APEC Climate Symposium 2009

Climate prediction and applications: Relevance for climate adaptation strategies

Singapore, 12-15 July 2009

Climate and hydrological prediction for energy and agriculture

James Renwick

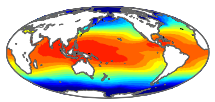
NIWA, New Zealand

j.renwick@niwa.co.nz

NIWA
Taihoro Nukurangi

Outline

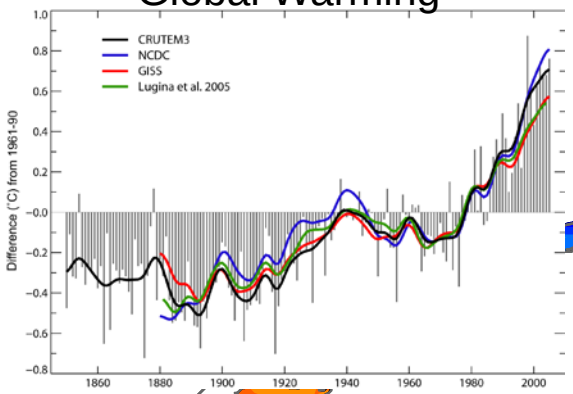
- A brief sketch…
- New Zealand climate
- Applications of hydrological modelling
- An example farming application
- Summary

