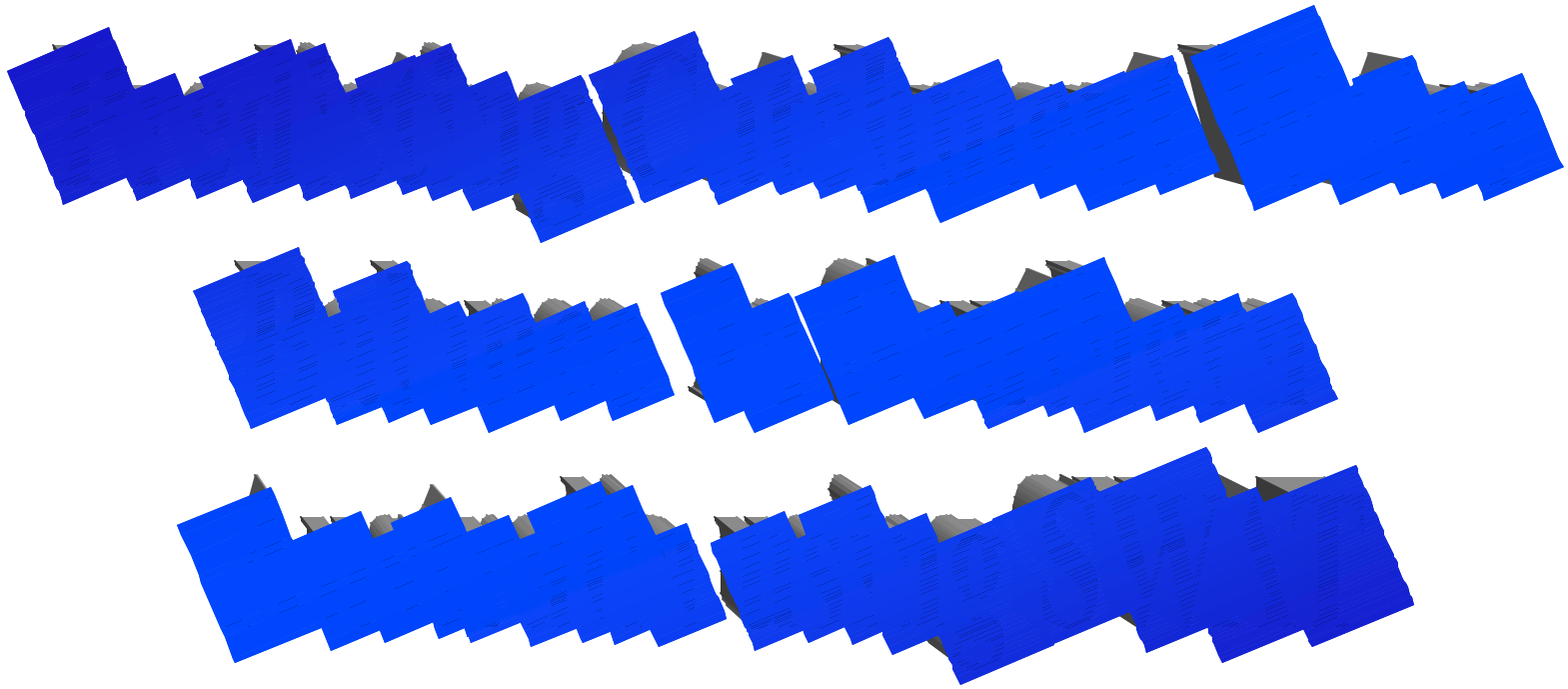
SCHOOL OF ENGINEERING AND TECHNOLOGY

DEAKIN UNIVERSITY 2003



Brett Watson

Dr. Mohammed Ghafouri

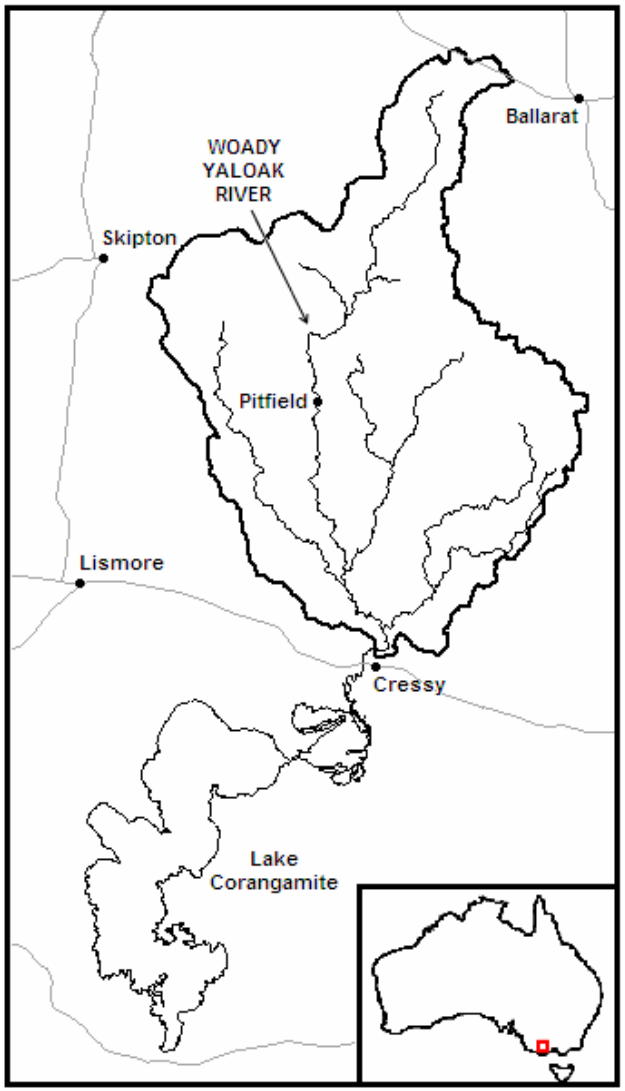
Dr. Selva Selvalingam

Introduction

- Land use change is a major concern for catchment management authorities in Australia
- Potential to cause detrimental impacts to water balance and water quality of agricultural and rural catchments
- To effectively manage land use change hydrologic models are required to test the outcomes of future scenarios
- SWAT has excellent qualities for modelling land use change impacts
- SWAT has not been utilized extensively in Australia to date
- SWAT has been adopted to predict land use change impacts of a catchment in southern Australia
- Preliminary exercise is to evaluate performance of SWAT for predicting water balance

