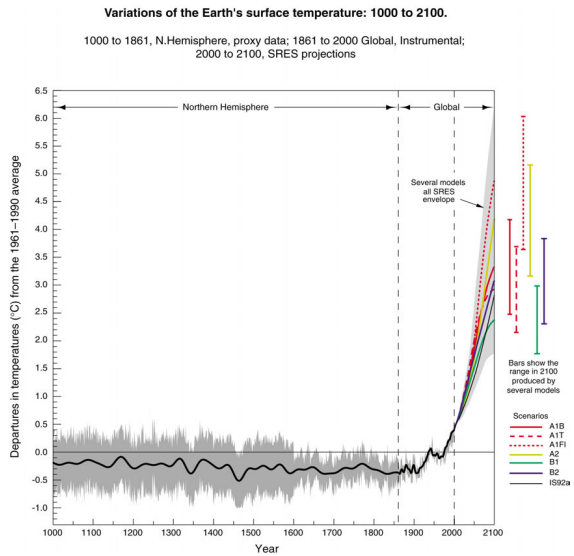
Climate Change – Reducing Agriculture and Forestry Vulnerability

Dr Jim Salinger, NIWA, Auckland

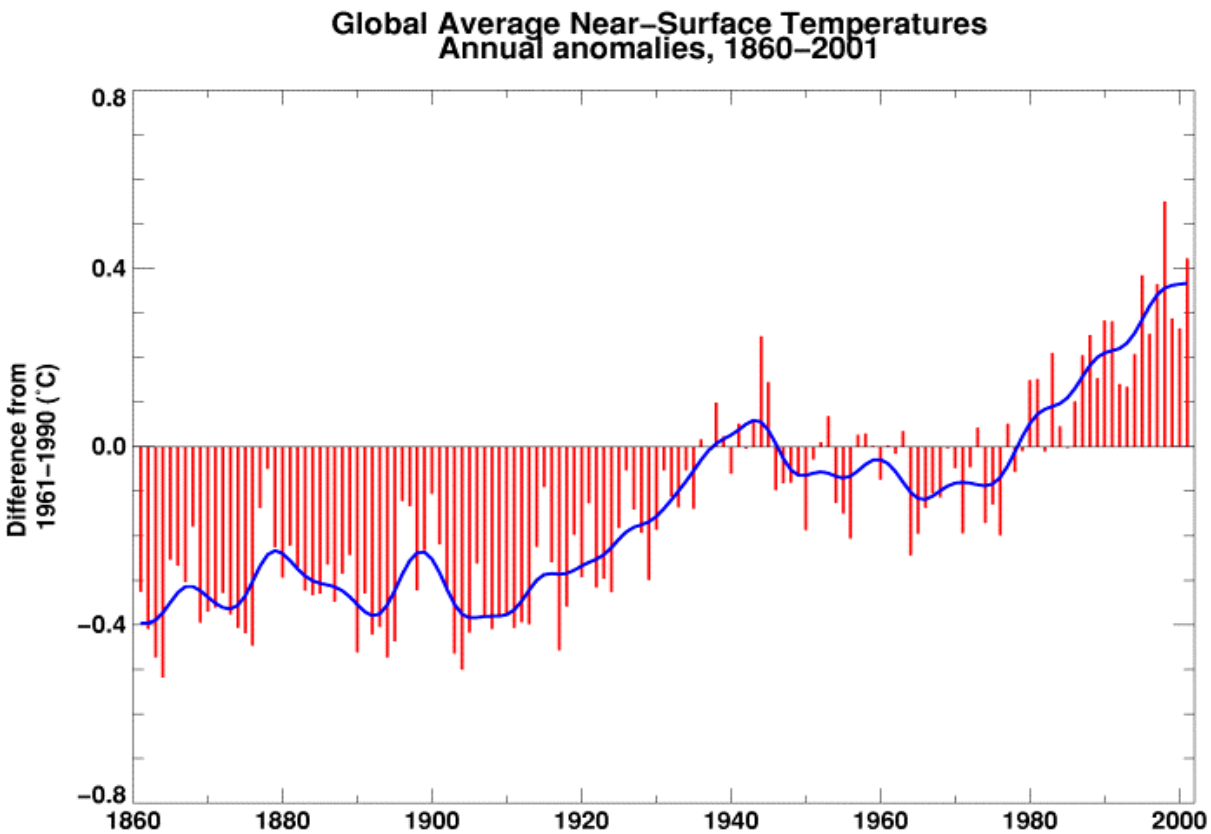
- **Climate – Past present and future**
- **Climate impacts on agriculture**
- **Climate forecasting**
- **Management practices**
- **International workshop**
- **Conclusions**