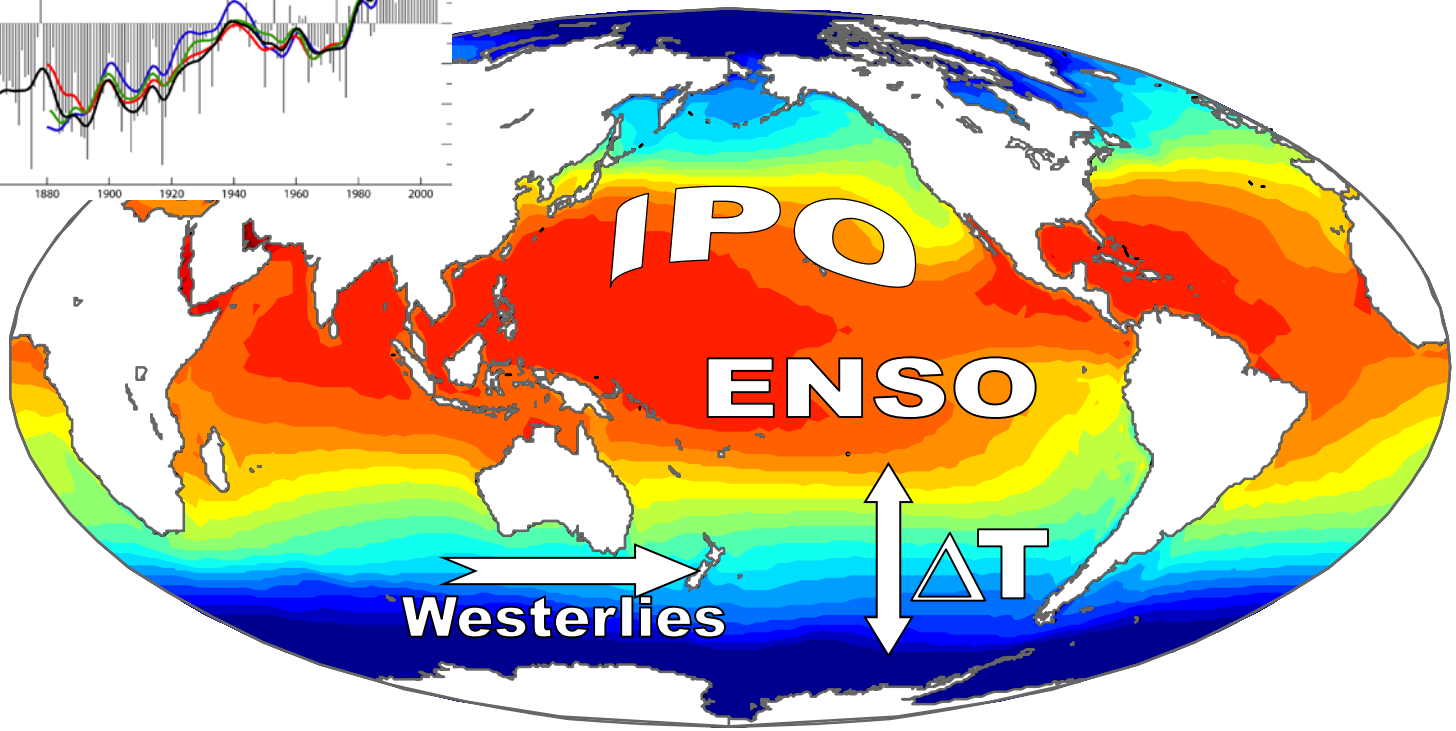


NIWA
Taihoro Nukurangi

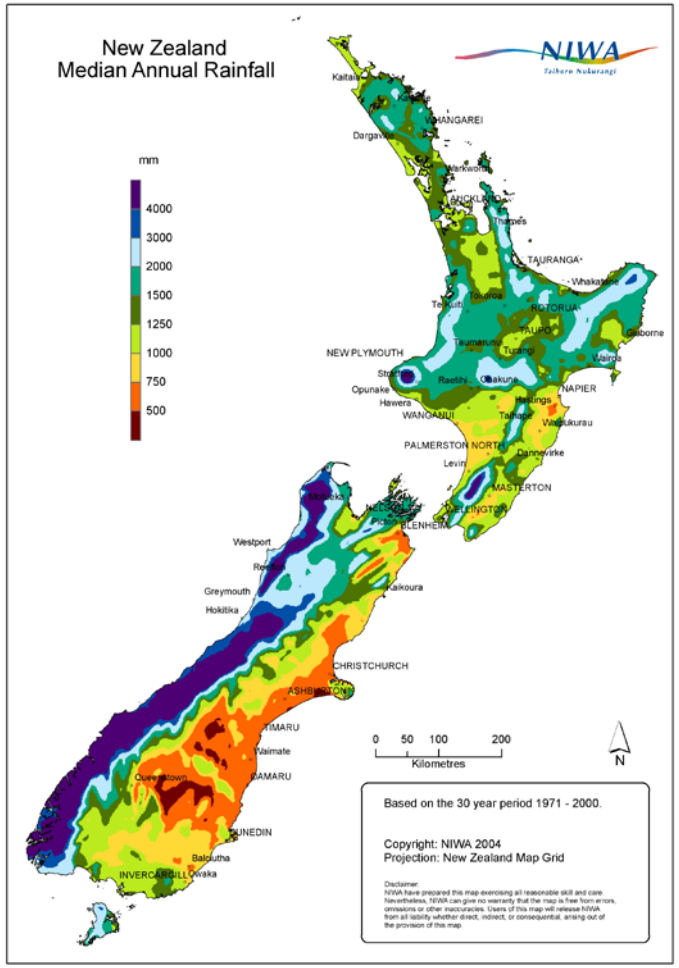
The Physical Setting

Global Warming

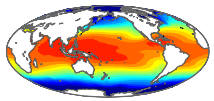




