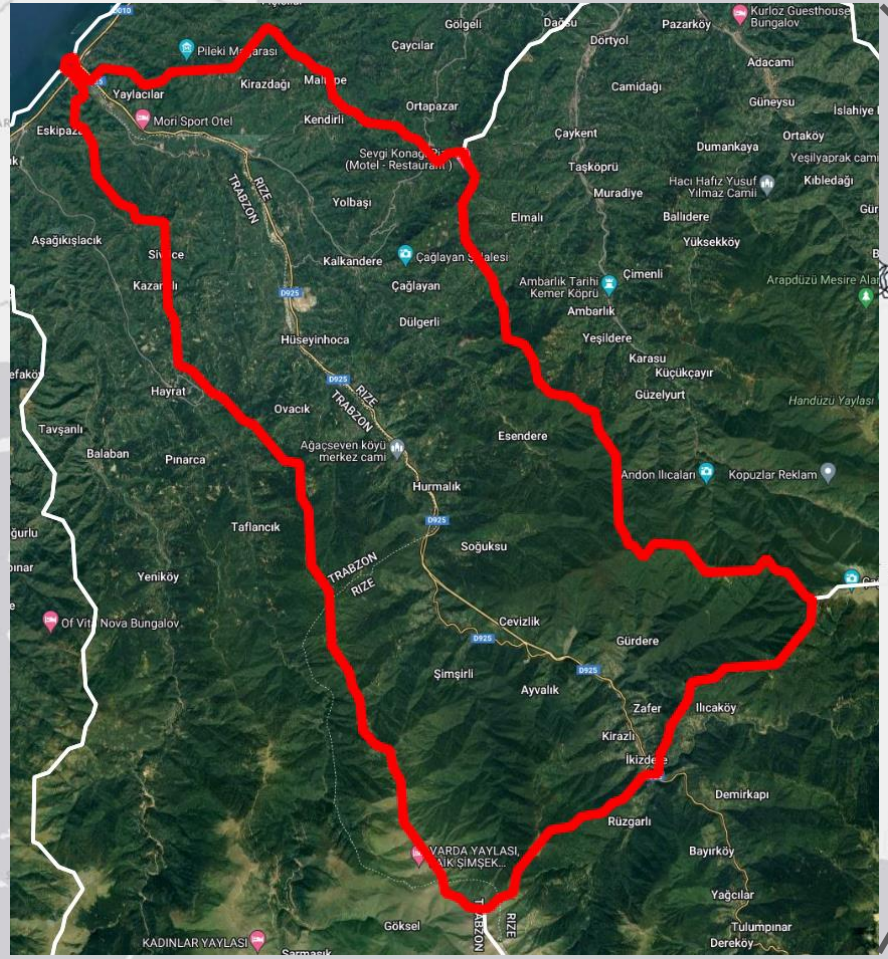
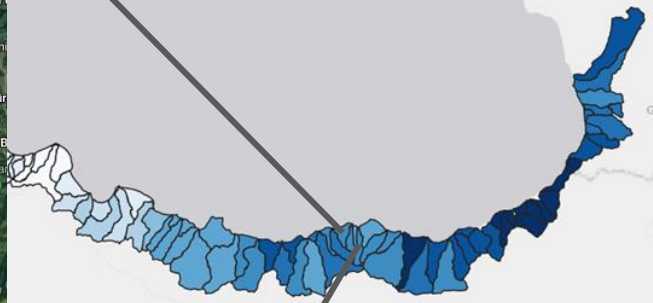
Scerin11 - Chania

Introduction

- Turkiye’s Black Sea coast belongs to temperate wet climatic zone
- Particularly the eastern Black Sea coastal areas receive 1200 to 2000 mm of rainfall with west to east rainfall gradient
- Steep slopes over short distances along the coast means quick runoff
- Flooding due to extreme precipitation is exacerbated by land use change (urbanization) along the floodplain