APN Asia-Pacific Network for Global Change Research

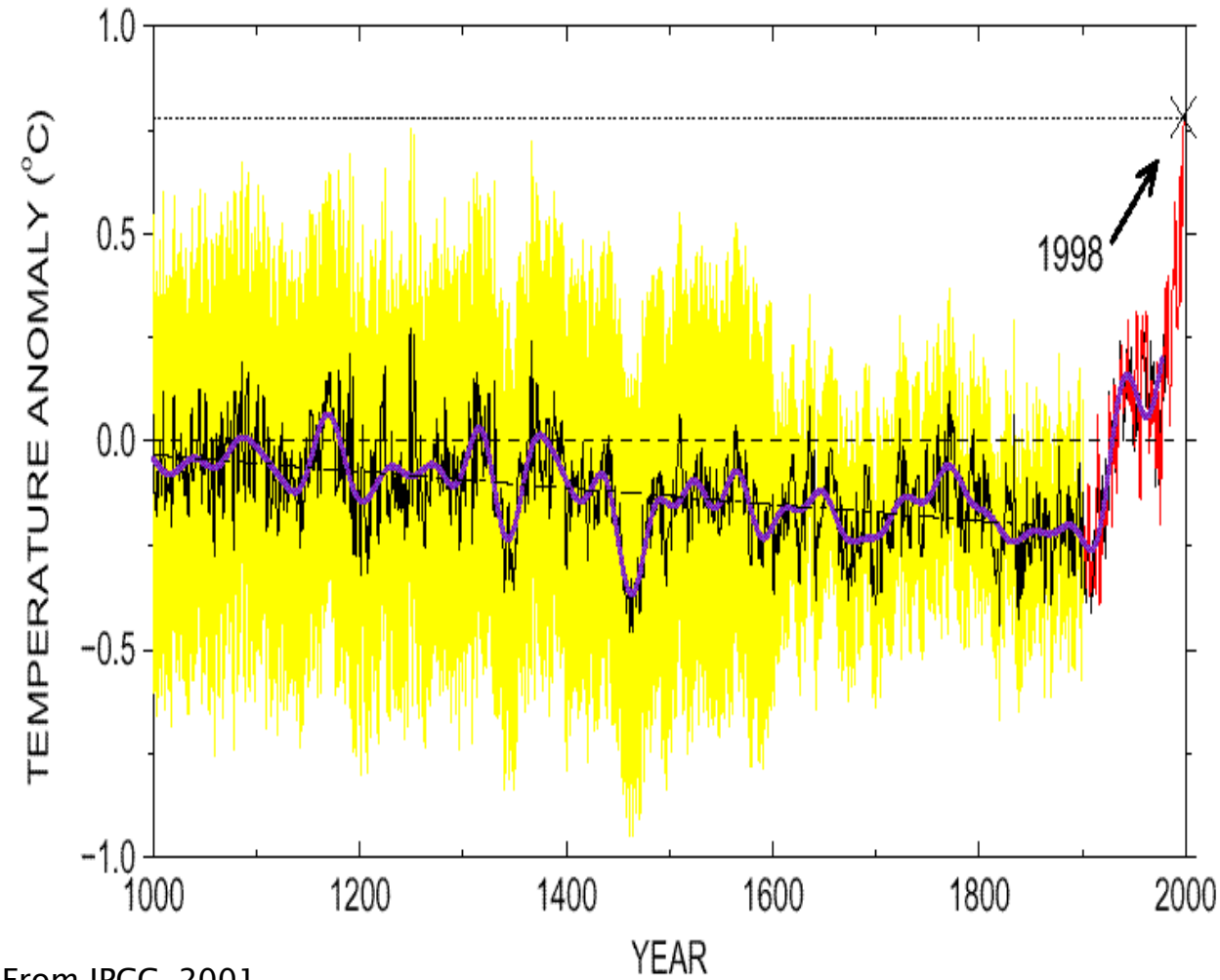
NIWA Taihoro Nukurangi

Climate – Past, present and future



- Global temperatures have increased by about 0.6° C over the 20th century
- Very likely that the 1990s was the warmest decade, 1998 the warmest year