Mean Rainfall



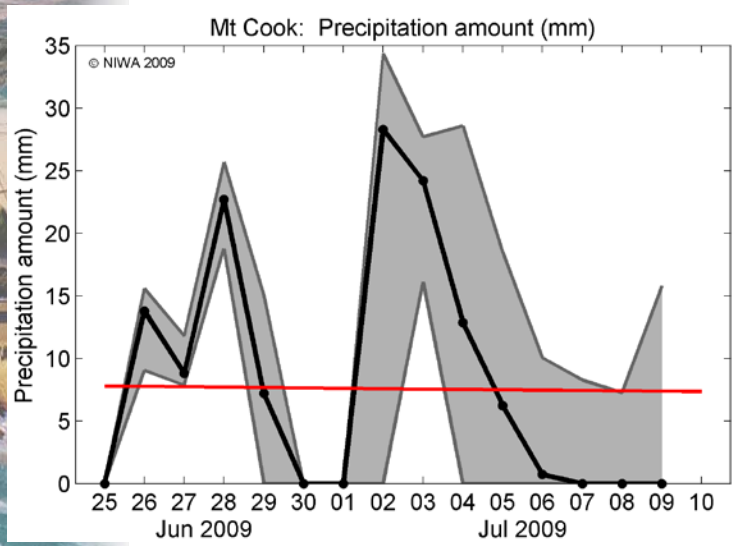
- Range between 400mm/year to 10,000mm/year
- Winter “dry” in the western S.I., wet over the N.I.