Study Area

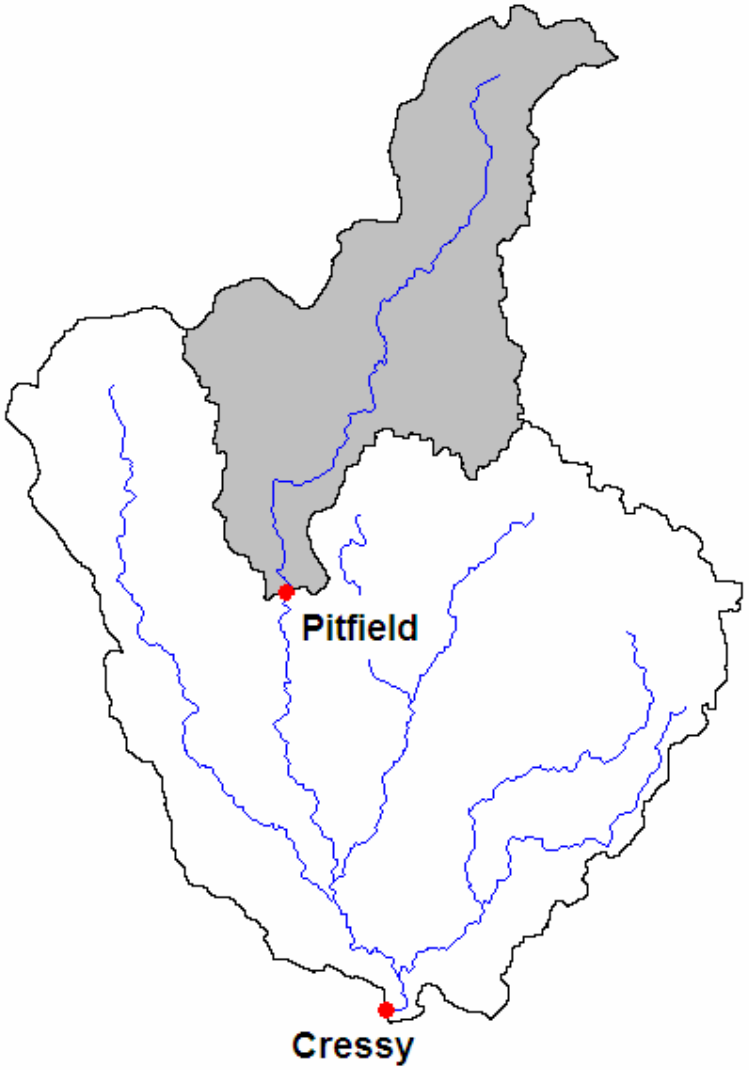
- Woady Yaloak River catchment
- Located in southwest Victoria, Australia
- Extensive land use change has occurred since 1800's
- Significant land use change is expected in coming decades
- Land use change will have impacts on environment and economy
- Lake Corangamite – Ramsar site
- Significant contributor to Australia's agricultural output



Study Area

SWAT Setup

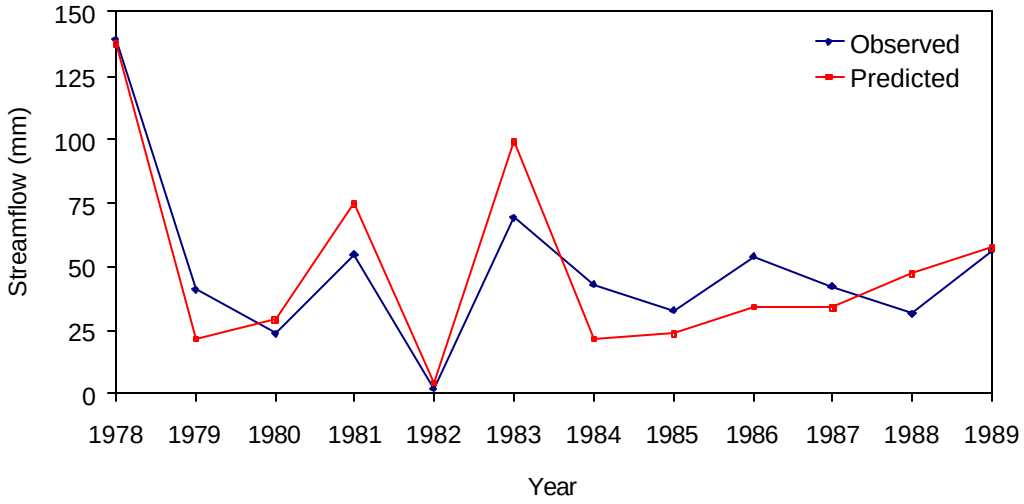
- Streamflow gauges
  - Pitfield – 306 km^2
  - Cressy – 1157 km^2
- Catchment configuration
  - 29 Subbasins
  - 92 HRUs (10% threshold)
- Major land use categories
  - Livestock grazing
  - Cropping
  - Eucalyptus forests
  - Plantations
- Soils are predominately duplex
- Operational testing periods
  - Calibration 1978 – 1989
  - Validation 1990 – 2001