Black Sea
BULGARIA
GEORGIA
Marmara Sea
TURKEY
Sea of Crete
mm/year
684 - 806
806 - 869
869 - 1023
1023 - 1092
1092 - 1190
1190 - 1509
1509 - 1609
1609 - 1845
1845 - 2064
2064 - 2424





mm/year

- 684 - 806
- 806 - 869
- 869 - 1023
- 1023 - 1092
- 1092 - 1190
- 1190 - 1509
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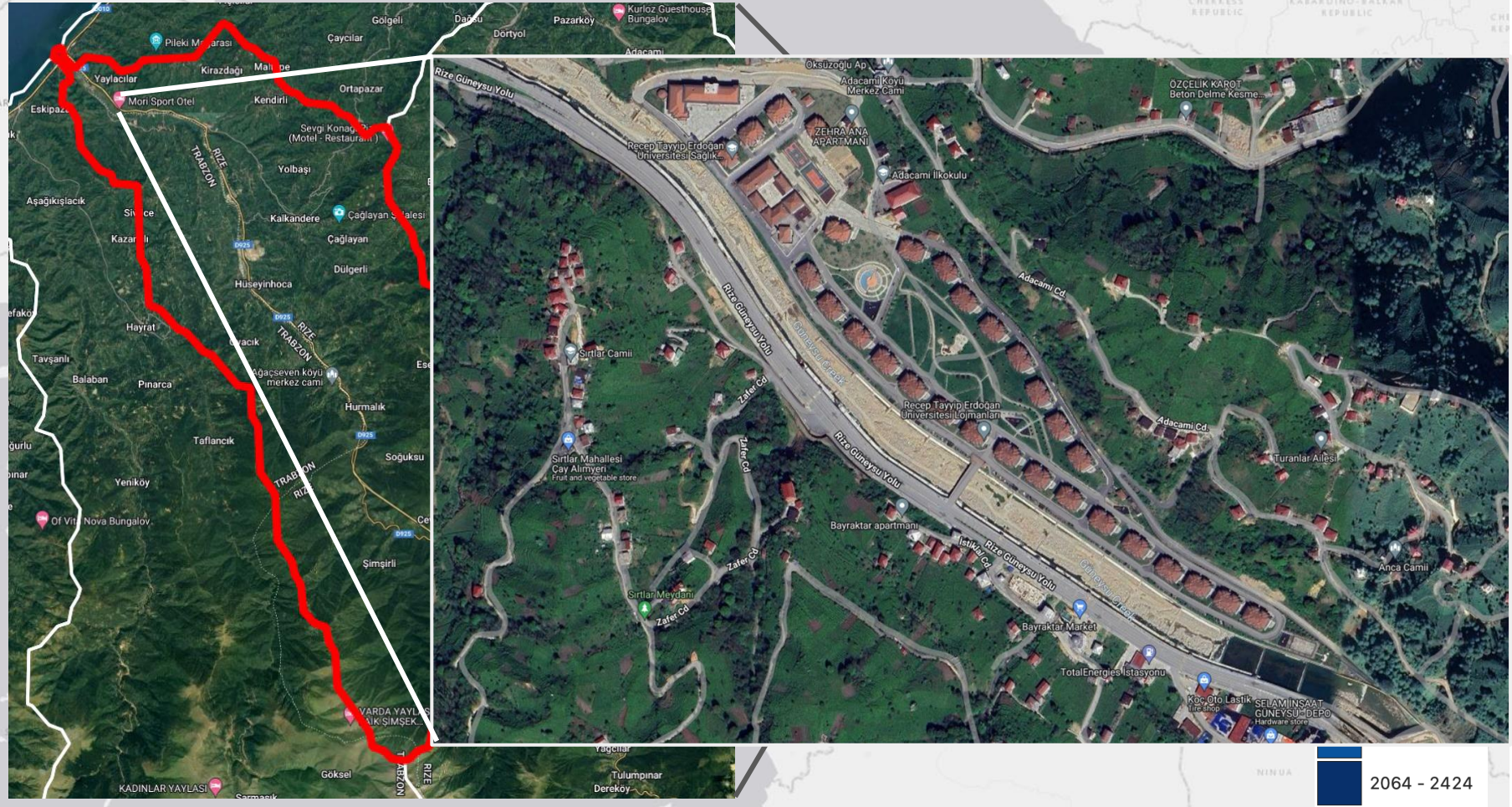
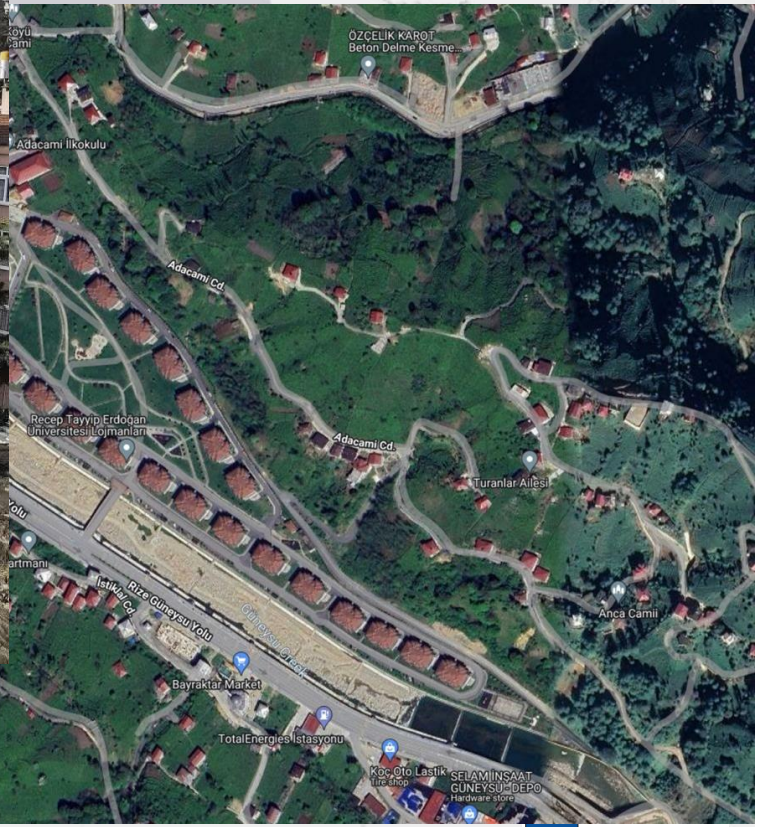