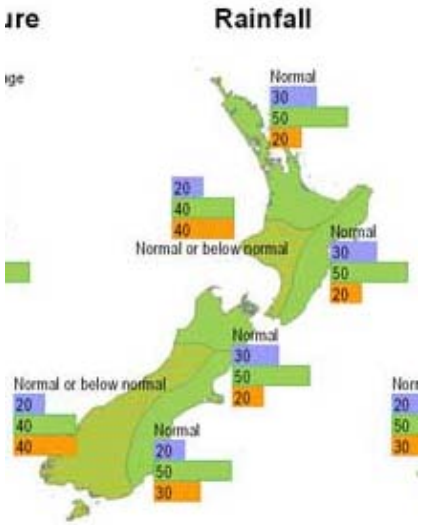
NIWA
Taihoro Nukurangi

Predictions

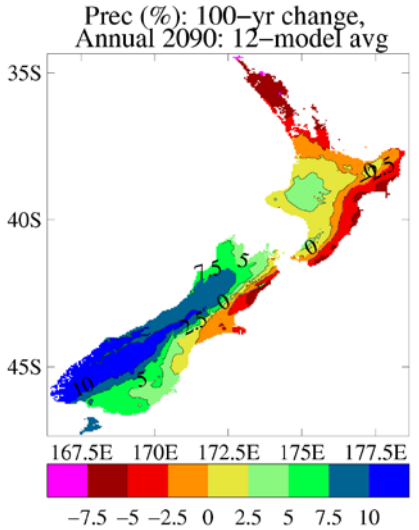
Sub-seasonal



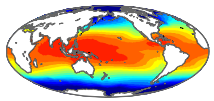
Seasonal



Climate change: 100 y



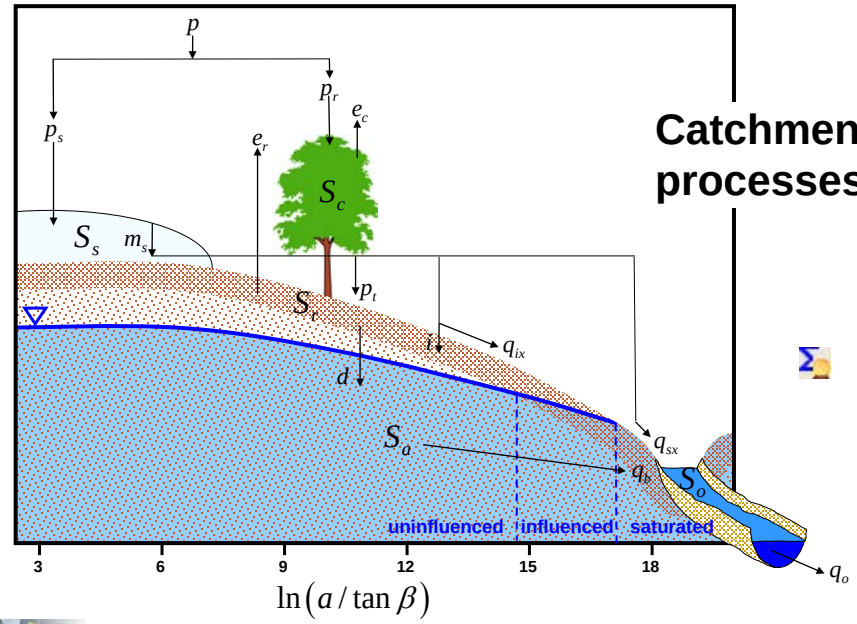
- Time scales from days to decades
- All cast in terms of local/regional precipitation (etc)
- Input to hydrological model, and for snow/glacier models



