

# Climate Change and the Sahel

## Mobility & modernity in a long-term environmental context

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## Climate change & the Darfur conflict: villain or scapegoat?

- *“A major contributing factor to the conflict in Darfur has been a shift in rainfall that has put nomadic herders and settled pastoralists into conflict with each other.”*

*John Ashton, E3G (BBC News, 08.09.2006)*

- *“Intensive farming and traditional methods have exhausted the soil and brought a decline in soil fertility. Rainfall is increasingly erratic and unreliable... Over the last two decades the mean annual rainfall has dropped by 64%. The result has been great loss of livestock, crops, natural vegetation and wildlife.”*

*Practical Action (Challenging climate change: Terracing technology in Darfur, 2005)*

- *“Climate change ... lies at the heart of the bloody conflict in Darfur, a panel of United Nations scientists said yesterday .... Sudan was unlikely to achieve peace until it tackled the accelerating environmental damage responsible for exacerbating tribal and political tensions. But their highly controversial analysis failed to win over some regional experts. Darfur peace campaigners say that climate has a limited role compared with the actions of a brutal Government intent on genocide.”*

*Times Online, 23 July, 2007*



## Past environmental change in the Sahel-Saharan zone

- Arid-humid cycles: humid conditions from ~8000-3000 BCE



**Image: lake sediments in the Libyan Sahara**

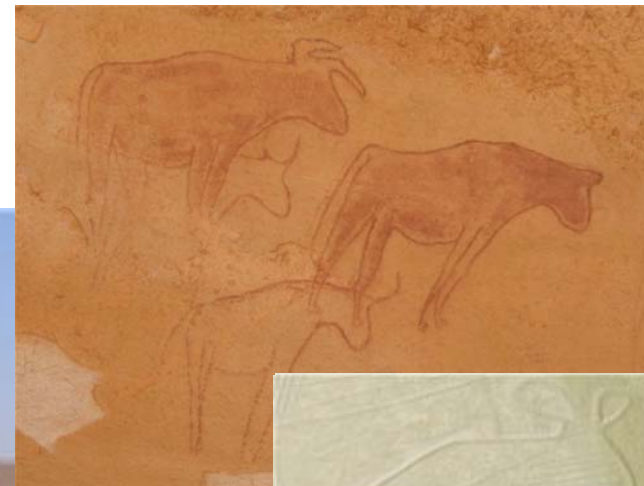
For review of linked environmental & cultural change in the prehistoric Sahara & elsewhere see Brooks et al. (2005) & Brooks (2006)

## Cattle Pastoralism & the Saharan Megalithic

Origins of pastoralism as adaptation to harsher climatic conditions

- Increasingly important as environment became more variable & marginal
- Rapid spread apparently in response to drying after ~5000 BCE
- Mobility key to adaptation
- Monumental funerary architecture, rock art