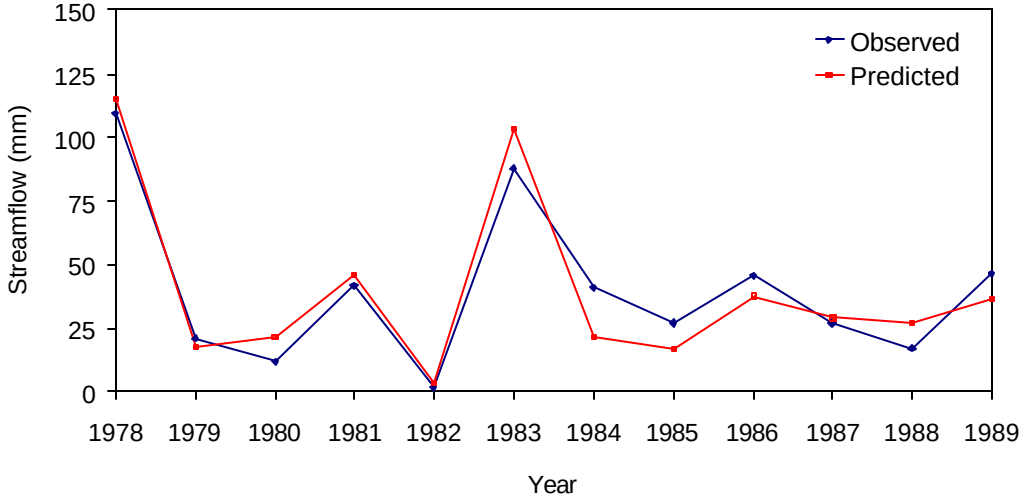
Woady Yaloak River catchment

Model Results and Assessment

Annual Streamflow – Calibration Period



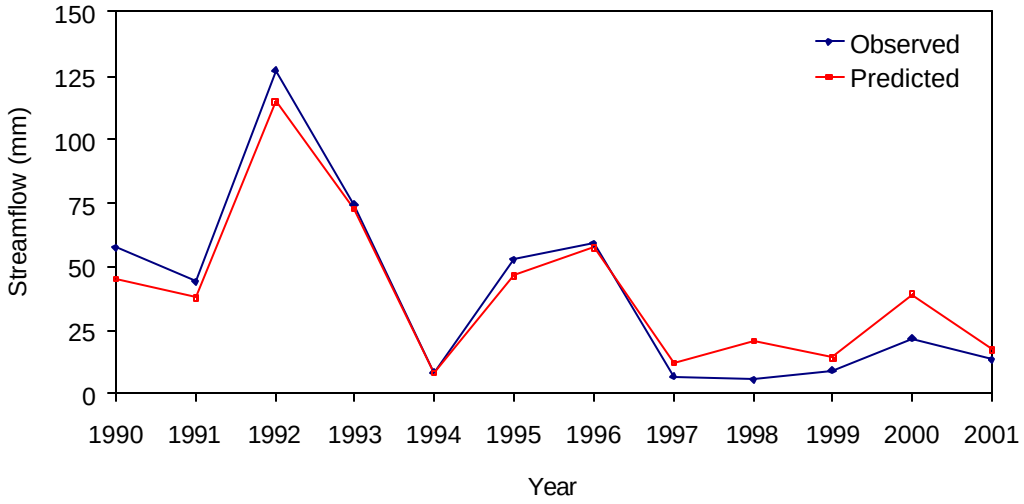
Pitfield



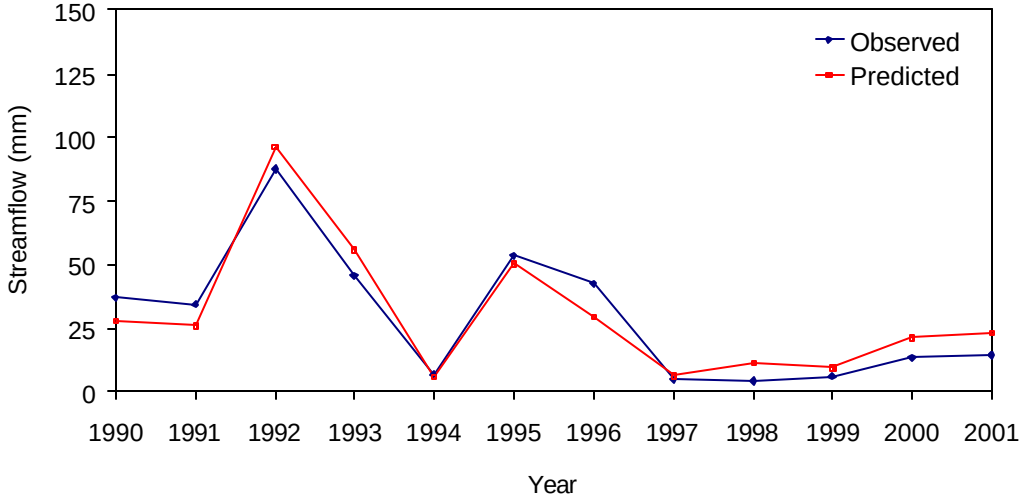
Cressy

Model Results and Assessment

Annual Streamflow – Validation Period



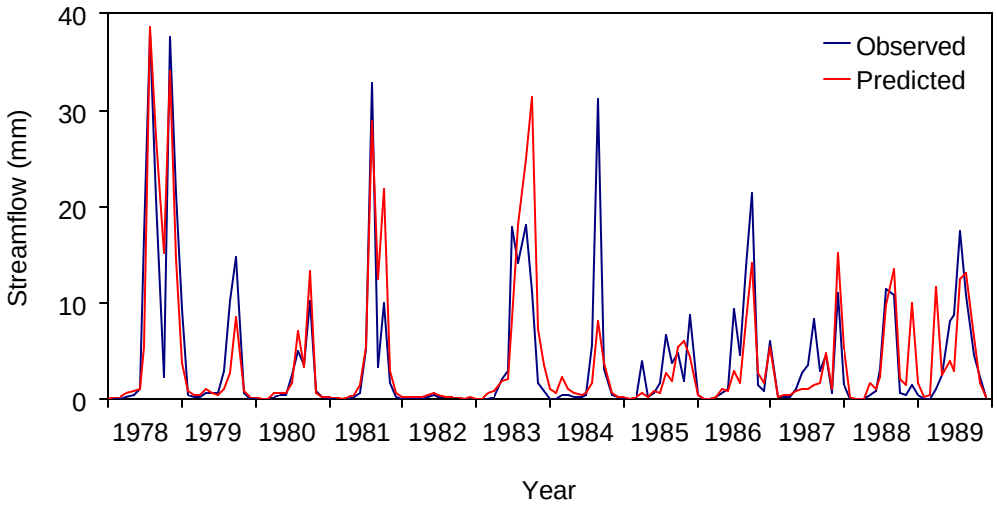
Pitfield



Cressy

Model Results and Assessment