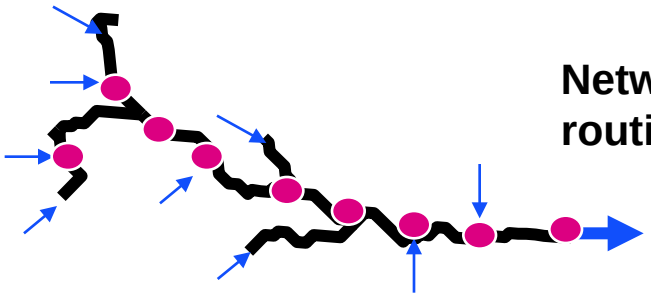
NIWA
Taihoro Nukurangi

Application to river basin flow modelling

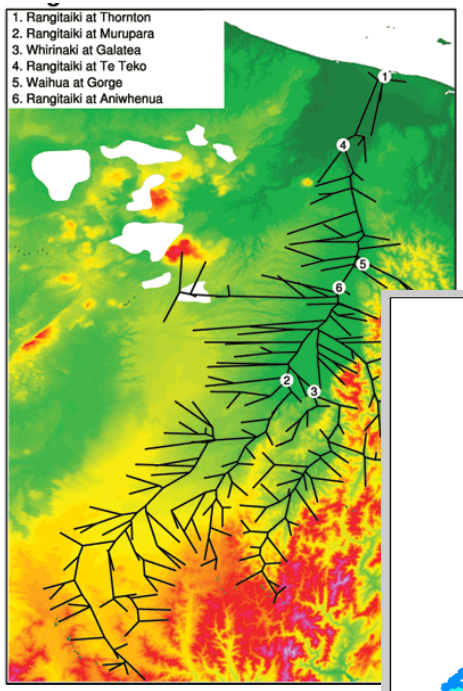
distributed hydrological model

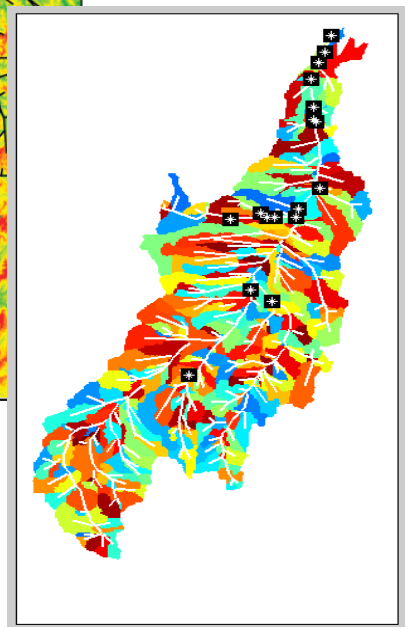


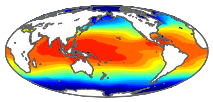
Catchment processes