Brooks et al. 2005; di Lernia 2006

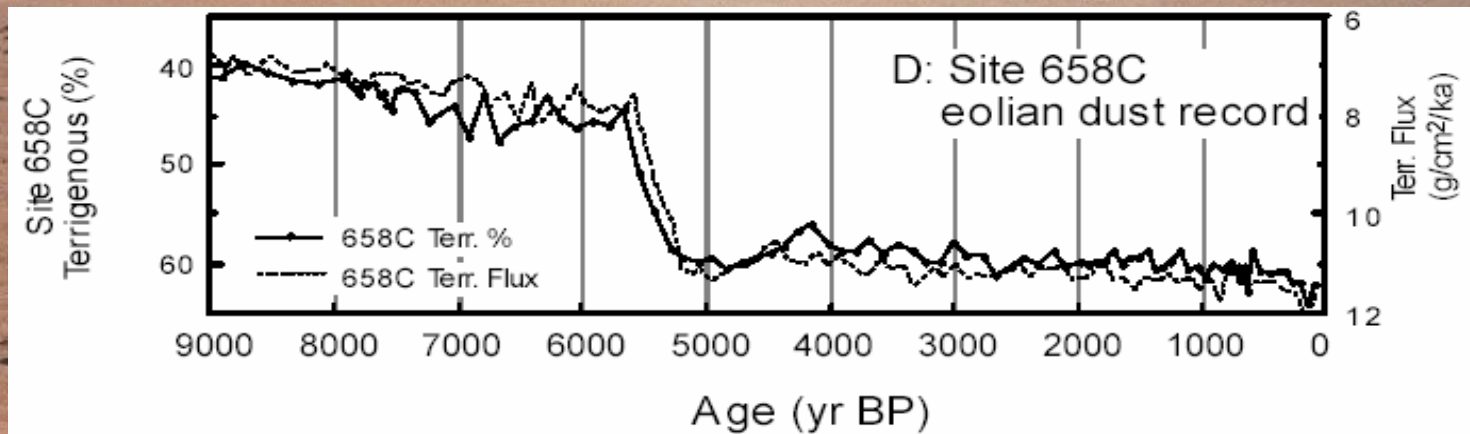


Anticlockwise from top left: Cattle engraving, Wadi Mathandoush, Libya; funerary monument, Area 177, southern Libya; cattle engraving, wadi Erni, Western Sahara; cattle paintings, Rekeiz Lemgassem, Western Sahara

# Abrupt Desertification in 4th millennium BCE



Dust input in eastern tropical Atlantic sediments. Note reversal of vertical scale. From DeMenocal et al. (2000)