Climate – past, present and future

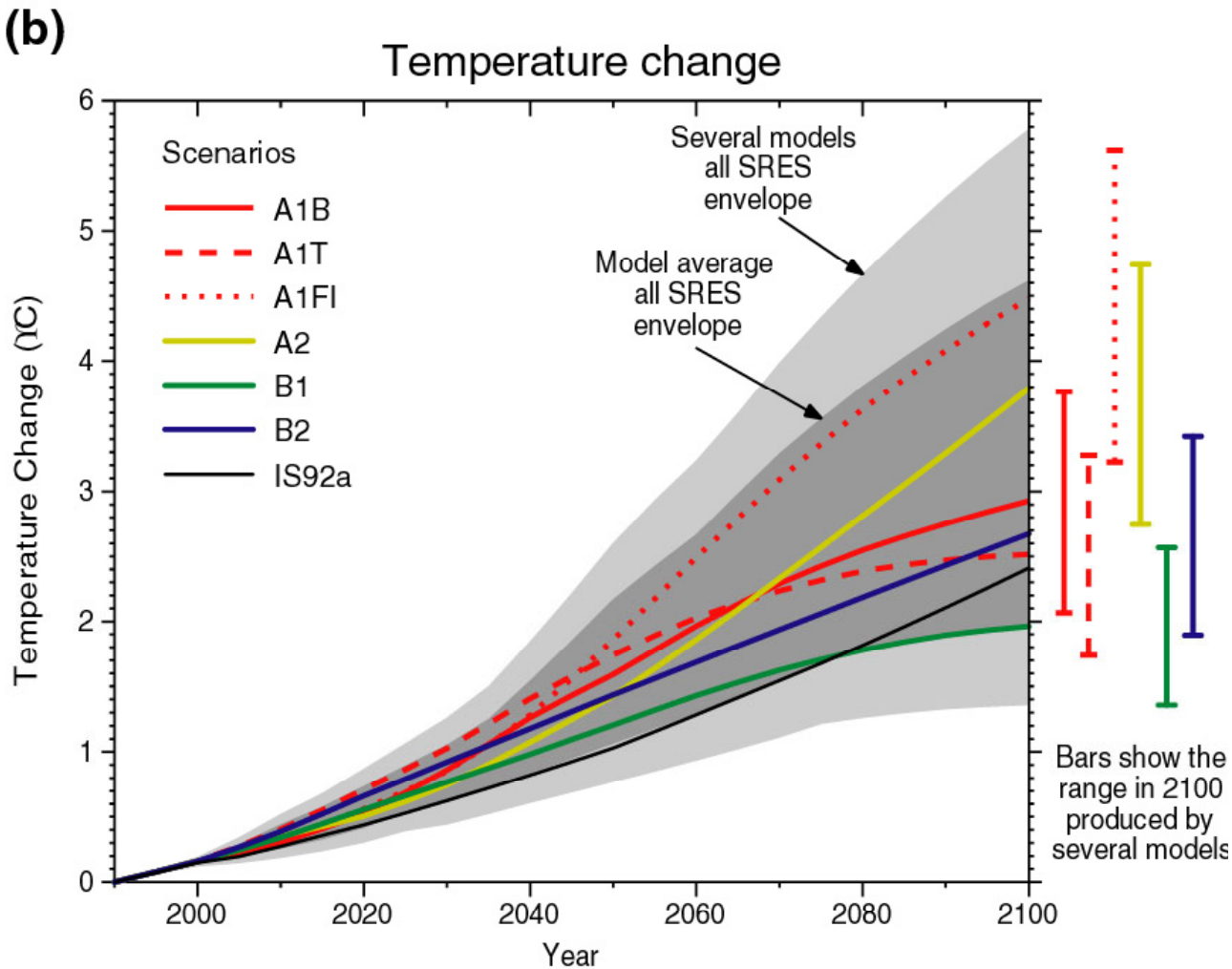


From IPCC, 2001

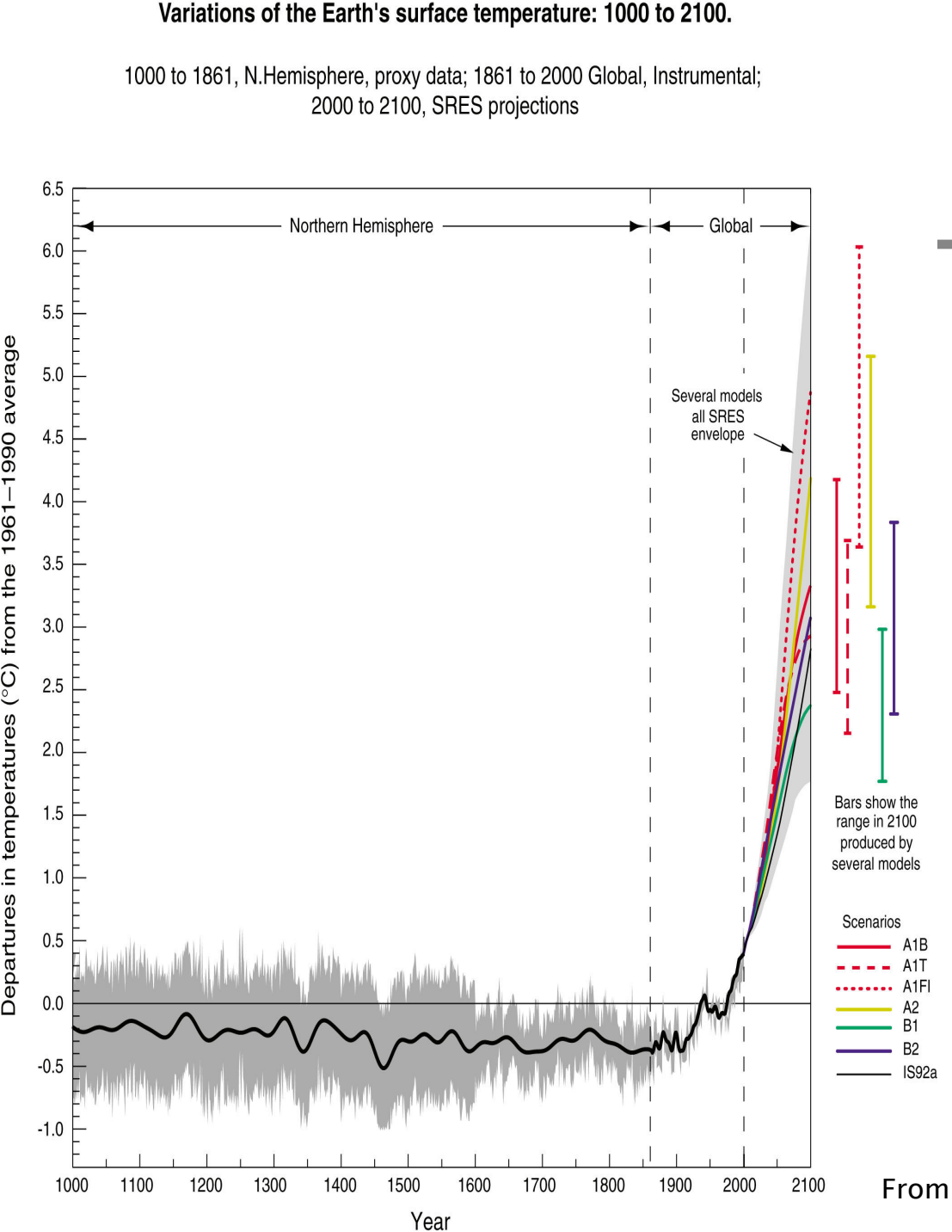
New analyses of proxy data for the Northern Hemisphere indicate that the increase in temperature in the 20th century is likely to have been the largest of any century during the past 1000 years

It is likely the Northern Hemisphere that the 1990s was the warmest decade, and 1998 the warmest year

Climate – past, present and future



Climate – past, present and future



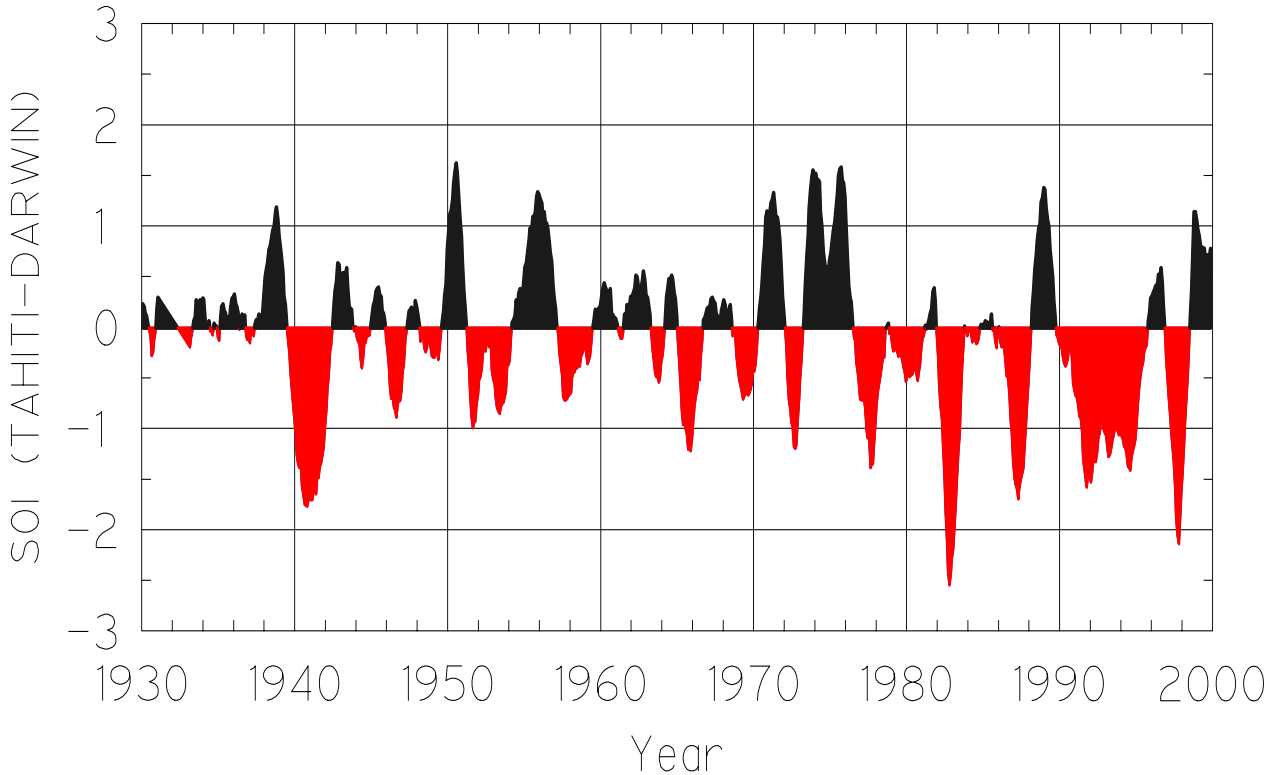
"Global average temperature and sea level are projected to rise under all IPCC SRES scenarios"