Network routing

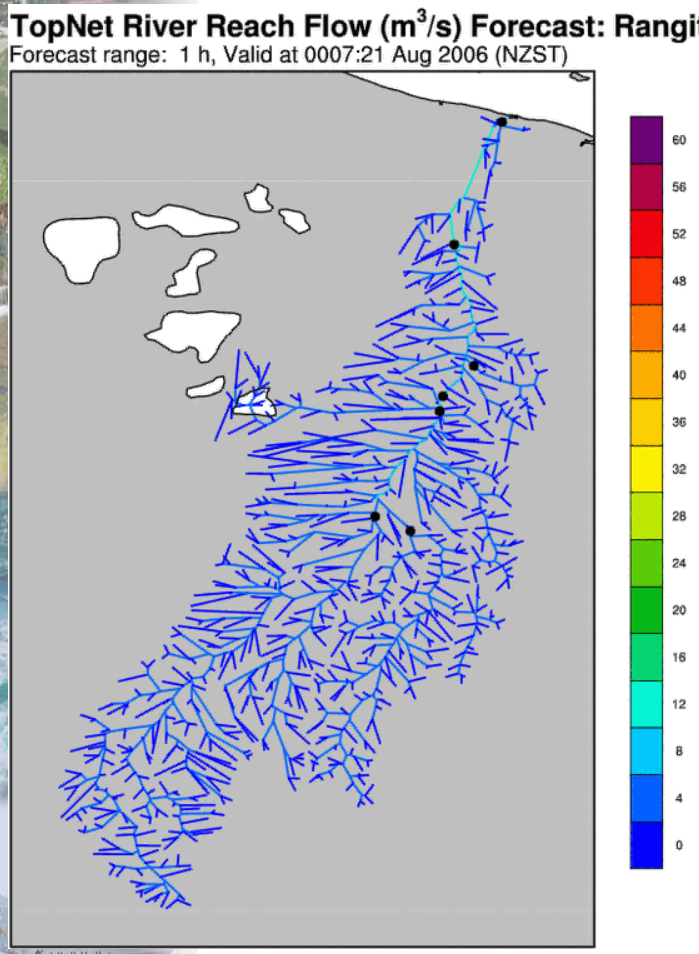


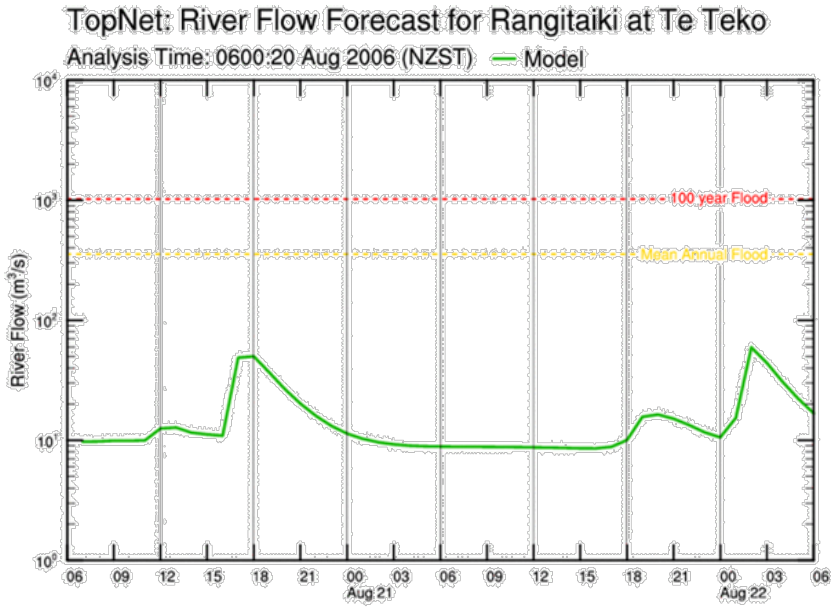


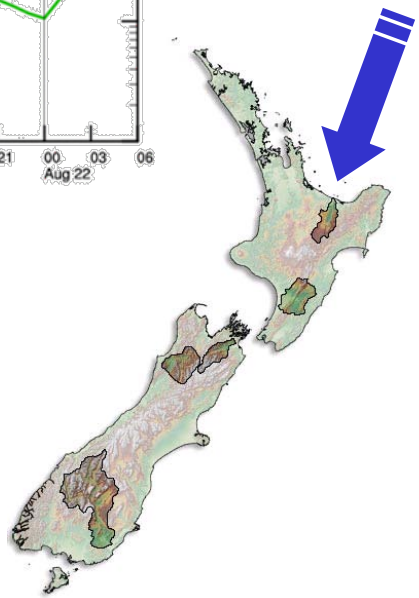


NIWA
Taihoro Nukurangi

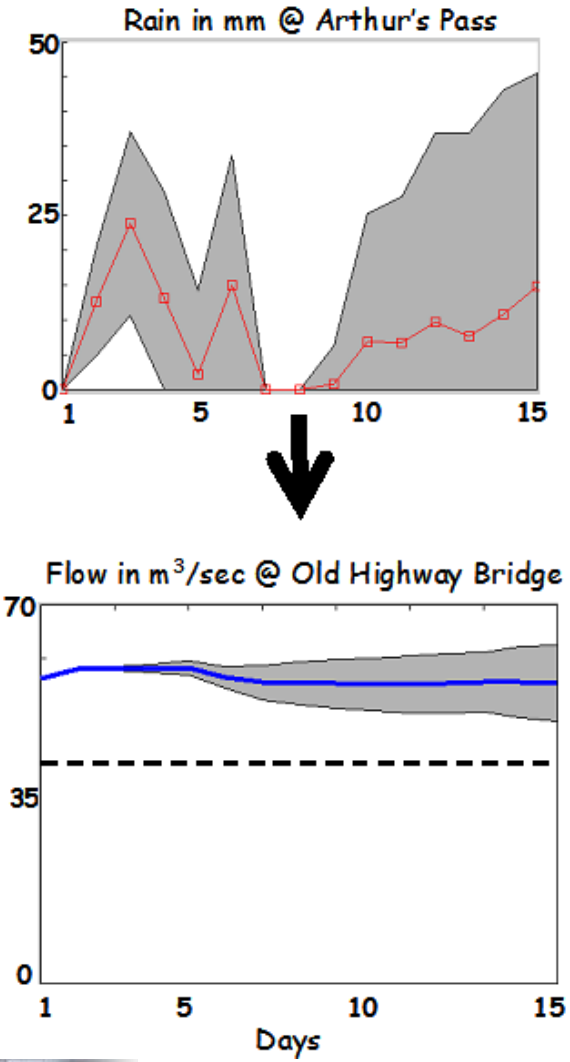
Daily flow forecasts:
Flood prediction, Electricity generation