Pileki Mağarası
Yaylacılar
Kirazdağı
Mali Tepe
Çaycılar
Gölgeli
Dağsu
Dortyol
Pazarköy
Kurloz Guesthouse Bungalov
Adacami
Ortapazar
Kendirli
Mori Sport Otel
Sevgi Konaklar (Motel - Restaurant)
Yolbaşı
Aşağıkışlacık
Kalkandere
Çağlayan Şelalesi
Çağlayan
Dülgerli
Hüseyinhoca
Hayrat
Tavşanlı
Balaban
Pınarca
Ağaçseven köyü merkez cami
Hurmalık
Taflancık
Soğuksu
Yeniköy
Of Vit Nova Bungalov
Şimşirli
YARDA YAYLA
KADINLAR YAYLASI
Göksel
Yağcılar
Tulumpınar
Dereköy
RIZE
TRABZON
D925
Rize Güneysu Yolu
Öksüzoğlu Ap
Adacami Köyü Merkez Cami
ZEHRA ANA APARTMANI
Adacami İlkokulu
Recep Tayyip Erdoğan Üniversitesi Sağlık...
ÖZÇELİK KAROT Beton Delme Kesme...
Adacami Cd.
Sırtlar Camii
Zafer Cd.
Recep Tayyip Erdoğan Üniversitesi Lojmanları
Turanlar Ailesi
Sırtlar Mahallesi Çay Alımyeri
Fruit and vegetable store
Bayraktar apartmanı
İstiklal Cd.
Anca Camii
Sırtlar Meydanı
Bayraktar Market
TotalEnergies İstasyonu
Koç Oto Lastik
Tire shop
SELAM İNŞAAT GÜNEYSU - DEPO
Hardware store
2064 - 2424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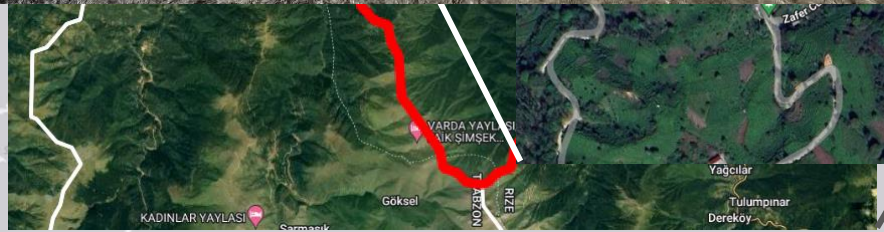
YARDA YAYLASI
KADINLAR YAYLASI
Göksel
Yağcılar
Tulumpınar
Derekoy
RIZE

