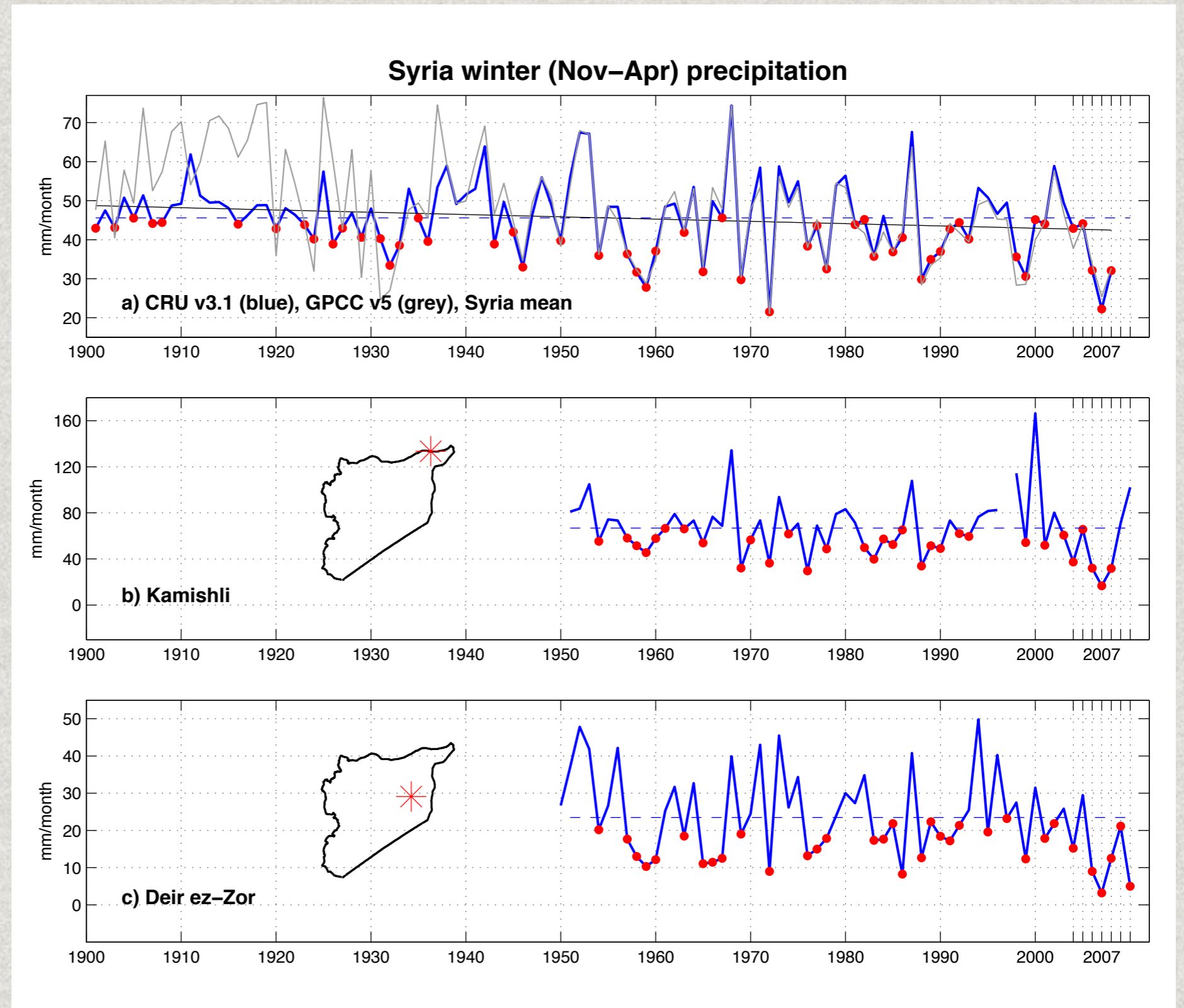# Climate variability and change and migration, some thoughts

Richard Seager
Lamont Doherty Earth Observatory of Columbia University

SYRIA HAD A RECORD THREE YEAR DROUGHT IN 2006-8. MODELING AND OBSERVATIONAL ANALYSIS INDICATE DROUGHT MADE LONGER AND MORE SEVERE BY HUMAN-INDUCED DRYING TREND