Monthly Streamflow – Calibration Period



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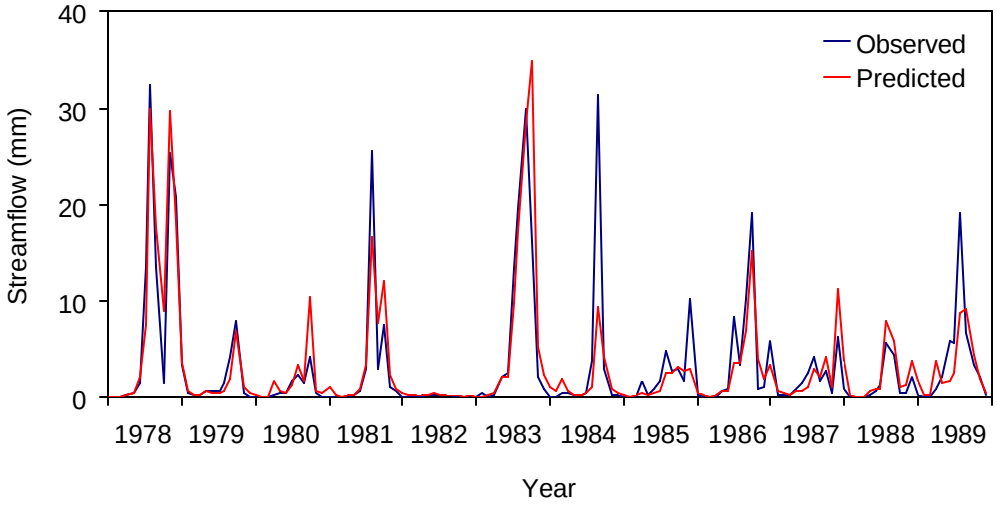
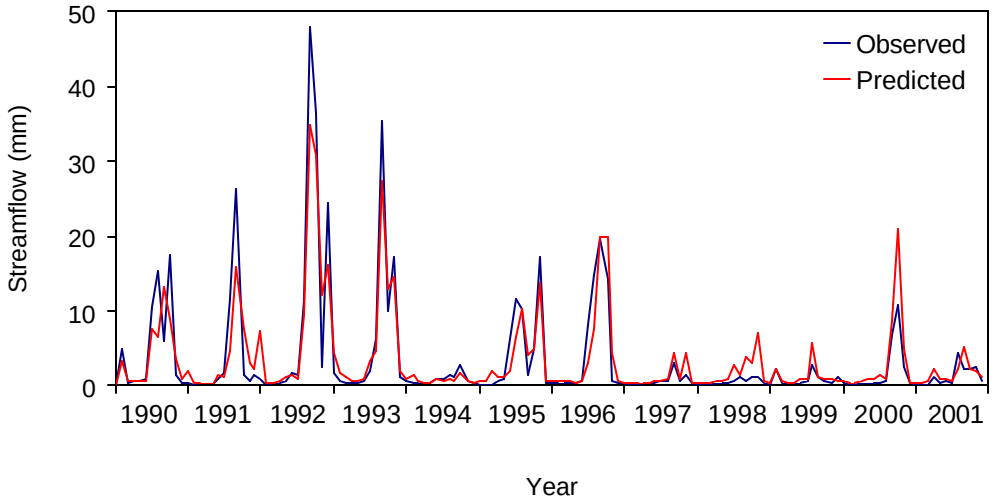


Cressy

Model Results and Assessment

Monthly Streamflow – Validation Period



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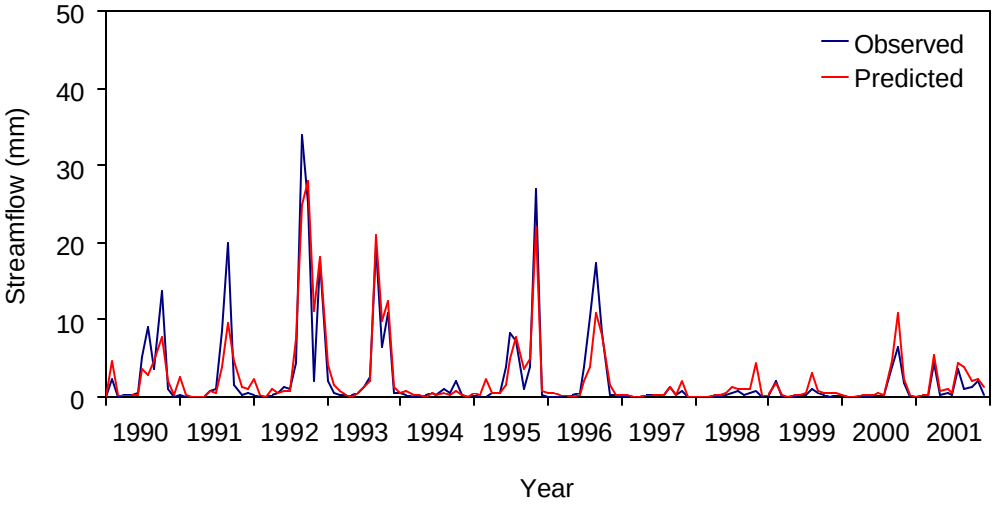
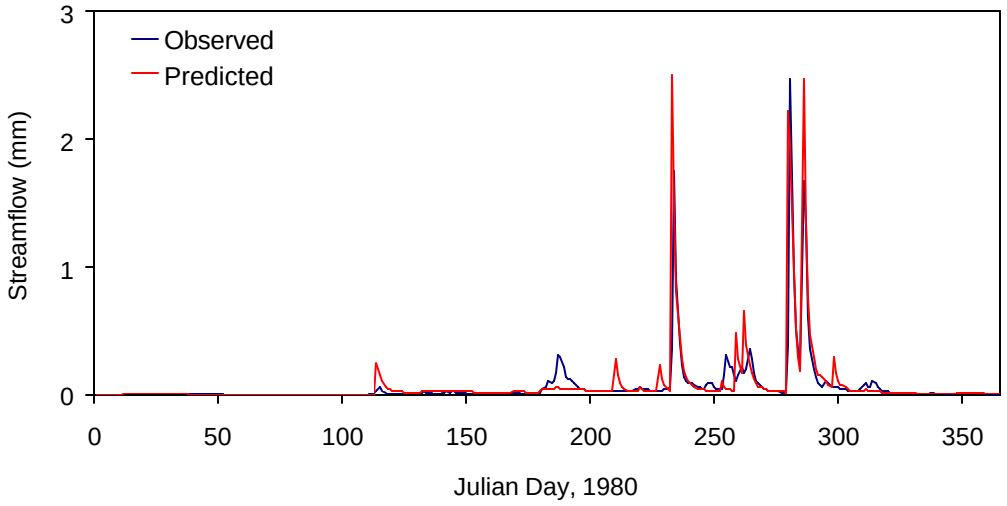