Intergovernmental Panel on Climate Change, 2001

From IPCC,2001

Climate Variability

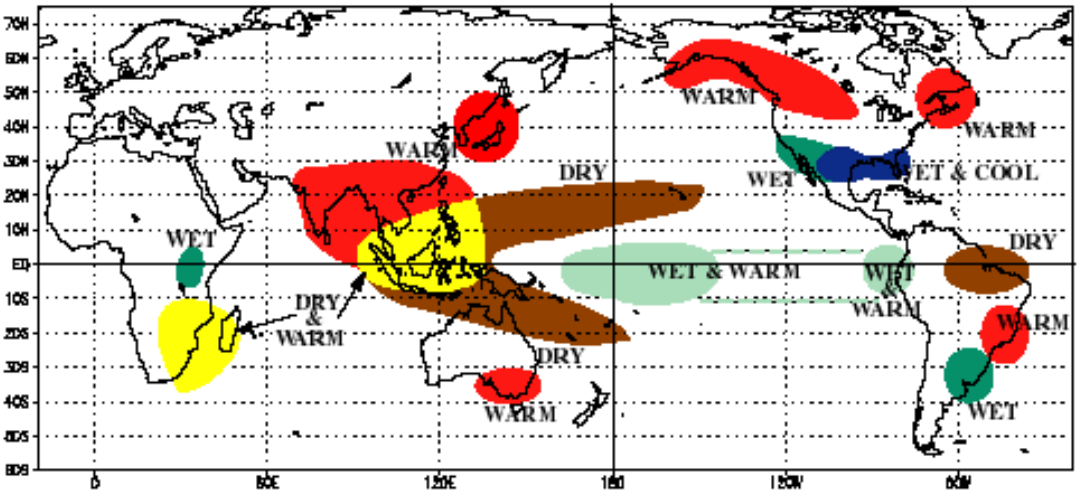
The El Niño/Southern Oscillation



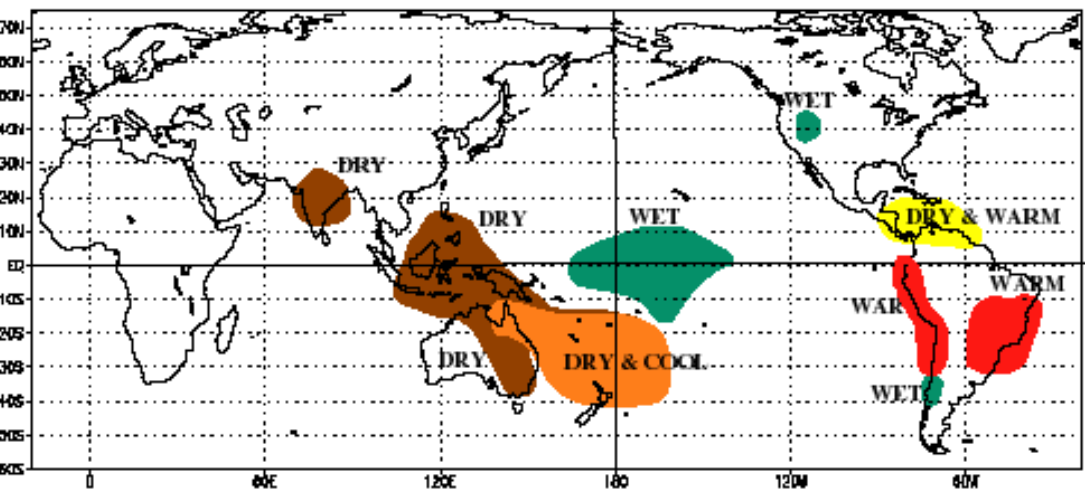
- Year-to-year variability between El Niño and La Niña
- A 3 - 5 year climate cycle of global importance driven out of the Pacific Basin