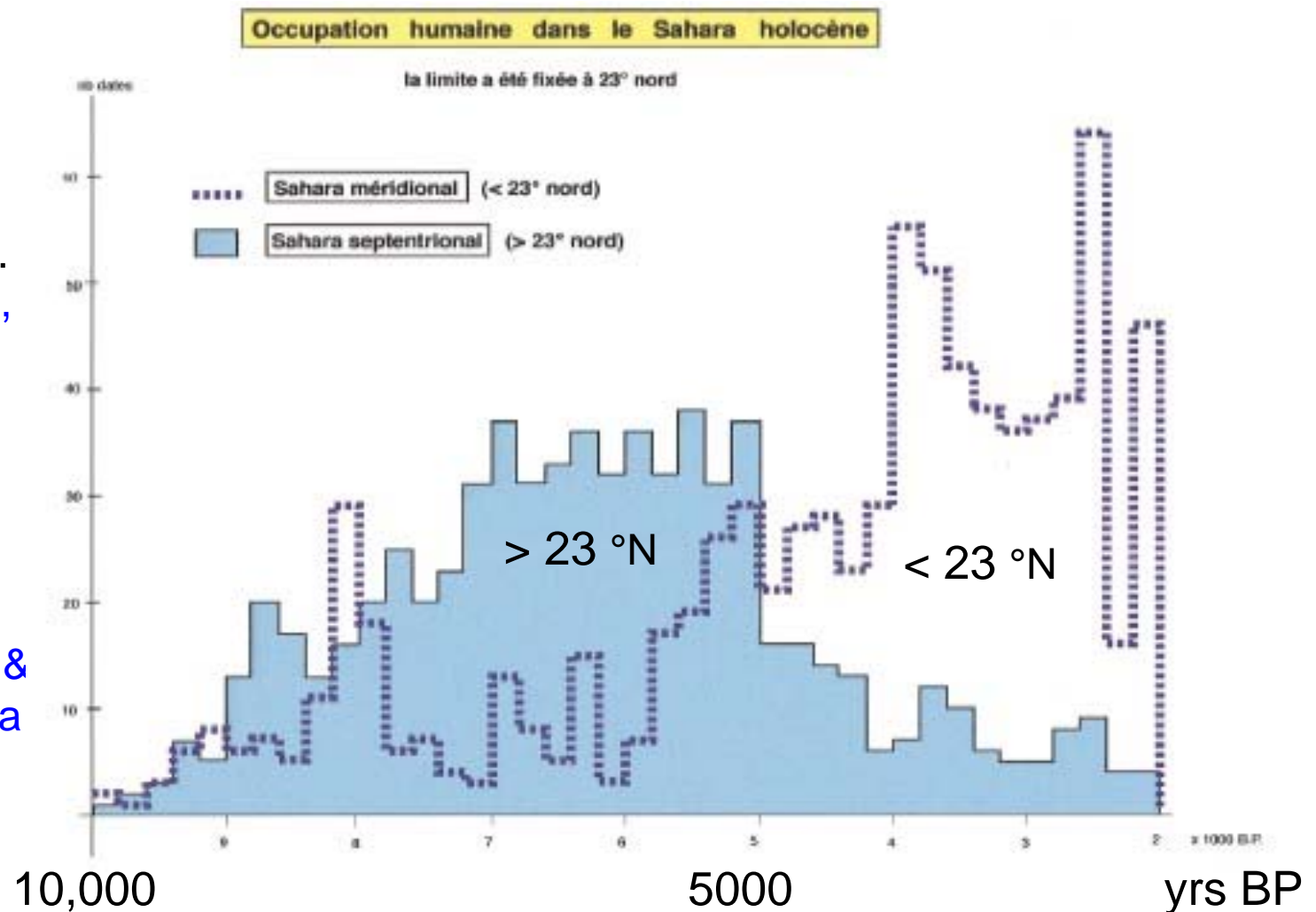


# Population responses to aridification ~4000-3000 BCE

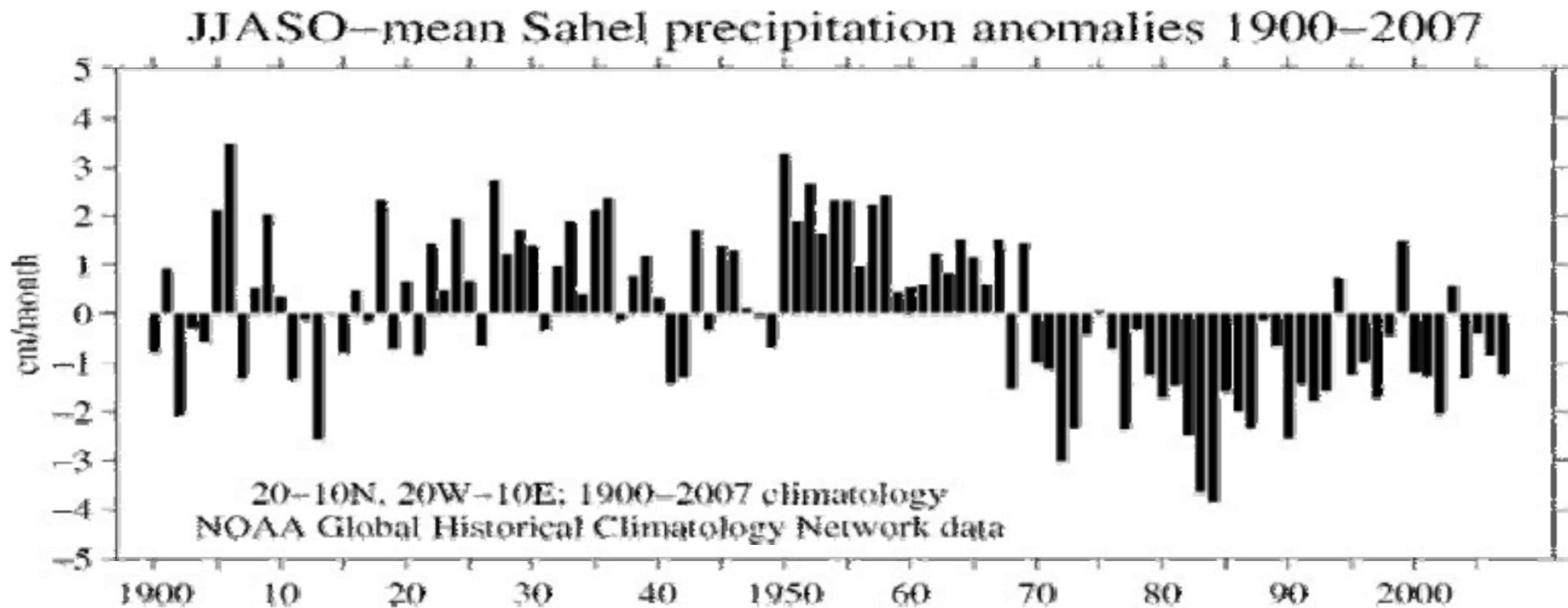
Carbon 14 dates from 1040 archaeological sites in the Sahara between 13° and 34° N. From Vernet and Faure, 2000.

Southward shift in occupation after 5000 BP

5000 BP represents “hinge” between humid & arid conditions (di Lernia & Manzi, 1998)



## Climate change & variability in the 20th century Sahel



- Wet in 1950s, rainfall decline from late 1960s
- Drought & famine of early 1970s - 100s of thousands of people, millions of animals dead
- Long-term desiccation, shift from annual to decadal-scale variability
- “Natural” disaster due to extreme climatic conditions, or human-induced?