2064 - 2424


POLİS
DALGIÇ
POLİS
DALGIÇ
POLİS
DALGIÇ


KADINLAR YAYLASI
Göksel
RIZE
Yağcılar
Tulumpınar
Derekoy


ÖZÇELİK KAROT
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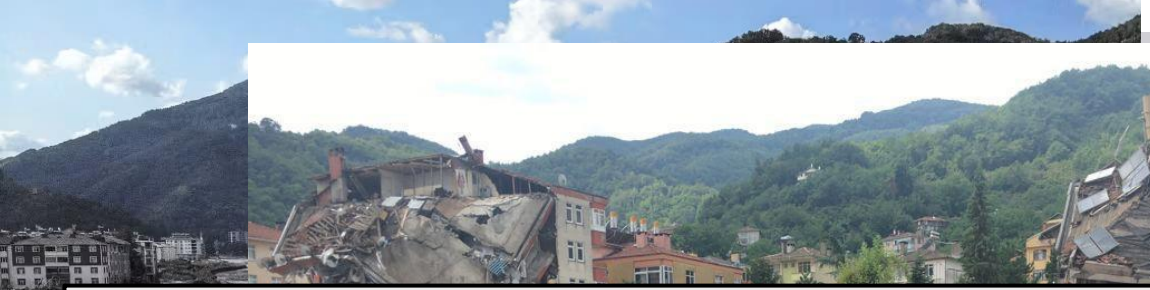
2064 - 2424


KARACHAY-CHERKESS REPUBLIC
KABARDINO-BALKAR REPUBLIC
ÖZÇELİK KAROT
Beton Delme Kesme...