Syria winter (Nov–Apr) precipitation

a) CRU v3.1 (blue), GPCC v5 (grey), Syria mean

b) Kamishli

c) Deir ez–Zor

DROUGHT, CROP FAILURE AND MIGRATION PLAYED A ROLE IN THE EVENTS THAT LED UP TO THE BEGINNING OF THE SYRIAN REVOLT IN 2008

Timeline of Events
Prior to the 2011 Uprising

2003-2010: Iraqi and Syrian Refugee Net Urban Influx (in Millions)

Syrian Refugees

Iraqi Refugees

1970s-1990s
Agricultural policies promote production of staple crops, leading to increase in number of groundwater wells and use of inefficient and outdated irrigation methods
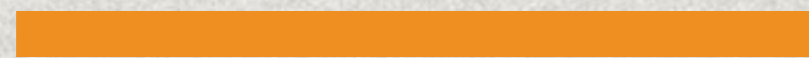
Drought (1988-93) **Drought (1998-2000)**

Drought (2004-10)

1971   1995   2000   2005   2006   2007   2008   2009   2010   2011
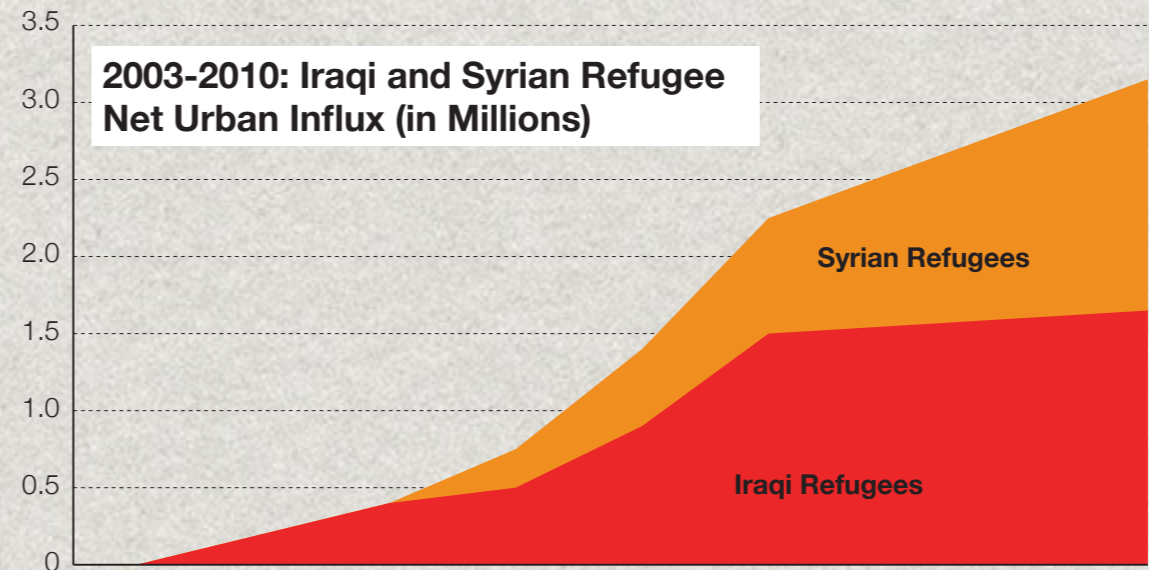
12 March, 1971
Hafez al-Assad becomes president of Syria

Syria achieves self-sufficiency in wheat production
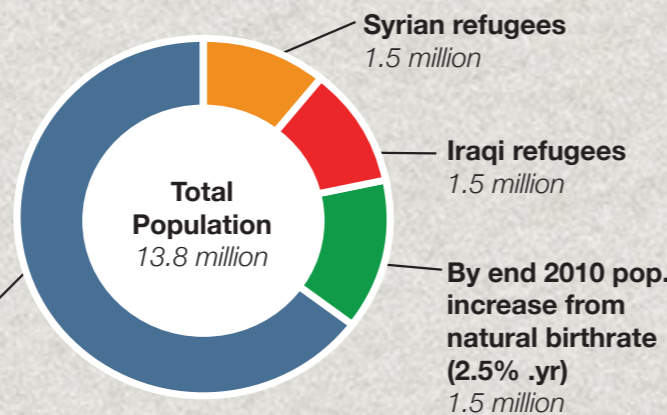
Drying of the Khabur River in NE Syria