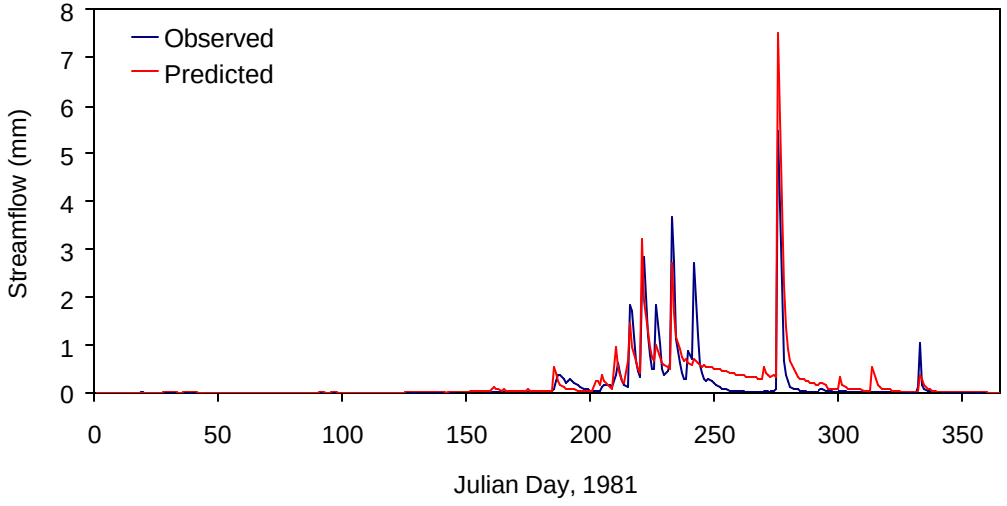
Cressy

Model Results and Assessment

Daily Streamflow at Pitfield – 1980 and 1981



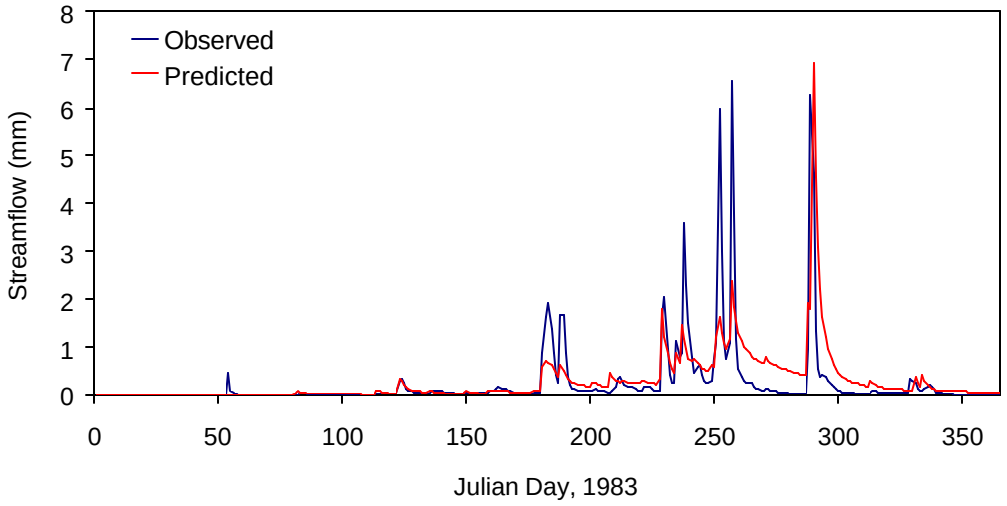
1980



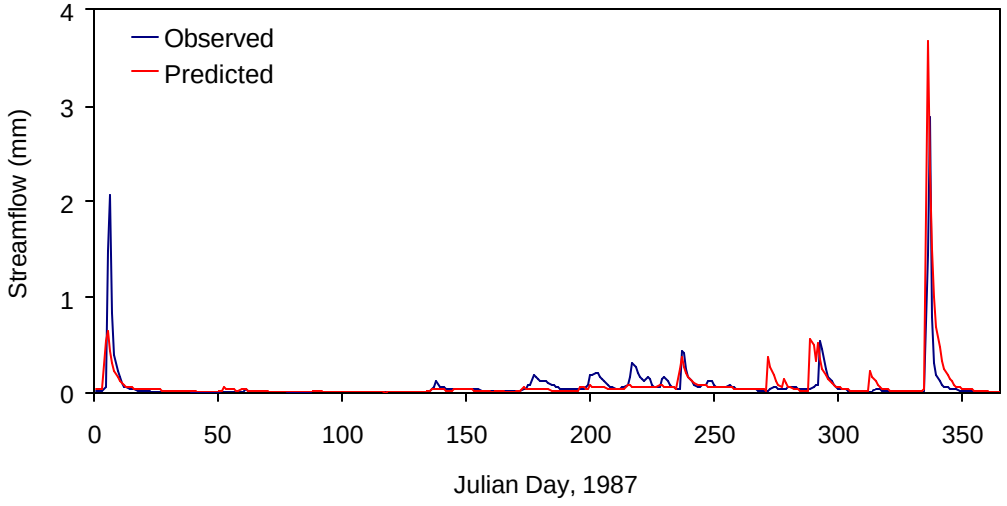
1981

Model Results and Assessment

Daily Streamflow at Cressy – 1983 and 1987



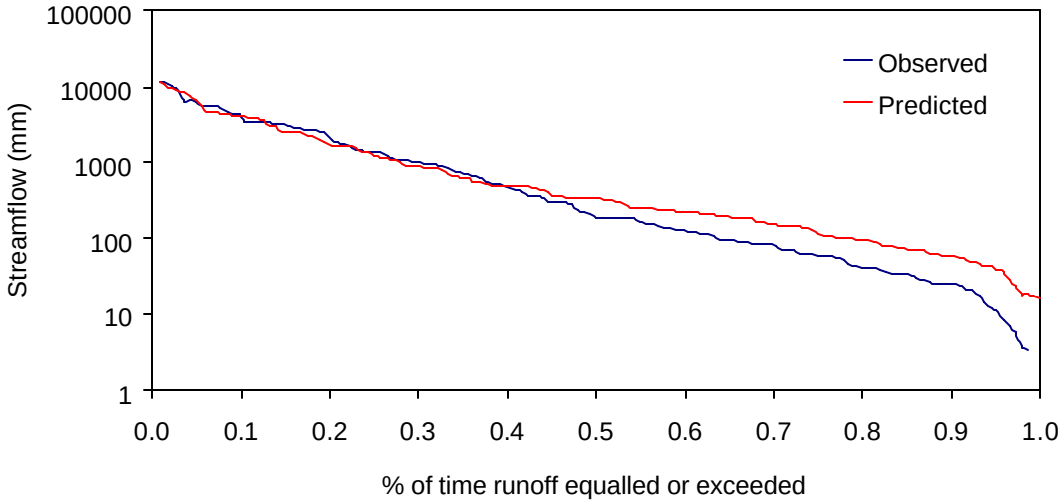
1983



1987

Model Results and Assessment