at Bankası


YARDA YAY
AK ŞIMŞE
Göksel
KADINLAR YAYLASI
Sarmasık

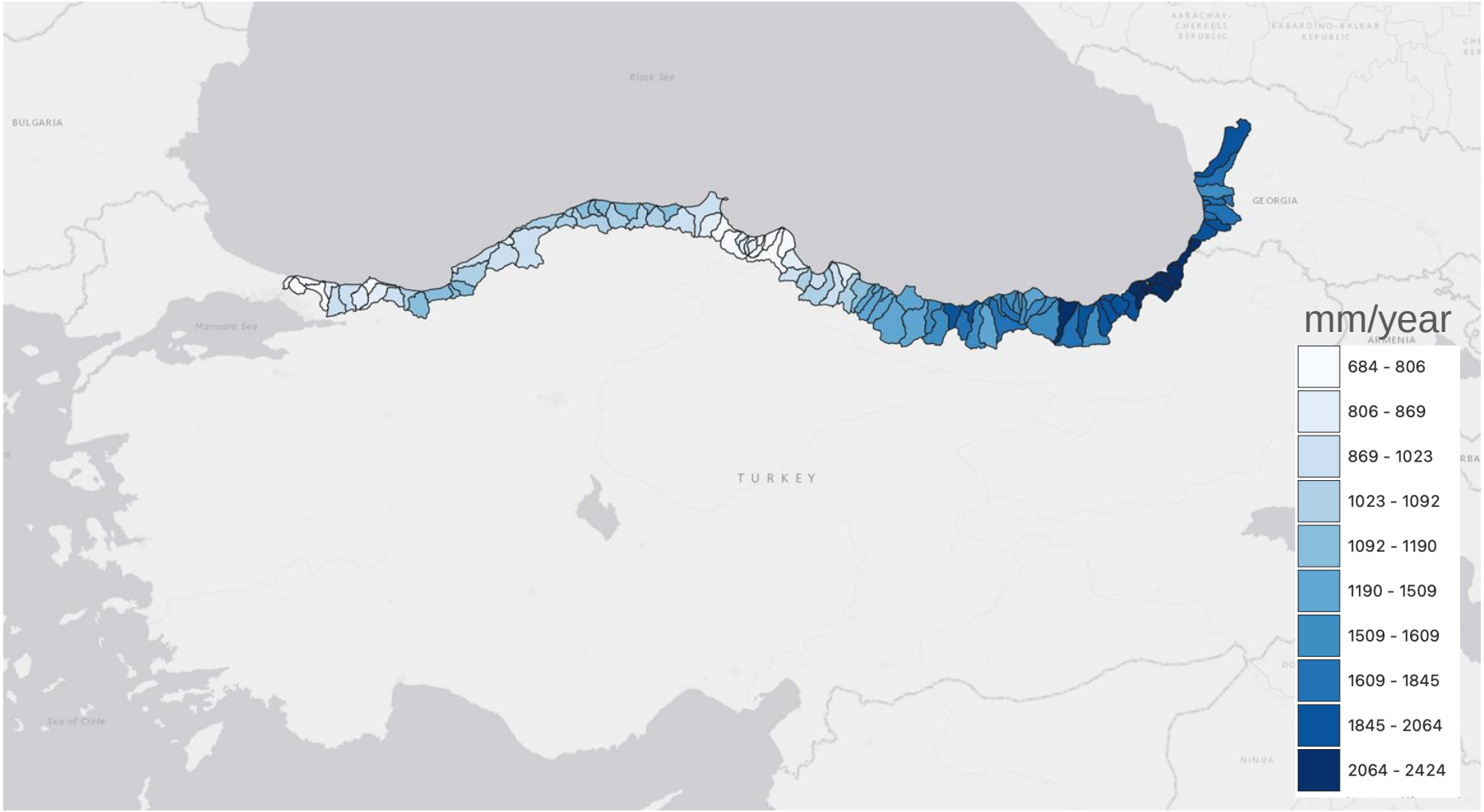


The research questions we are asking are:

- Do annual precipitation patterns change over time?
- Does extreme precipitation events increase in frequency and intensity?