Winter 2007-08
Driest in observed record

March 2011
Uprising in Syria

Syrian Urban Population Increase, 2003-2010

Total Population
13.8 million

Syrian refugees
1.5 million

Iraqi refugees
1.5 million

By end 2010 pop. increase from natural birthrate (2.5% .yr)
1.5 million

End 2002 urban population
8.9 million

Since 2005
Apartment prices in Damascus have more than doubled

Since 2007
Wheat, rice, and feed prices have doubled

SINCE THE DROUGHT HAD A CLIMATE CHANGE COMPONENT THIS IS LIKELY A CASE OF HUMAN-INDUCED CLIMATE CHANGE CONTRIBUTING TO SOCIAL CONFLICT

# It's natural climate variability + human-induced climate change that matters

Migration can be induced by:

climate change: steady deterioration of livelihood (e.g. reduced crop yield from gradual warming, depletion of water resources)

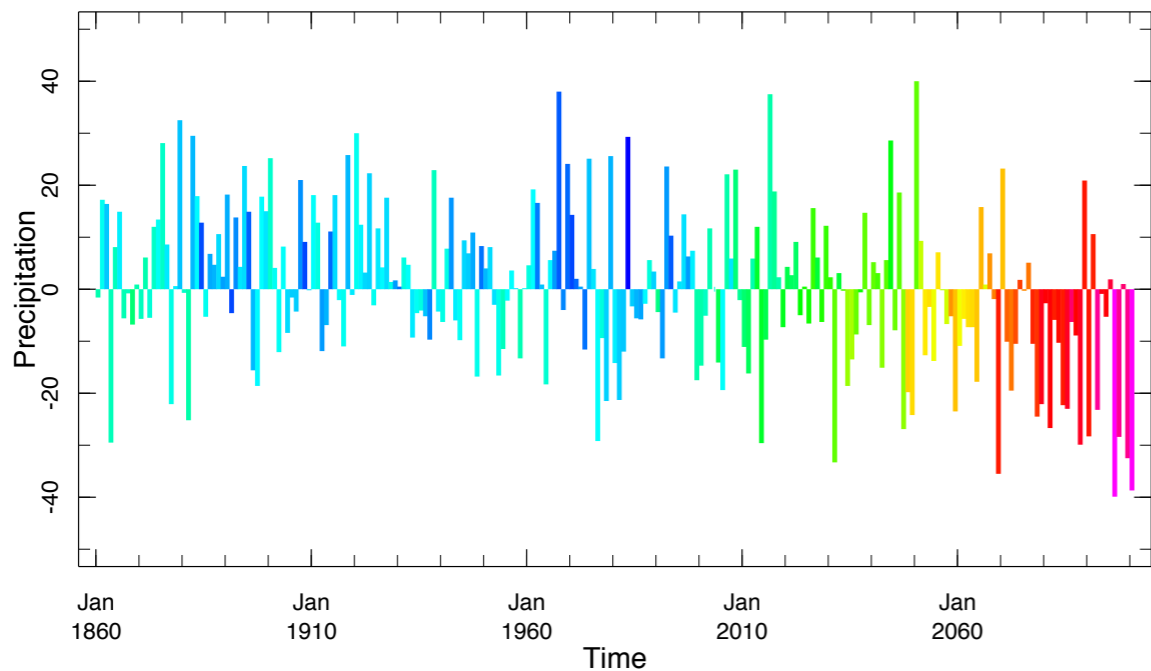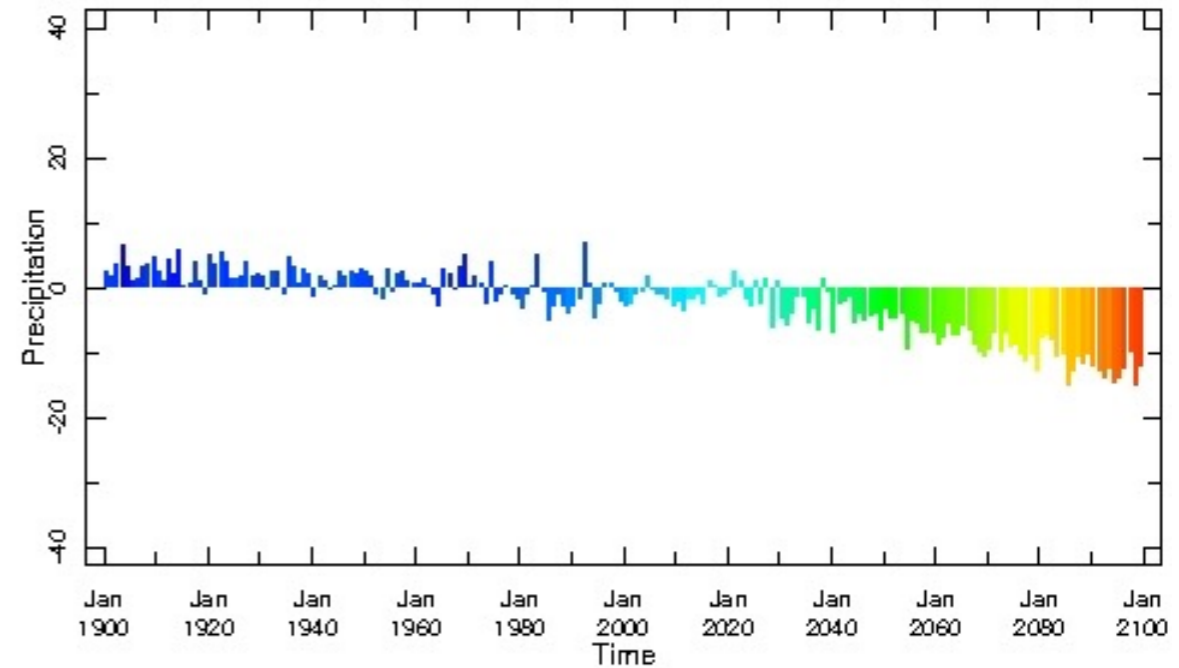variability: extreme events (e.g. a severe and long drought, floods)