Monthly Flow Duration Curves – Calibration Period



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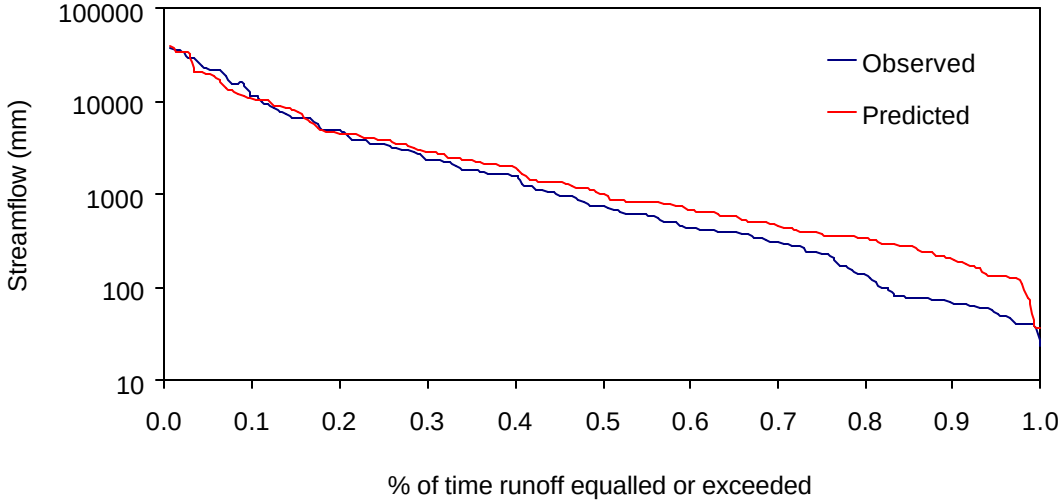
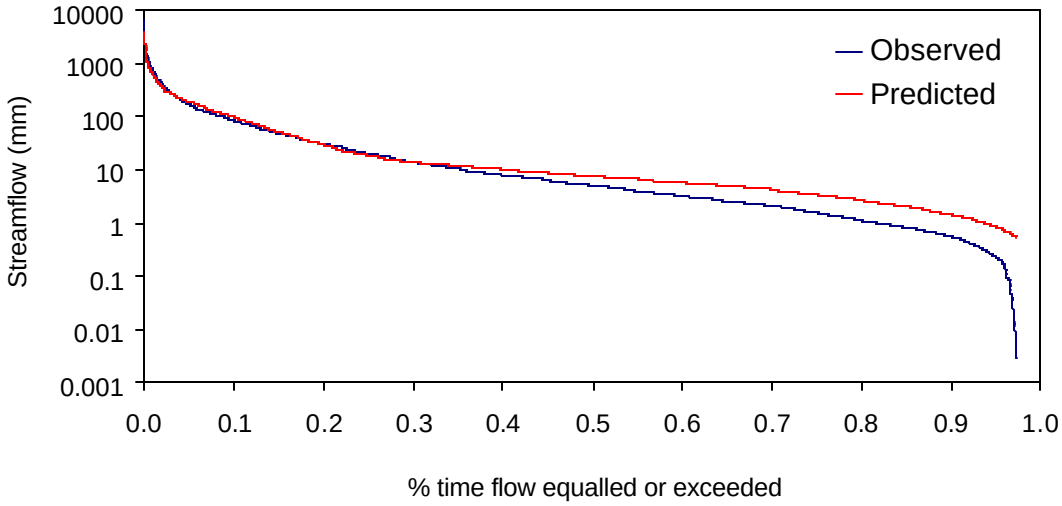


Cressy

Model Results and Assessment

Daily Flow Duration Curves – Calibration Period



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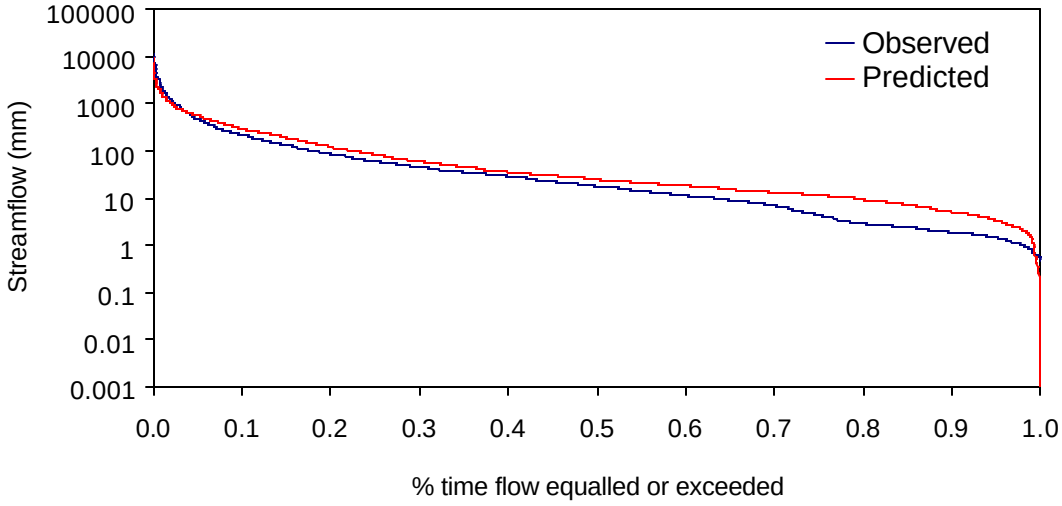