Methodology

- Gather daily rainfall data (ERA5) between 1970 and 2023
- Aggregate to watershed level
- Compute annual values
- Compute extreme values
  - Defined as daily precipitation > 98th percentile (or 99th percentile)
- Conduct trend analysis
- Results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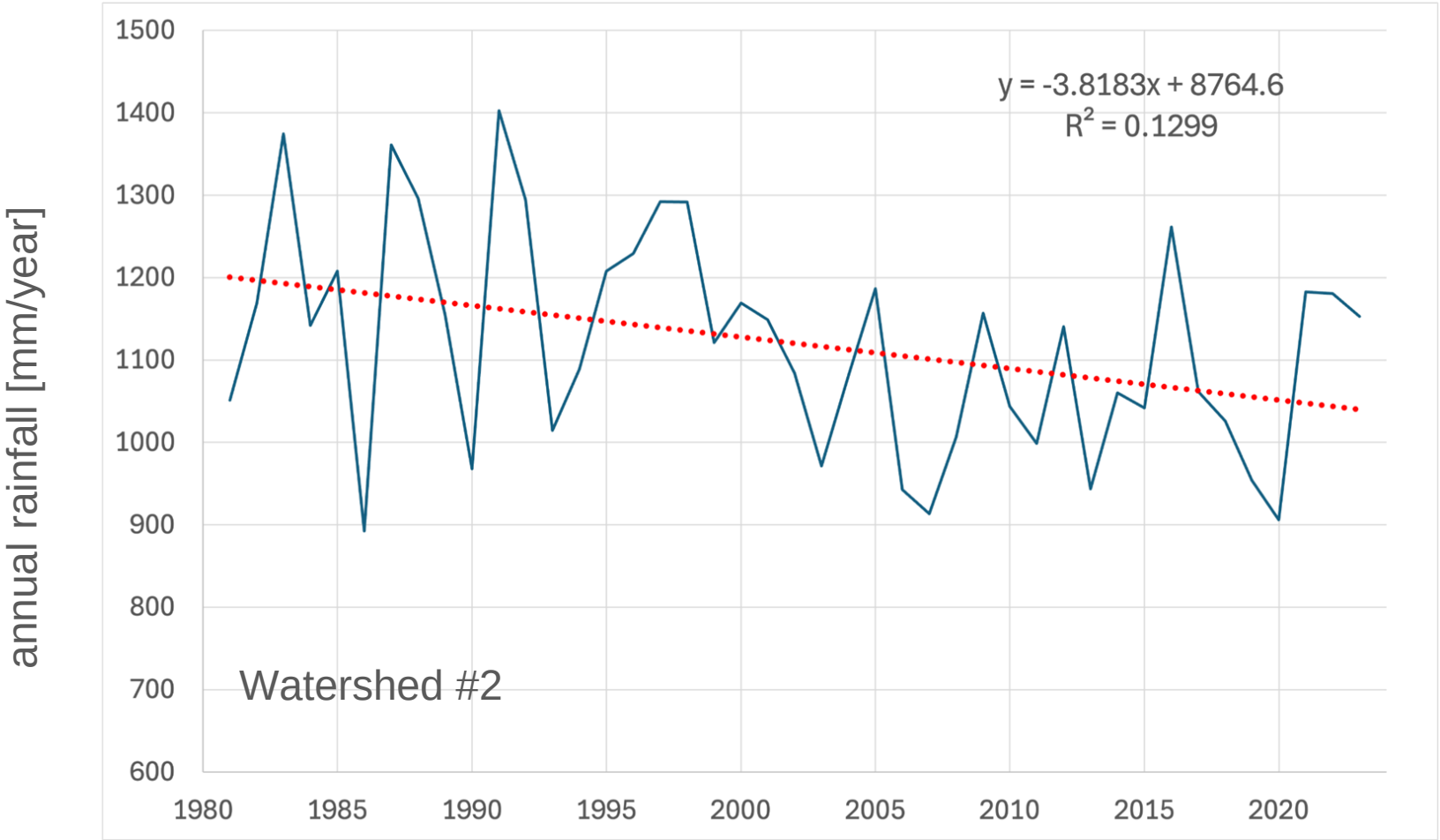
Results (annual rainfall trends)

- Annual rainfall values have varying degrees of trends
- Most trends are negative
- Most of the negative trends are concentrated in central Black Sea
- Positive relationship between annual rainfall and trends
    - Wet areas -> higher trends


annual rainfall [mm/year]
1500
1400
1300
1200
1100
1000
900
800
700
600
1980
1985
1990
1995
2000
2005
2010
2015
2020
y = -3.8183x + 8764.6
R² = 0.1299
Watershed #2

Annual rainfall trends

mm of rain / year

Results (extreme rainfall event trends)

- Extreme rainfall values largely follow annual rainfall events but in the opposite direction
- Most trends are positive
- Most of the negative trends are concentrated in central and eastern Black Sea watersheds
- Trends range from -3 to + 4 events per decade

Extreme event trends (pr > 98th percentile)

number of events / decade

Next steps

- Extend this work to near (20 years) and long term (50+ years) analysis to understand the effects of climate change on the observed trends
- Using CORDEX downscaled rainfall data under CMIP6 scenarios
  - Using preliminary results from the ITU node
- Preliminary results suggest large inter-model variation, but
- In general drying (decreasing annual rainfall) trend is emerging
- Trends of extreme rainfall events are somewhat inconclusive but appear to have a small positive trend

Conclusions

- There are important and significant trends in annual rainfall amounts in Turkish Black Sea coastal areas
- Central Black Sea has decreasing trends while easter areas have increasing trends (these are the higher annual rainfall areas to begin with)
- Occurrence of extreme events (pr > 98th percentile) are generally increasing, especially in easter areas that already have large annual rainfall amounts
- Such trends are potentially exacerbated by land use change (removal of forests in upstream areas and urbanization in downstream areas)
- Government should think about risk mitigation strategies as the risk appears to be increasing!

Ozdogan and Wright, Journal of Hydrology (in review)

Questions?

ozdogan@wisc.edu