variability+change: unprecedented droughts/floods that exceed adaptation capacity

Middle East precipitation (bars, % 1950-99 average) and air temperature (colors,℃)
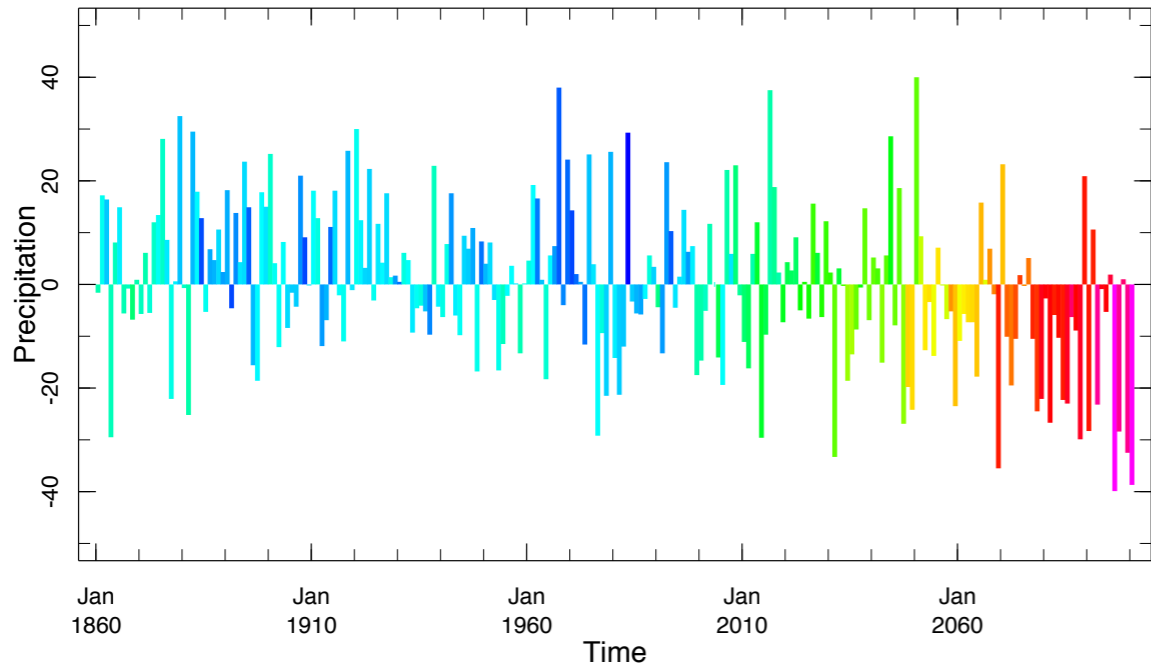
one run of GFDL CM3
historical+rcp85

The 43 model multimodel
mean: historical+rcp85

one run of MIROC-ESM
historical+rcp85

Impacts of drought: the social context matters

Syria 2006-2008

Migration from farm regions to cities

National background: widespread social stress from Iraq war refugees, social and political conflict