Cressy

Model Results and Assessment

Surface Runoff, Base Flow and Streamflow

Total Volume (mm)	Pitfield		Cressy	
	Observed	Predicted	Observed	Predicted
Surface Runoff				
Calibration	332	330	269	256
Validation	269	256	192	204
Base Flow				
Calibration	256	255	206	220
Validation	209	232	156	159
Streamflow				
Calibration	588	584	475	474
Validation	478	486	348	361

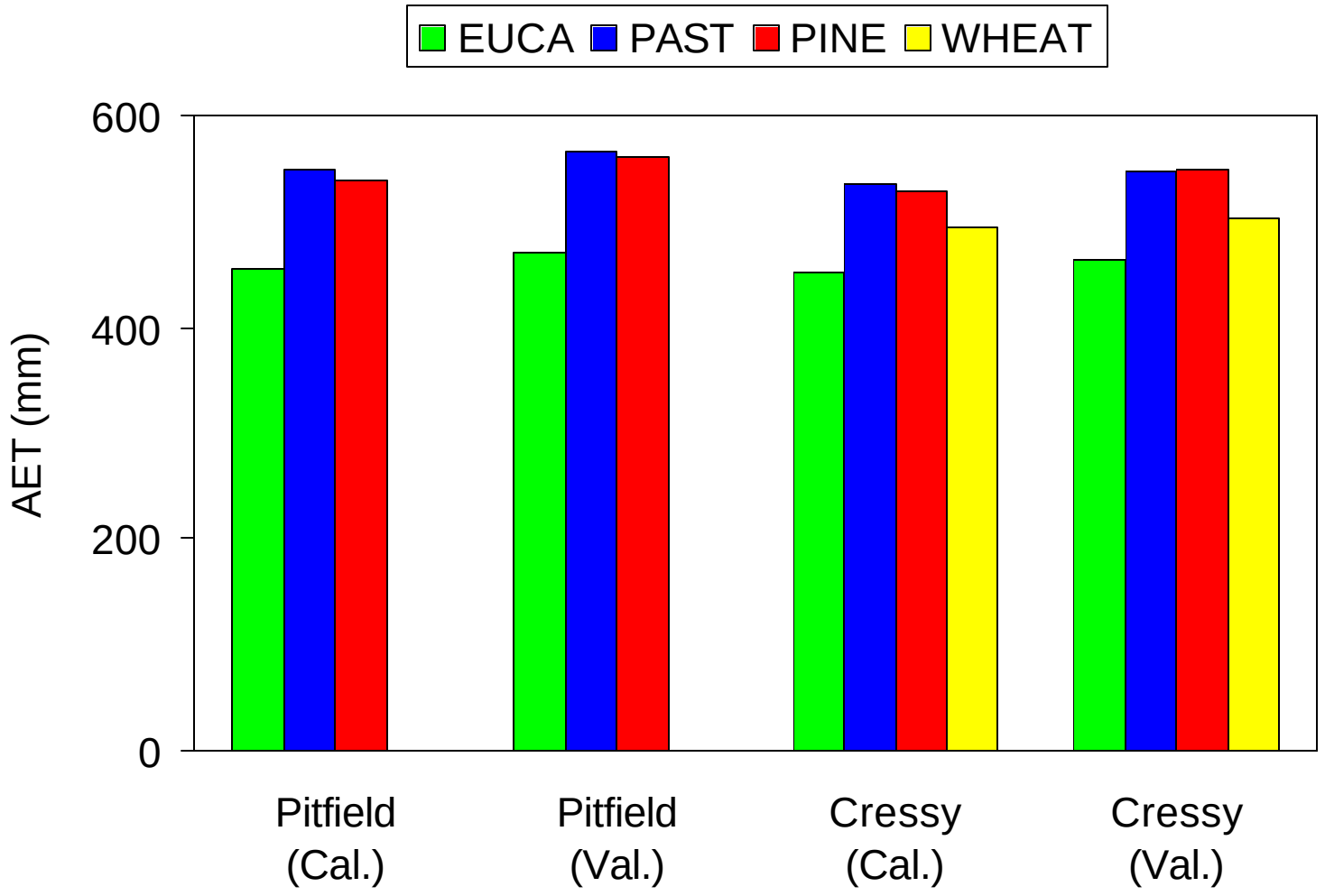
Model Results and Assessment

Statistical Parameters

Statistic	Pitfield		Cressy	
	Calibration	Validation	Calibration	Validation
Annual Streamflow				
r^2	0.82	0.95	0.95	0.91
R^2	0.76	0.93	0.89	0.90
Monthly Streamflow				
r^2	0.68	0.84	0.75	0.85
R^2	0.67	0.83	0.74	0.85
Daily Streamflow				
r^2	0.55	0.54	0.52	0.51
R^2	0.54	0.54	0.52	0.51