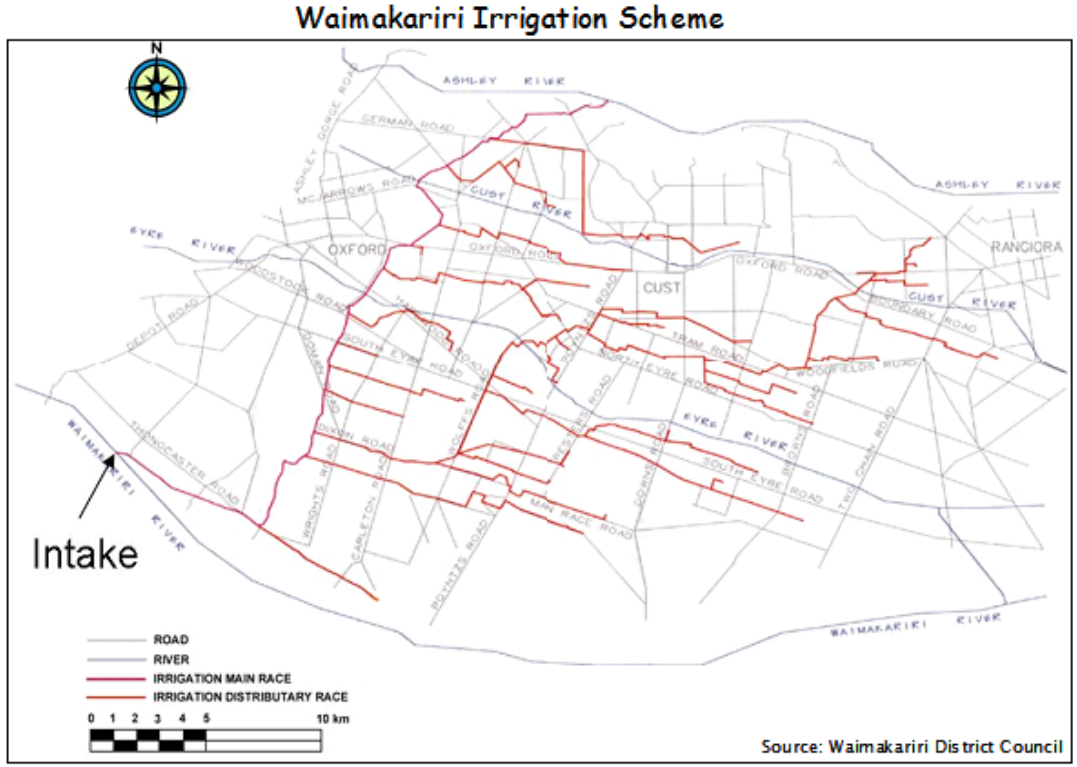




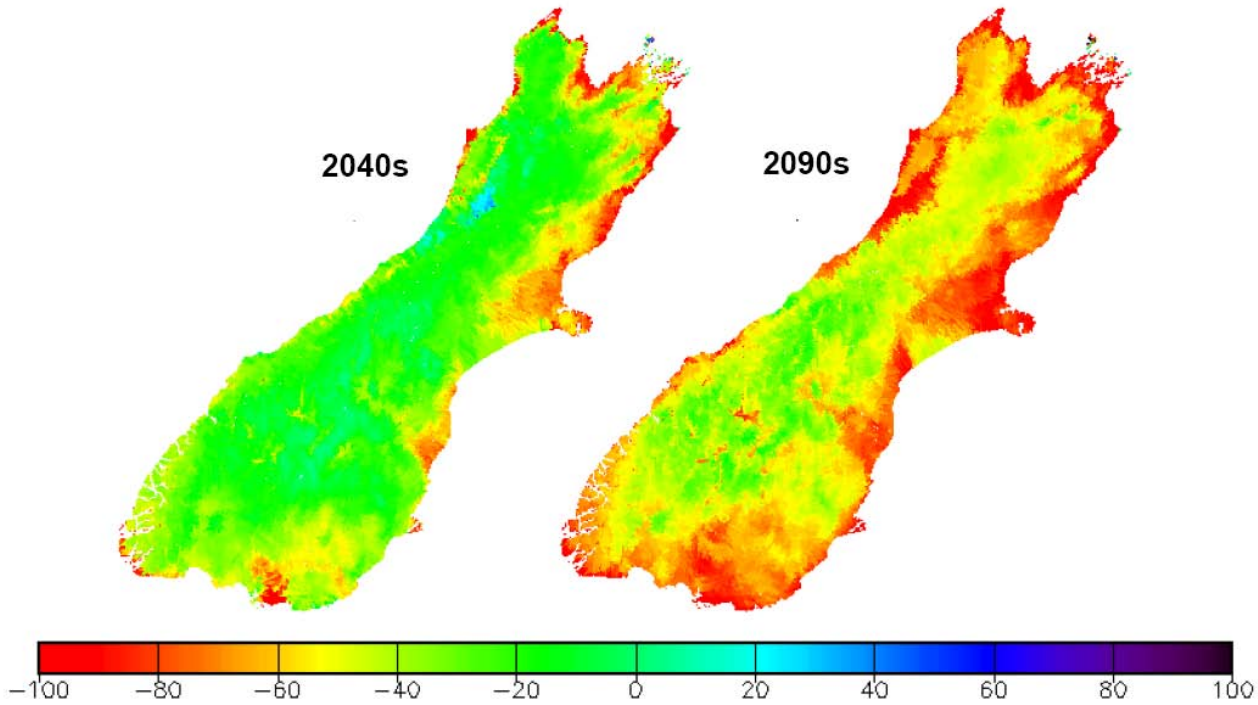


Two-week flow forecasts: irrigation planning





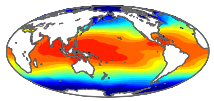
Climate Change: snow accumulation



- Percentage difference for 2040s and 2090s, for “mid-carbon” future

Climate and dairy farm modelling

- Farm scale modelling (Whole Farm Model)
  - Explore management options giving the best profitability with the lowest risk under different climatic conditions
- Decision support tools (on farmers' PC)
  - Help farmers to manage pastures better by predicting pasture growth rates and herbage mass
- Forecasted pasture growth rates (e-mails)
  - Predicted pasture growth rates e-mailed to regional demonstration farms



(courtesy Pierre Beukes, DairyNZ)

NIWA
Taihoro Nukurangi

National Institute of Water & Atmospheric Research

Regional scale
Seasonal outlook with probabilities for temp and rainfall

District scale
From actual weather stations
Historic, real-time, 15-day forecast climate data
Temp, rainfall, radiation, PET

Farm scale
Interpolated weather data
Historic, real-time climate data
Temp, rainfall, radiation, PET

