



# Driving Earth Systems Collaboration across the Pacific

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# What's our business?

- **Earth System Science**

- Study of earth system components

- Meteorology, oceanography, terrestrial, glacial and sea ice, high altitude physics, geophysical, biogeochemical, hydrology, solid earth

- Interdisciplinary studies of earth systems

- Weather, carbon cycle, climate change, greenhouse gases, ozone depletion, severe weather, El Nino / La Nina, land resource use, volcano hazards, etc.
    - Incorporation of the full range of natural and anthropogenic forcings

# Australian Earth System Science

- **Australian Universities**
- **The Australian Greenhouse Office**
- **Geoscience Australia**
- **(CAWCR) Centre for Australian Weather and Climate Research**
  - Merging of Bureau of Meteorology Research Centre (BMRC) and CSIRO Marine and Atmosphere Research (CMAR)
- **(ACCESS) Australian Community Climate Earth-System Simulator**
  - Joint initiative by BMRC, CMAR, Universities
  - Climate change and carbon cycle research
  - Fully coupled earth system components

# Centre Capability

## “Weather, Ocean and Environment”

### Weather and Environment

- Downscaling, Verif
- Forecast System
- Aviation Weather
- Nowcasting Weather
- Bushfire Weather
- Trop. Predictability
- Operational Sys.
- Wind Resources

### Ocean Prediction

- Ocean Prediction
- Satellite ocean analyses and observations
- Marine Met Prediction

## “Earth System Modelling and Climate Science”

### Seasonal and inter-annual prediction

- Dynamical prediction and applications
- Climate variability and predictability

### Climate change

- Detection and Attribution
- Sea-level and coasts
- Impacts and Adaptation
- Projections

### ALOA

Atmos. & Land Observation & Assessment

- Surface and atmospheric satellite
- Monit. Clouds, (radiation) and precip
- Greenhouse Gases: Evolution, Impact
- Atmosphere/Land Exchanges
- Carbon Cycle and Water Availability
- Reactive Gases & Particles

### ACCESS

Modeling, Assimilation

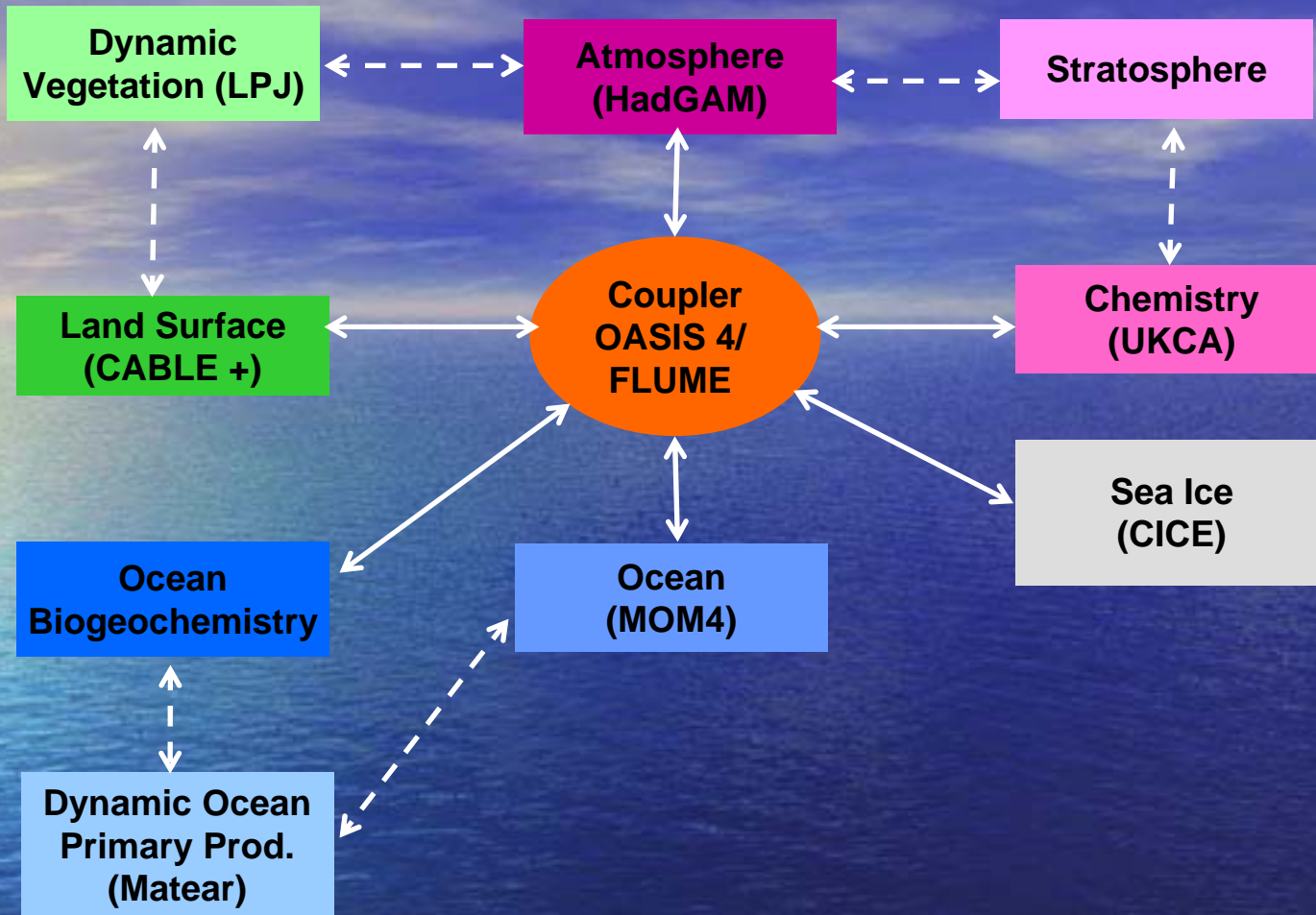
- Atmospheric Modelling
- Data Assimilation
- Ocean & Coupled Modelling
- Model Evaluation
- Land-surface and Carbon Cycle
- Model systems (aka infrastructure)