Government response: failure to manage stresses

Spreading unrest, conflict

Out-migration from nation

US Dustbowl 1930s

Migration out of farm regions esp. to California "refugee" camps

National background: widespread social stress from Great Depression, social and political conflict

Government response: farm aid, Soil Conservation Service, Federal aid programs

Refugees reincorporated into booming economy of WWII and after, agricultural consolidation and modernization, protection of land resources
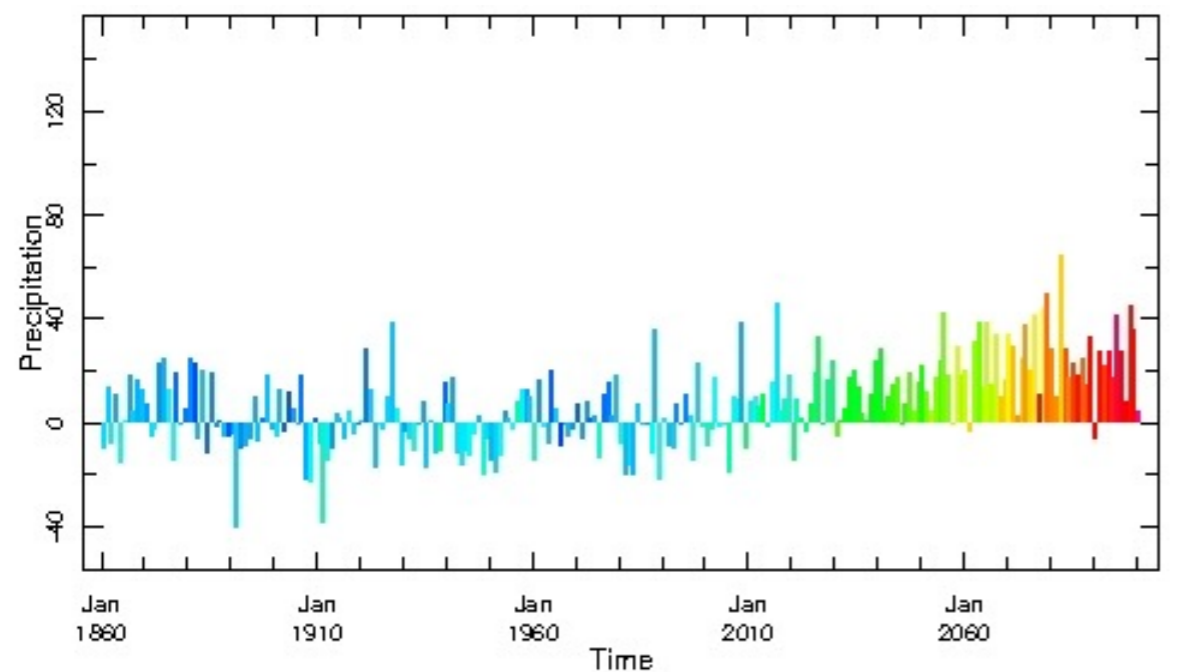
climate and migration