Open access from website

Historic and real-time data - auto from website

Forecast data – auto daily ftp

Tailored data – auto daily ftp

DairyNZ server

Climate files updated

DairyNZ Farm scale model

Climate drives pasture and crop sub-models

Explore strategic and tactical management options

DSS tool on farmers' PC

Users update via internet

Info for improved pasture management

E-mails to key clients

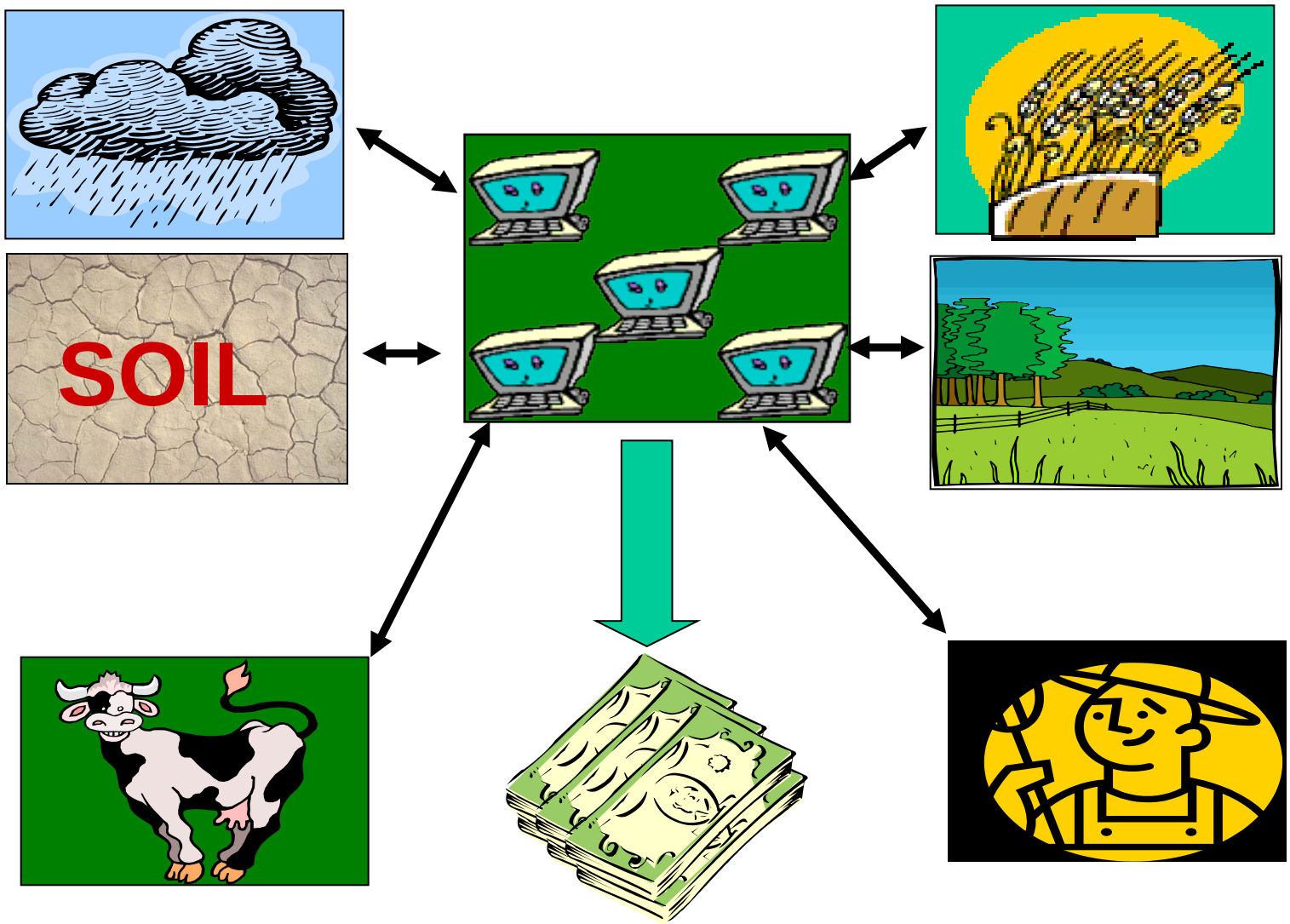
Growth rates e-mailed to clients

Automated pasture growth rate predictions

(courtesy Pierre Beukes, DairyNZ)

NIWA
Taihoro Nukurangi

Farm Scale Model



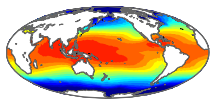
Cost-benefit ; Optimization; Risk analysis; Sensitivity

(courtesy Pierre Beukes, DairyNZ)

NIWA
Taihoro Nukurangi

Summary

- Aim to integrate predictions on many time scales
  - Regional, catchment-scale, and local sites
- Link climate forecasts to hydrological model
  - Snow, ice components
  - Applications to hydroelectricity, irrigation, infrastructure planning…
- Applications to agriculture
  - Integrate past, present, and future climate information
  - Link to pasture growth models
  - Risk management, on-farm decision-making
- Plan to provide New Zealand climate information on standard high-resolution grid
  - Historical data, forecasts, scenarios
  - A “seamless suite” of data



NIWA
Taihoro Nukurangi