# Drought & famine: natural or human disasters?

A popular, and persistent, view

*“[In North Kordofan]...ecological degradation .... largely due to past and current land use practices .... accelerated during periods of drought.” [Sand encroachment is] .... the result of several thousand years of abuse of the fragile ecosystems which formerly existed in the Sahara and Nubian areas ... [There is a] need to educate the rural population, particularly as many of the problems are due to traditional and hitherto unquestioned practices.”*

Lamprey, 1975

## But widely challenged<sup>1</sup>

- No systemic, irreversible, region-wide desertification
- Recovery in rainfall & vegetation since early 1990s
- Successful agricultural adaptation in some areas<sup>2</sup>
- 20th century changes in climate probably not unusual
- Long-term variability driven by global factors
  - κ Patterns of ocean surface temperatures<sup>3</sup>
  - κ Possibly by atmospheric pollution in northern hemisphere
  - κ El Niño, North Atlantic Oscillation
  - κ Minimal/negligible role of local factors e.g. land use



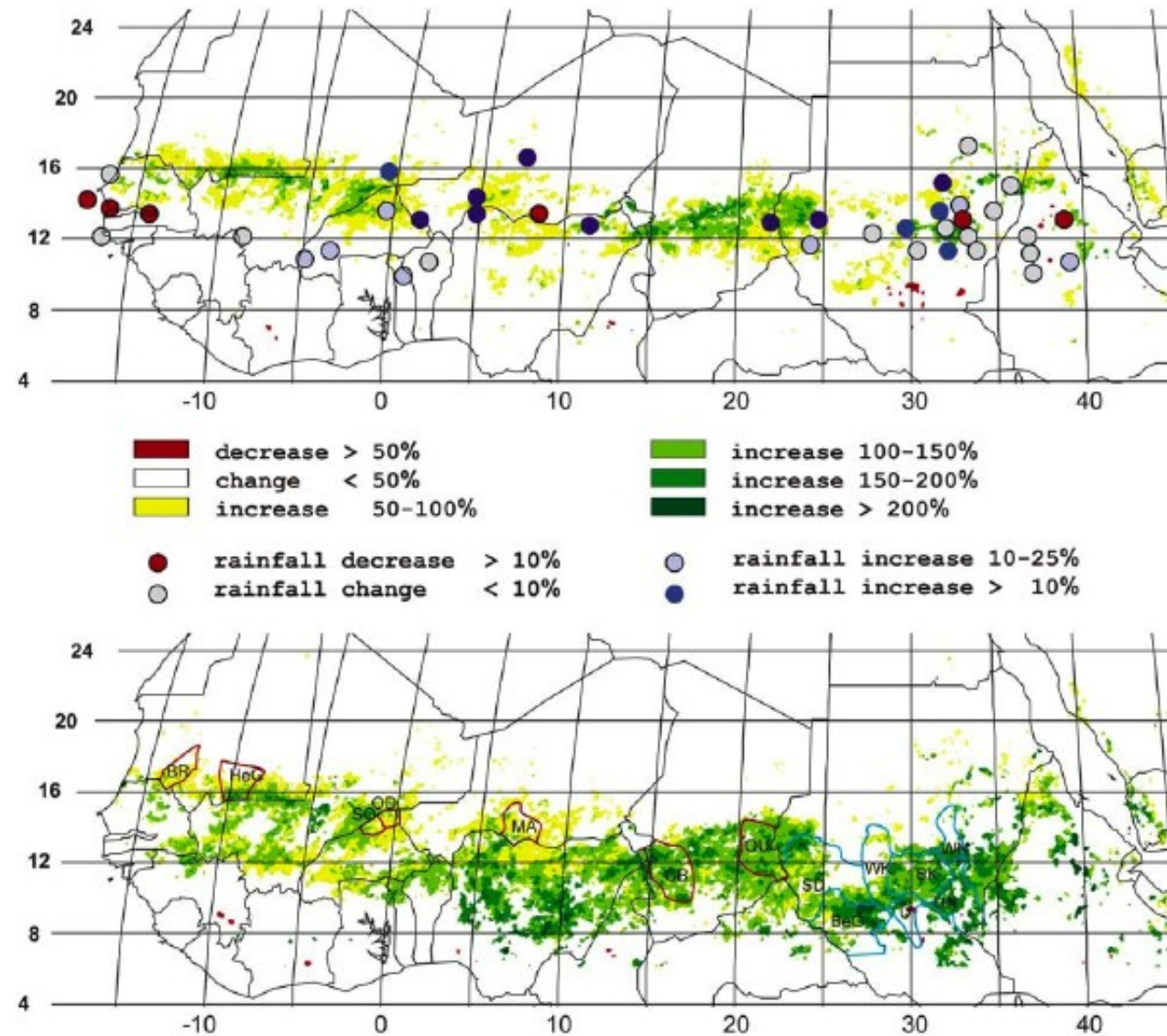
## The greening of the Sahel

Changes in vegetation cover between 1982-1990 and 1991-1999, derived from NDVI satellite data.