NIWA
Taihoro Nukurangi

WARM EPISODE RELATIONSHIPS DECEMBER - FEBRUARY



WARM EPISODE RELATIONSHIPS JUNE - AUGUST



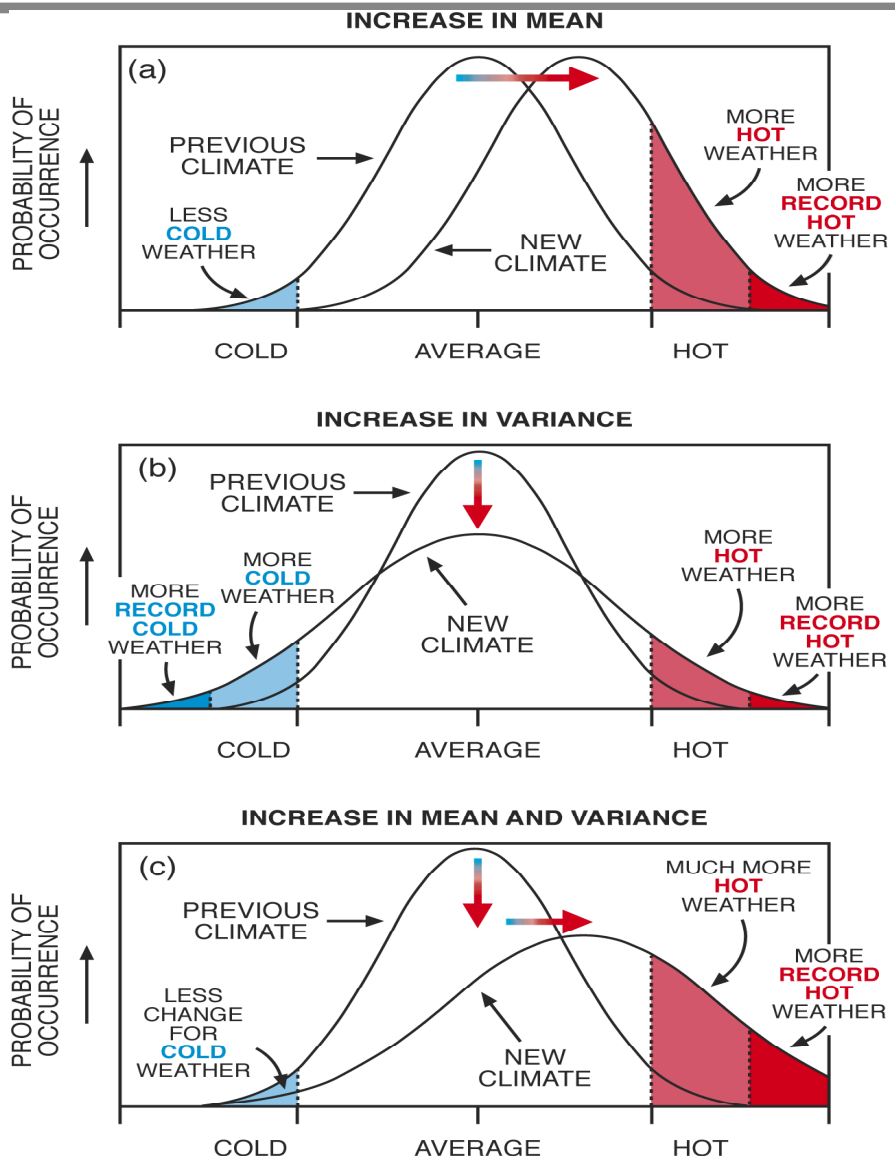
Climate Variability

ENSO Impacts

Climate Prediction Center
NCEP

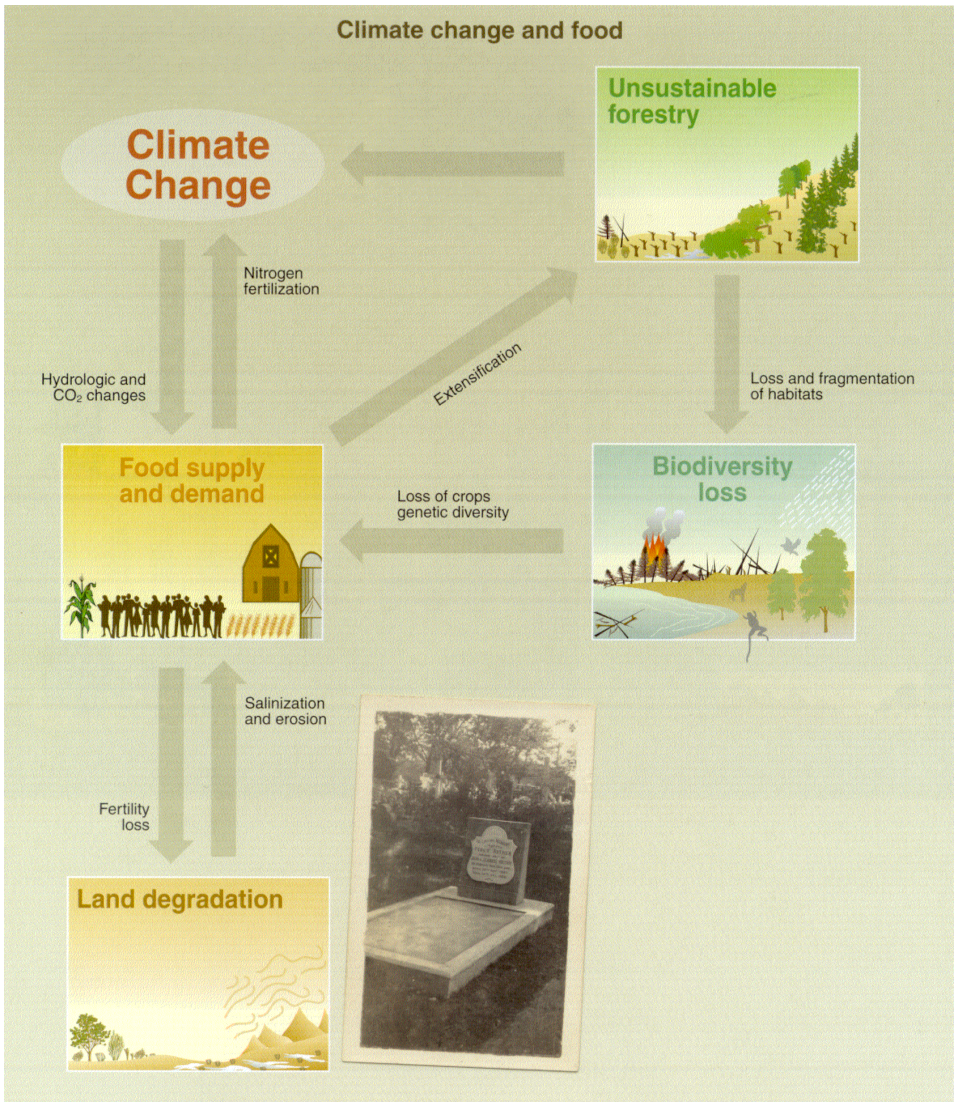
APN
Asia-Pacific Network for Global Change Research

Climate extremes



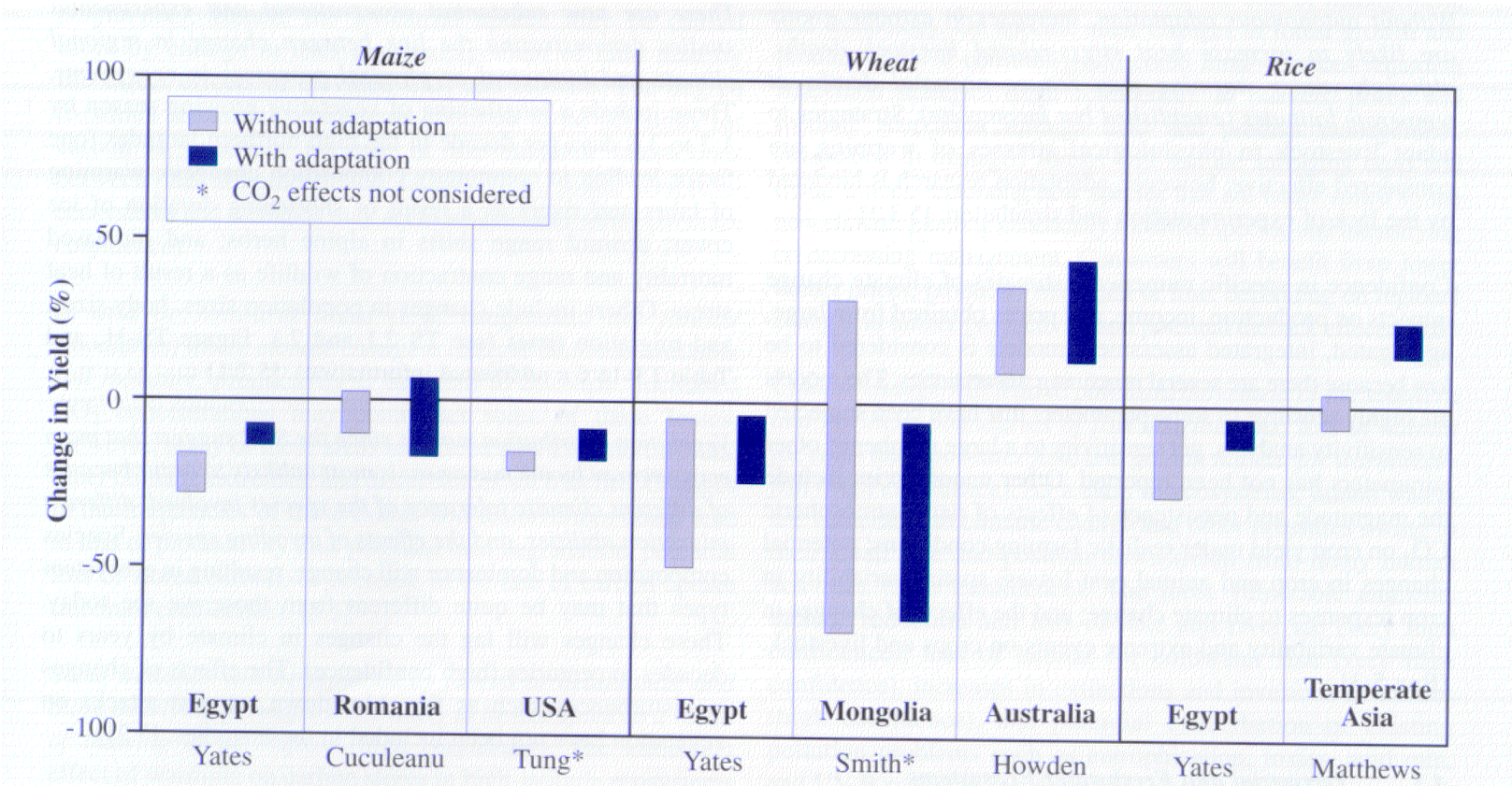
- Global average water vapour concentration and precipitation are projected to increase, with larger year to year variations very likely.
- More hot days and fewer frost days are very likely
- More heavy rainfall events are likely over many areas
- Increase in tropical cyclone peak wind intensities are likely over some areas