natural variability matters, not just climate change

consider full range of climate trajectories to develop
probabilistic scenarios

how climate impacts combine with vulnerability
(water resources, tech responses, government
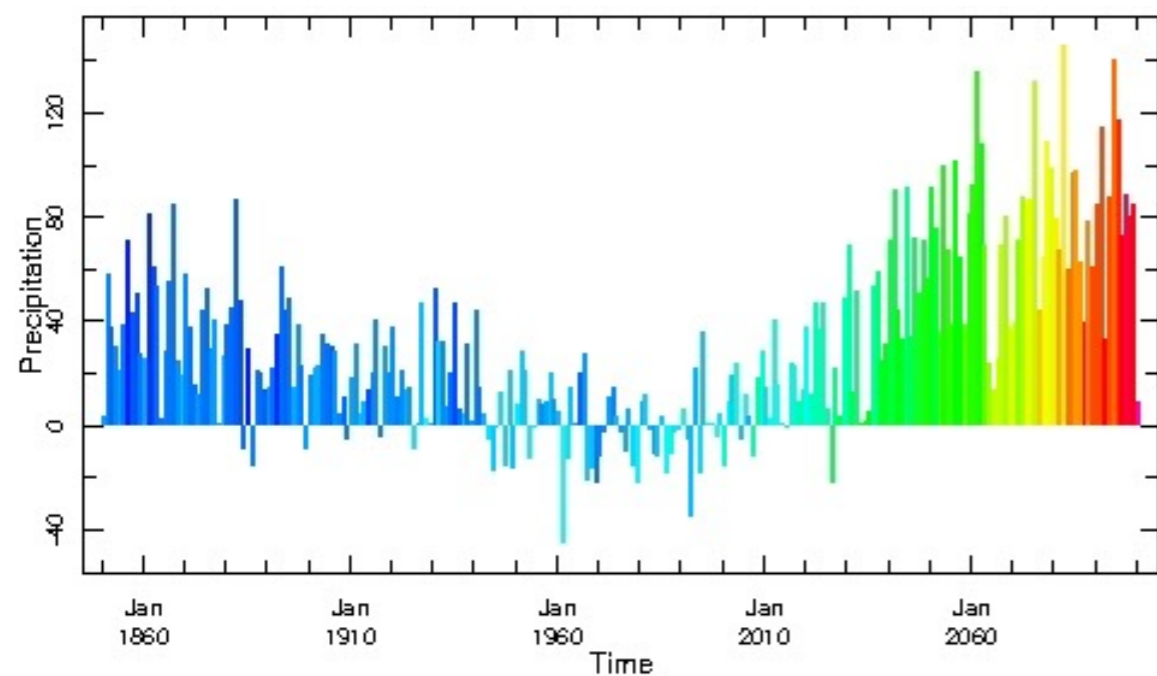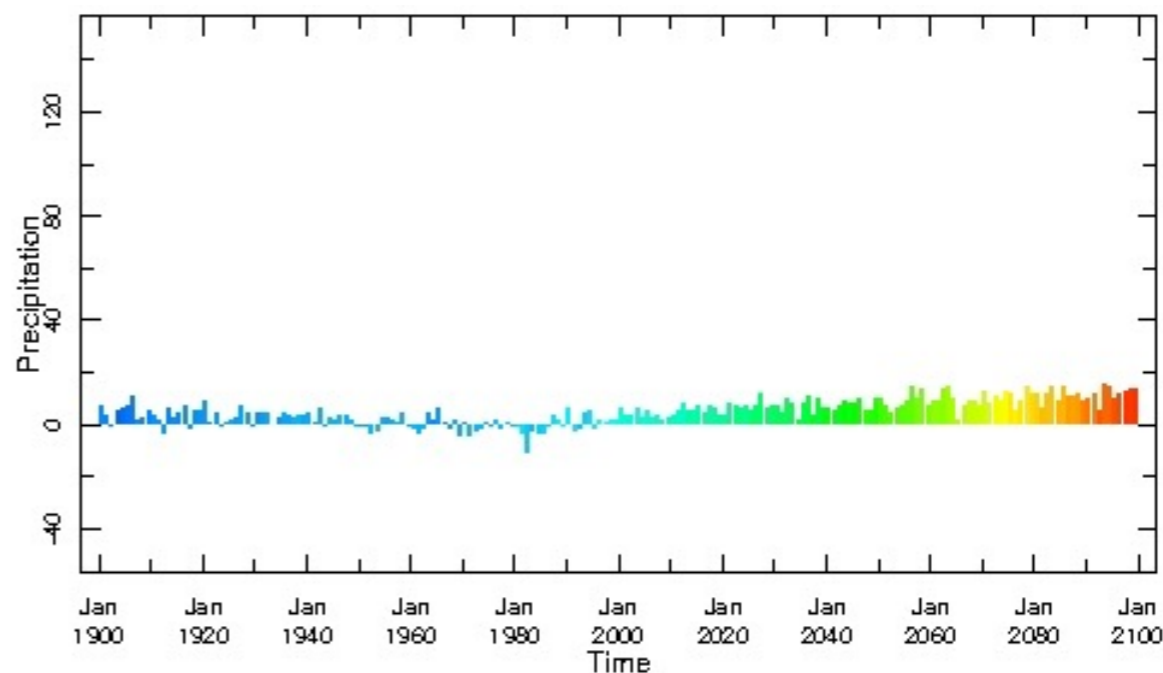assistance etc.) helps determine migration

Sahel precipitation (bars, % 1950-99 average) and air temperature (colors,℃)

one run of GFDL CM3 historical+rcp85

The 43 model multimodel mean: historical+rcp85

one run of MIROC-ESM historical+rcp85