**Top:** changes in amplitude of NDVI (i.e. strength of signal), capturing changes in maximum *amount* of green biomass up to a certain level.

**Bottom:** changes in time-integrated NDVI, which capture changes in factors such as length of growing season, amount of vegetation during periods when vegetation cover not at maximum.

Authors state that “greening” cannot be explained wholly by increase in rainfall, as only 8 of 40 meteorological stations show statistically significant increase in rainfall.



## A complex web of interactions

### Famine as a development disaster<sup>1,2,3,4</sup>

- Colonial development policies in **unusually wet 1950s**: subsistence to commercialisation
- Traditional subsistence undermined, pastoralism marginalised
- Expansion of agriculture into historically marginal areas, intensification
- No consideration of long-term variability - output “maximised” under existing conditions
- Collapse of agriculture when conditions became drier (as should have been expected)

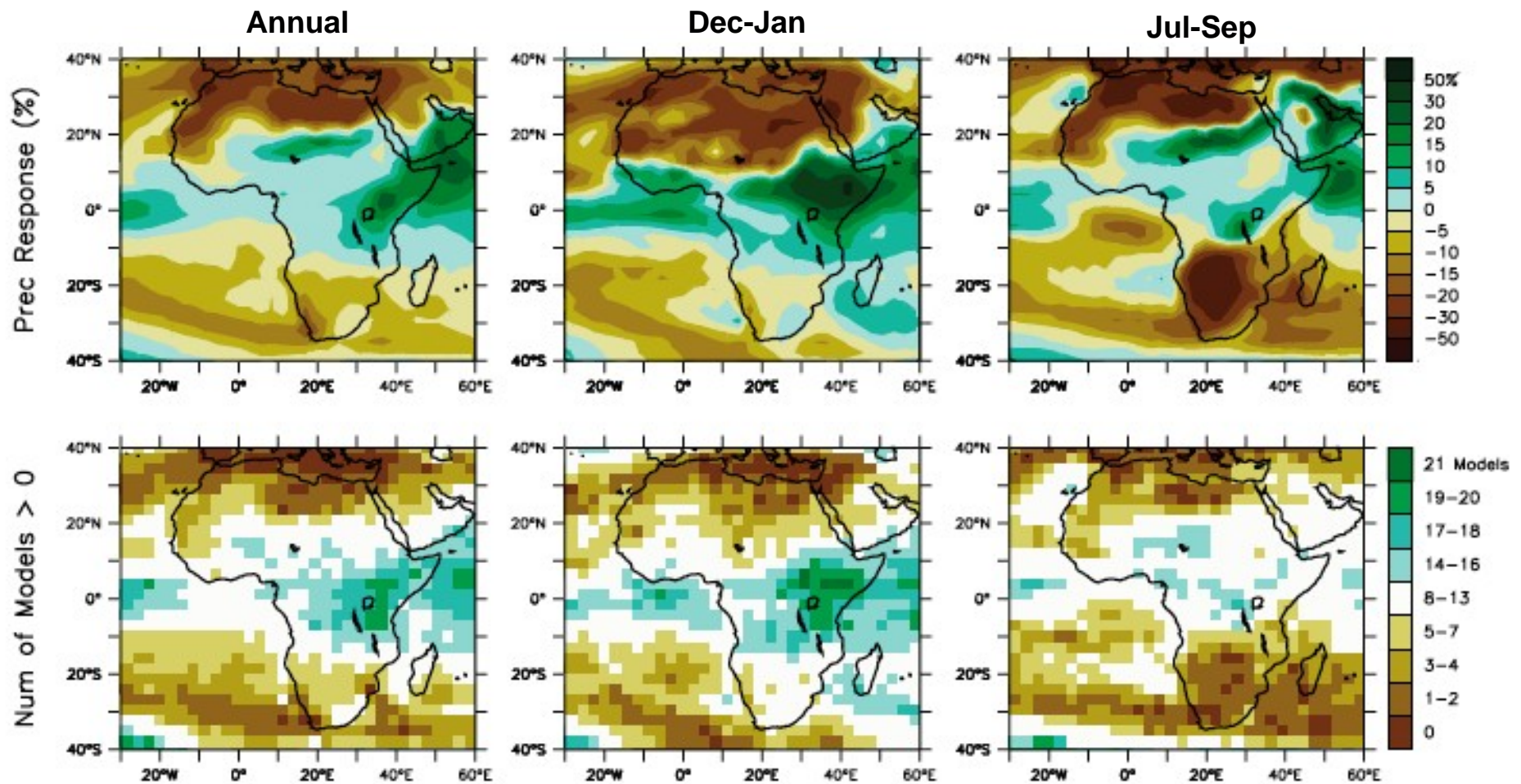
### Climate change and conflict<sup>5,6</sup>