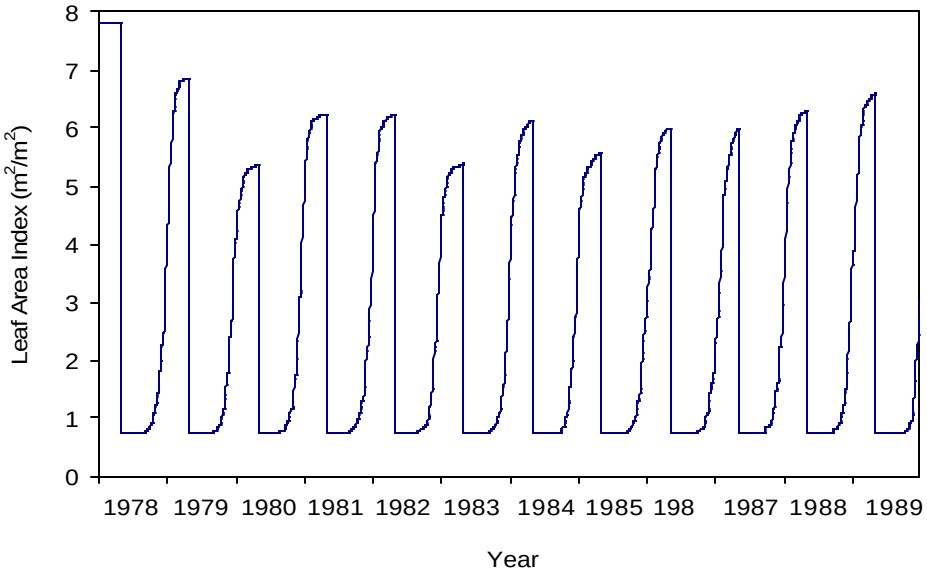
Model Results and Assessment

Average Annual AET for Various Land Use Classes

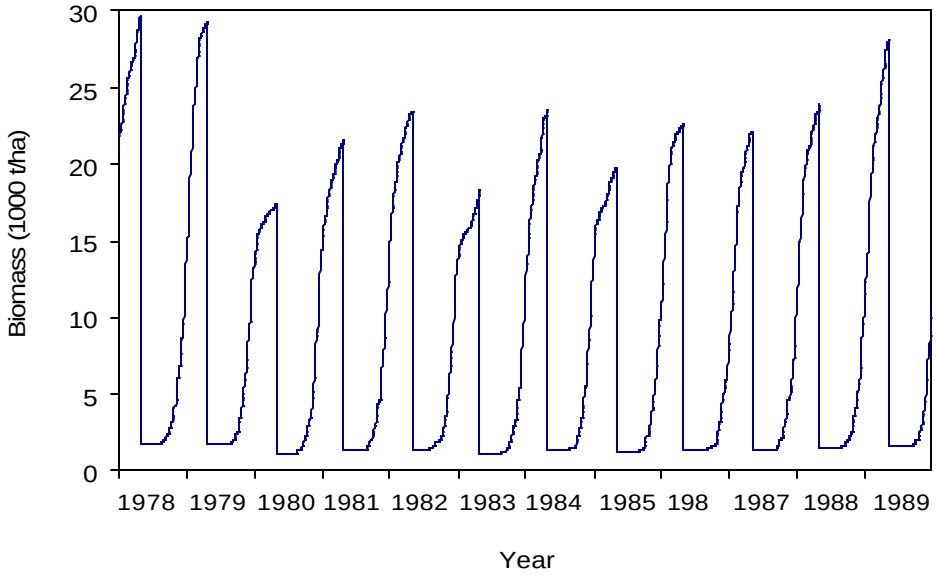


Model Results and Assessment

LAI and Biomass of Eucalyptus Trees in HRU #4



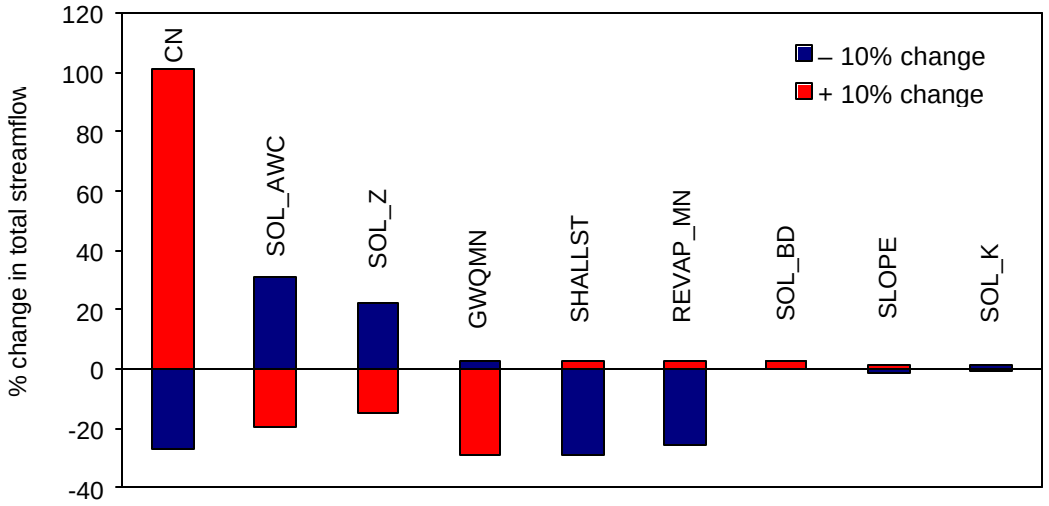
LAI



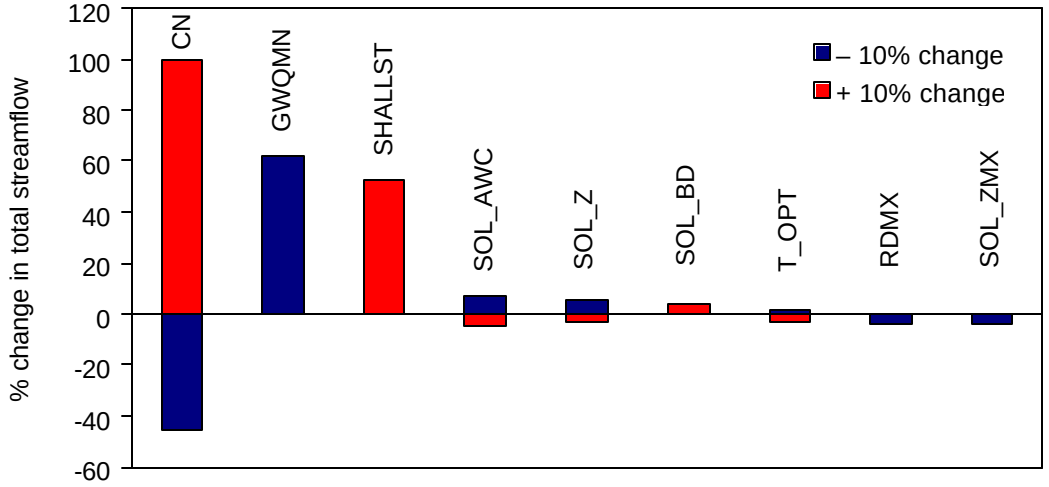
Biomass

Model Results and Assessment

Sensitivity Analysis



Pasture



Eucalyptus

Conclusion

- Performance of SWAT on annual time step was excellent
- Improvement of daily streamflow predictions desirable
- Base flow was not reproduced very well on daily time step
- Inadequate simulation of eucalyptus trees may affect evapotranspiration
- Other factors to affect model performance
  - Low density of rainfall stations
  - Insufficient or lacking data sets
- Performance of SWAT was very promising
- SWAT has the potential to be used extensively in Australia
- Several modifications will be made to improve model performance

Acknowledgments

- Dr Jeff Arnold, Nancy Sammons, and Mauro Di Luzo (USDA)
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