Climate Impacts on Agriculture



- A general reduction in potential crop yields in most tropical and subtropical regions with increases in temperature.
- Arid and semi-arid tropics has low and variable rainfall
- A reduction, in potential crop yields in most mid-latitude regions
- Increases in some mid-latitude regions for smaller temperature increases
- A potential increase in global timber supply from some managed forests

Climate Impacts on Agriculture

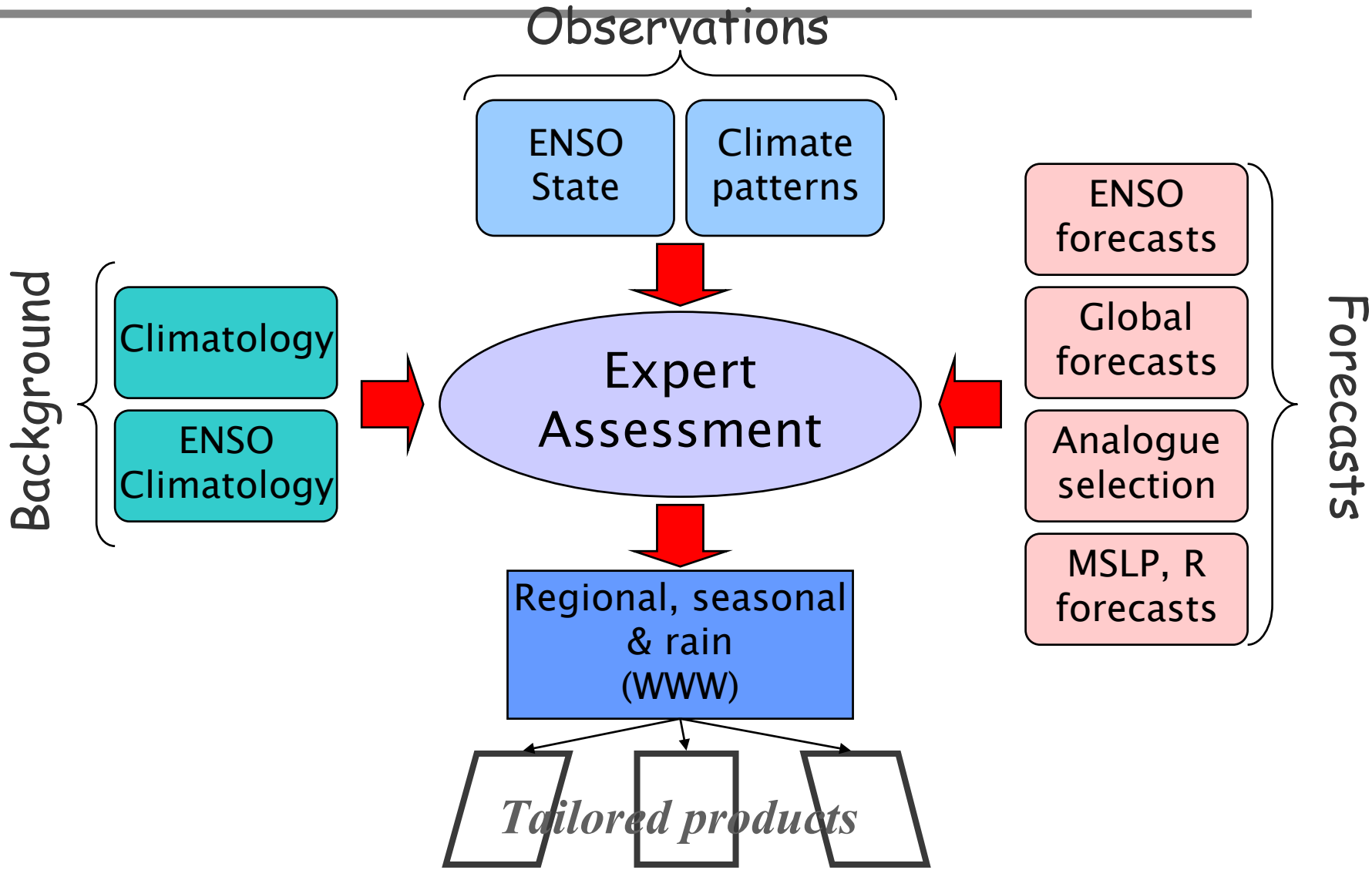


- Ranges of % changes in crop yields spanning various scenarios
- Each pair of results shows with and without adaptation

Climate Forecasting

- Based on slow variations, mostly oceanic
- Seasonal time scale
- Large spatial scales
- Climate somewhat chaotic
  - a limit to predictability
  - statistical/probabilistic predictions
- History often a fair guide

Climate Forecasting



Climate Forecasting - Benefits

- Extremes constrain land use
- Information on “average” climate alone is inadequate
- Extremes likely to change with Global Warming
- Growth in climate forecasting to assist with seasonal extremes

Climate Forecasting - Applications

- Farm level - <u>when to plant</u> sorghum when the SOI is 'consistently deeply negative'