- Droughts of 1970s and subsequent years probably contributed to some conflicts
- Darfur conflict from 2003 at time of climatic improvement
- Earlier droughts may have helped set stage, but no climate change “trigger”

### Lessons<sup>1,2</sup>

- Human-environment interaction hugely important in Sahel due to variability
- Development must be built around climatic & environmental variability
- Rethinking development is urgent priority due to increased variability, unpredictability

# IPCC climate change projections



Top: Projected changes in rainfall in under medium emissions scenario which then reduce towards end of 21st century (IPCC A1B scenario). Bottom: Number of models simulating increase in rainfall.

## Contextualising the IPCC projections

- High uncertainty - considerable disagreement between models used in IPCC
- Many regional models indicate greening due to stronger monsoon
- Conditions wetter & greener during past warm episodes (c.f. 8000-5000 BCE)
- Recent observations indicate greening trends
- Models predicting wetter conditions are based on low-medium global warming scenarios
- These look increasingly conservative as greenhouse gas emissions exceed projections
- At least one study suggests high warming may be associated with Sahel drought

### In addition:

- Wetter conditions may not mean rainfall when it is needed
- Observations & anecdotal evidence indicate rainfall more variable & unpredictable
- Wetter conditions bring their own hazards
  - Changes in distribution & incidence of pests & diseases
  - More frequent locust swarms
  - Increased flood risk (e.g. in areas unused to flooding)



## Pastoralism as adaptation

### Key development questions

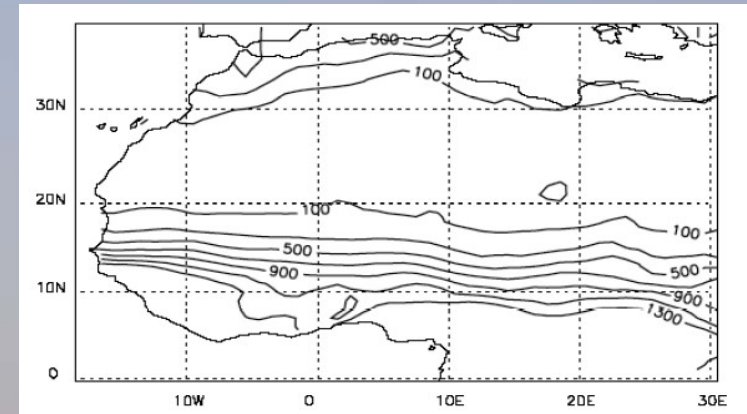
- How to adapt to increased variability & uncertainty?
- How to avoid “maladaptive” development in face of long-term variability?
- How to spread risk & ensure food security?

### Pastoralism as key to future development

- Ideally suited to coping with variability & uncertainty, through mobility
- Low impact if managed effectively
- Associated with intimate knowledge of environment which helps us monitor change
- Has proven (multi-millennial) track record of sustainability & risk spreading
- Has always been, & will continue to be, highly appropriate for Sahelian environment

### Issues

- Pastoralists severely marginalised - physically, politically, socially, economically
- Larger populations mean situation more complicated than simple return to past practices
- Pastoralism often seen as “backward” and unproductive
- Current development models antagonistic to pastoralism



# Conclusions: a manifesto for climate-resilient development

## Two assertions

- Current development models must be challenged in the Sahel (c.f. 1970s famine)
- Addressing long-term climate variability & uncertainty must be at heart of development

## Some recommendations

- “Philosophical” rehabilitation of pastoralism - target public, governments, dev. Agencies
- (Re)build reciprocal relations between pastoralists and farmers
- Integrate traditional knowledge with scientific information
- Recognise adaptation about more than technology (e.g. behaviour, resource management)
- Ensure real participation of local people in development
- Build development around livelihoods, not vice versa



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