### Ocean Observation and Assessment

- Ocean biogeochemistry
- Ocean monitoring
- Ocean analysis

# Australian-US Collaborations in Earth Systems

- (IPCC) Intergovernmental Panel on Climate Change
  - model intercomparisons of IPCC runs and analysis
- WMO - GTS real-time data stream - SIMDAT
- Tsunami research and warning system
  - Tsunami scenario database and inundation modelling
- GODAE
  - US GODAE data centres - real-time data streams
  - Model intercomparisons of ocean forecast systems
  - GHRSSST JPL GDAC - real-time data streams



# APAN Earth System WG

Charter 2003.11.14

- **Objective**

- Establishment of Grid-enabled Meteorological R&D infrastructure

- **General Goal**

- To provide an integrated, high-end system of computing, data facilities, connectivity, software, services, and instruments that enables all scientists and engineers to work in new ways on advanced research problems that would not otherwise be solved (cited from ESG II,USA)

<http://www.apan.net/wg/earth-system.html>

<http://www.apan.net/wg/monitoring.htm>

# Earth Systems Collaboration

- **Communications**
  - Video conferencing
- **Data Access**
  - Data portals
- **Security**
  - Authentication
- **Computing**
  - Grid services
  - Peta-scale modelling
- **Data Discovery**
  - Digital Libraries
- **Web Services**
  - Project management

# Security

- **Security is a roadblock that can't be removed**
  - Can't live with it, can't live without it.
  - Who can you trust?
- **Public Good - Gov't research data**
  - Security is to protect system availability and responsiveness
  - cost recovery (BoM structure)
    - Access setup and maintenance
    - Network transport (~\$15/GB AARNET)
- **Authentication required**
  - Federated Authentication is desired
  - Free from maintaining user accounts

# Data Access

- **NCAR IPCC data set ~35 TB**
  - In 2005, Bureau network charge at \$70/GB results in \$2,450,000 transport cost
  - Instead we flew people to NCAR with terabyte portable disk drives.
  - In 2007, proposed AARNET network costs at \$15/GB results in \$525,000 transport cost
- **Economics of data access**
  - Quick looks provided by user queries into dataset before transfers.
  - Reduce costs by subsetting, server-side processing, compression, and user knowledge of service.

# Digital Library and Data Mgmt

- TPAC digital library and Metcat
- Data registration service (within the institution)
  - Research digital library service to register user data sets, assign rights and ownership, and publish service
  - Data service setup, catalog, meta data discovery
  - Privacy and authorization control
  - Virtual and aggregated data set views
  - Interactive and API for registration and discovery
- Data discovery and search services
  - Access to institution's digital library
  - Meta data discovery and search tools
  - Access to data services (OPeNDAP, WxS,..)

# Computing

- **Grid services**
  - Lack of Australian Earth System portals
  - TPAC portal development ongoing
  - Focus on data portals
- **Petascale computing**
  - Peta-scale modelling starts at tera-scale facilities
  - Proven models that can scale to peta-scale
  - Science projects of recognized significance
- **Australian capability in peta-scale computing**
  - Earth system modelling available at tera-scale facility
  - Look for access to peta-scale facility which does not exist in Australia

# Web Services

- **Project Management and Services**
  - Development notes (trac wiki)
  - Repository for Source Code (svn)
  - Bug and feature tracking
- **Benchmarks**
  - System Environment
  - User Environment
- **Experiments and Results**
  - Log of project and location of data
- **Science**
  - Discovery, application, and discussion
  - Publishing and visualization

# Video Conferencing

- **Perceptions**
  - Quiet people not seen on telecoms
  - People seen at meeting are members of project
- **Access Grid video conferencing**
  - Not implemented in the Bureau
  - Can't be integrated in Bureau/CSIRO video conferencing systems
- **Feedback**
  - Request support for video conferencing standards like H.323 in research collaborative environments
- **Content**
  - Video streaming and playback of seminars

# eResearch opportunities

- **Authentication of users**
  - Australian users at ESG/Teragrid services
  - U.S. research users at Australian services
- **Data access**
  - to ESG/Teragrid data portals and services
  - to Australian data portals and services
- **Computing**
  - Earth system peta-scale modelling
- **Library of Knowledge**
  - Seminars and lectures
  - Data discovery and search
  - Project's development and portfolio