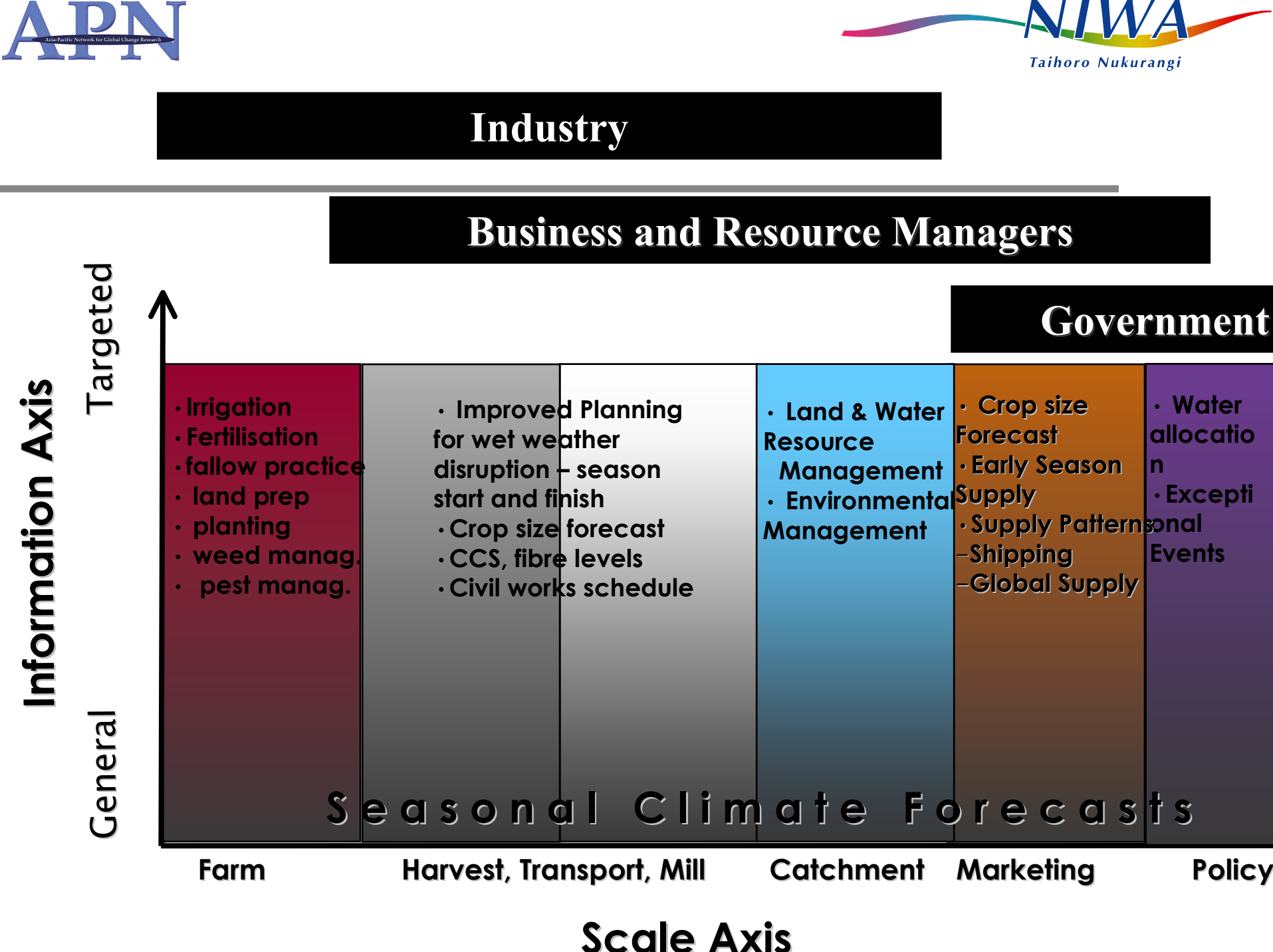
- <u>Which variety</u> of wheat to plant using climate forecasts of the risk of late frosts.

Climate Forecasting

- Simulate management scenarios using analogue years
- Evaluate outcomes/risks relevant to decisions

Agricultural Production Systems Simulator (APSIM) simulates

- yield of crops and pastures
- key soil processes (water, N, carbon)
- surface residue dynamics & erosion
- range of management options
- crop rotations + fallowing
- short or long term effects


Industry
Business and Resource Managers
Government
Information Axis
Targeted
General
· Irrigation
· Fertilisation
· fallow practice
· land prep
· planting
· weed manag.
· pest manag.
· Improved Planning for wet weather disruption – season start and finish
· Crop size forecast
· CCS, fibre levels
· Civil works schedule
· Land & Water Resource Management
· Environmental Management
· Crop size Forecast
· Early Season Supply
· Supply Patterns –Shipping –Global Supply
· Water allocation
· Exceptional Events
Seasonal Climate Forecasts
Farm
Harvest, Transport, Mill
Catchment
Marketing
Policy
Scale Axis

Traditional Management Practices

Natural Mulches

- Moderates soil temperature and extremes
- Less evaporations occurs conserving soil moisture
- Less erosion
- Supresses diseases and harmful pests

Traditional Management Practices

Intercropping

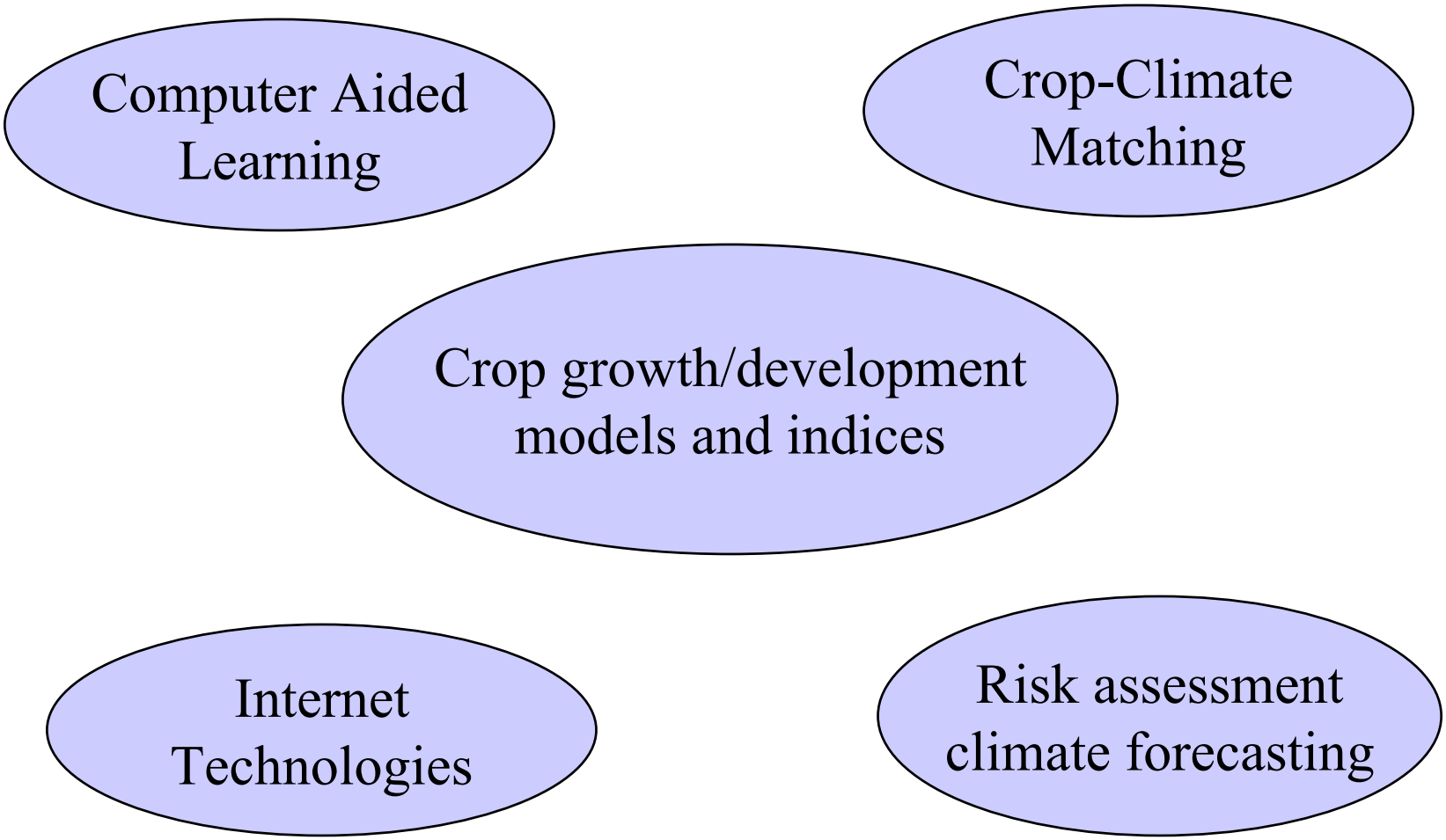
- Provides some shading and better water utilization

Traditional Management Practices

Shade Cropping and Agroforestry

- Modifies wind, water availability etc.

Education


Computer Aided Learning
Crop-Climate Matching
Crop growth/development models and indices
Internet Technologies
Risk assessment climate forecasting

Research

Commence climate adaptation research

Understand climate impacts on agriculture

Model climate change impacts on agriculture

Improve spatial measurement of crops

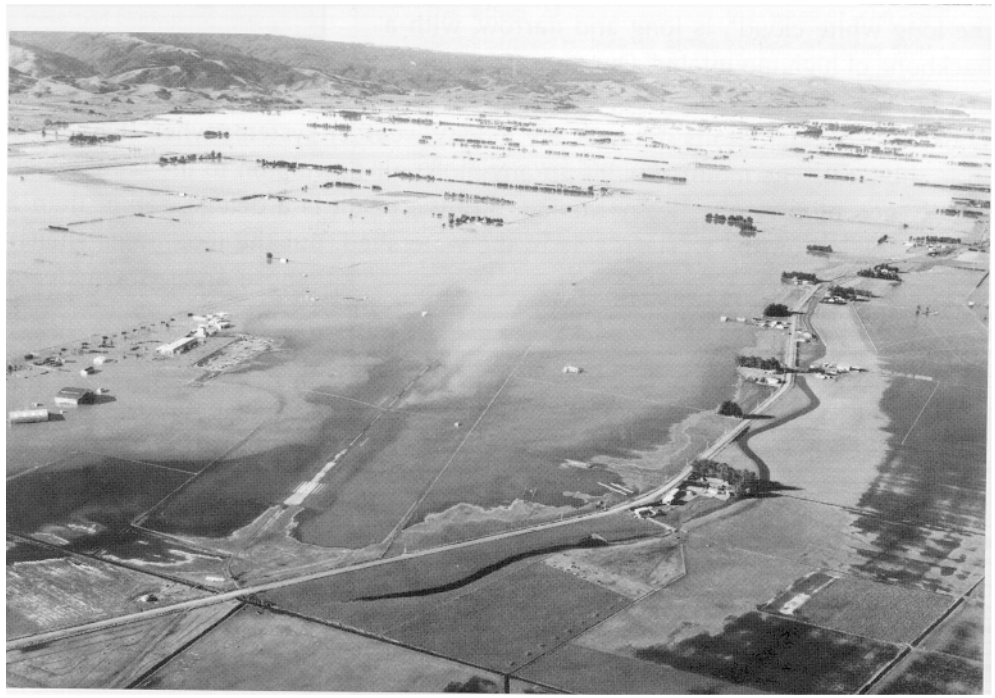
International Workshop

- Knowledge on climate variability and change
- Impacts of present and future variability on agriculture and forestry
- Impacts of global warming on agriculture and forestry
- Adaptation strategies used in the 20th century
- Seasonal to interannual climate forecasting
- Use of traditional methods for reducing vulnerability
- Use of new technologies for reducing vulnerability
- Research, training and education

Implications - Hazards

Natural Hazards - Heavy Rain and Drought

- Changes in rainfall intensity and extremes need to consider flood protection, sewerage and storm water systems
- Sea level rise impacts on lower flood plains
- For drought need to manage stocking and rural fire protection



Implications - Agriculture

Agriculture

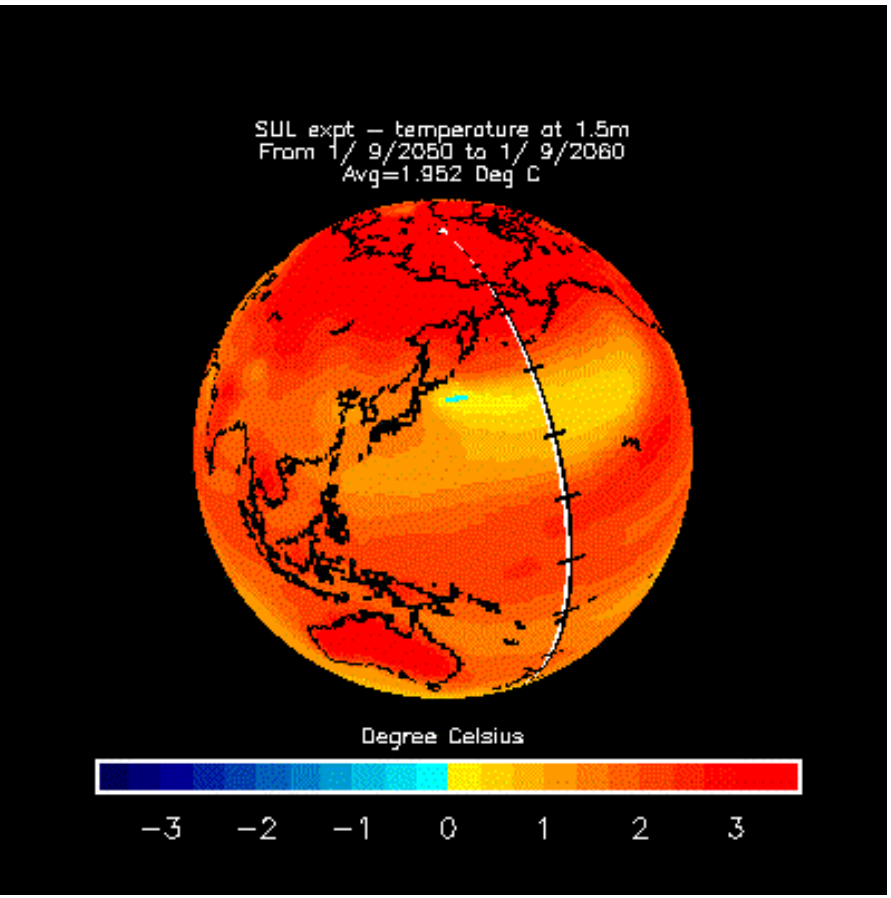
- Climate proofing of activities, especially pastoral farming to account for extremes from seasonal predictions
- Planning new activities as the climate shifts and warms

Implications - Crops

Crops

- Extremely sensitive to variability and change
- Shifts in crops ranges
- Manage between good and adverse seasons
- Plan new activities as climate shifts and changes

Conclusions



UK Met Office Climate Model

2050 - 2060

Reducing Vulnerability:

Whatever we do, climate change is inevitable during the 21st century

The rate of climate change will be rapid

Integrating preparedness for increasing climate variability and change