

# Outcomes of International EOS DB Meeting, Nov. 17-20, 2003

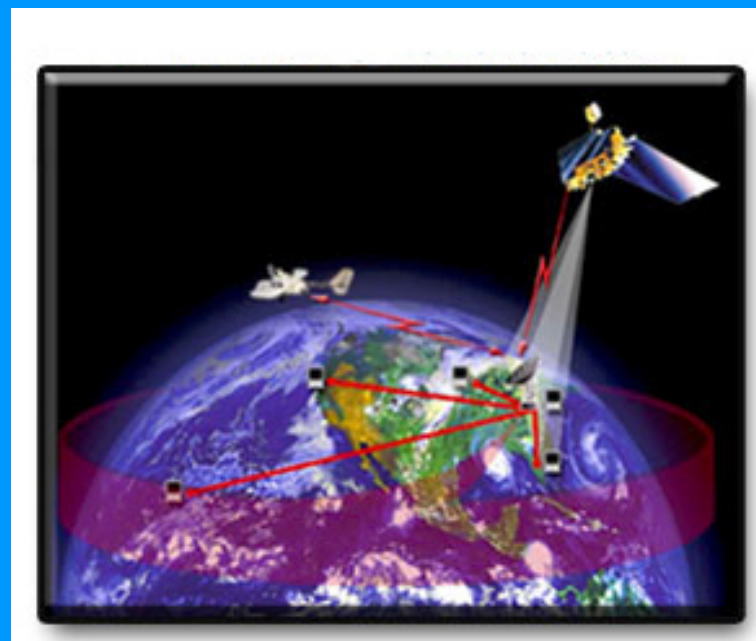
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Asia-Pacific Environmental Innovation Strategy Project  
Sydney, Australia, November 2003

# What is EOS DB?

- EOS = NASA's Earth Observing System (platforms: Terra & Aqua)
- DB = Direct Broadcast (of data to users in-situ)
- Allows immediate local application of data **provided** you can process it.



# Conference Theme:

- “EOS Direct Broadcast Software and Systems for the Generation of Products from the Satellite Data”.
- Approx. 70 participants, mostly from the US but also the Asia-Pacific and Northern Europe.

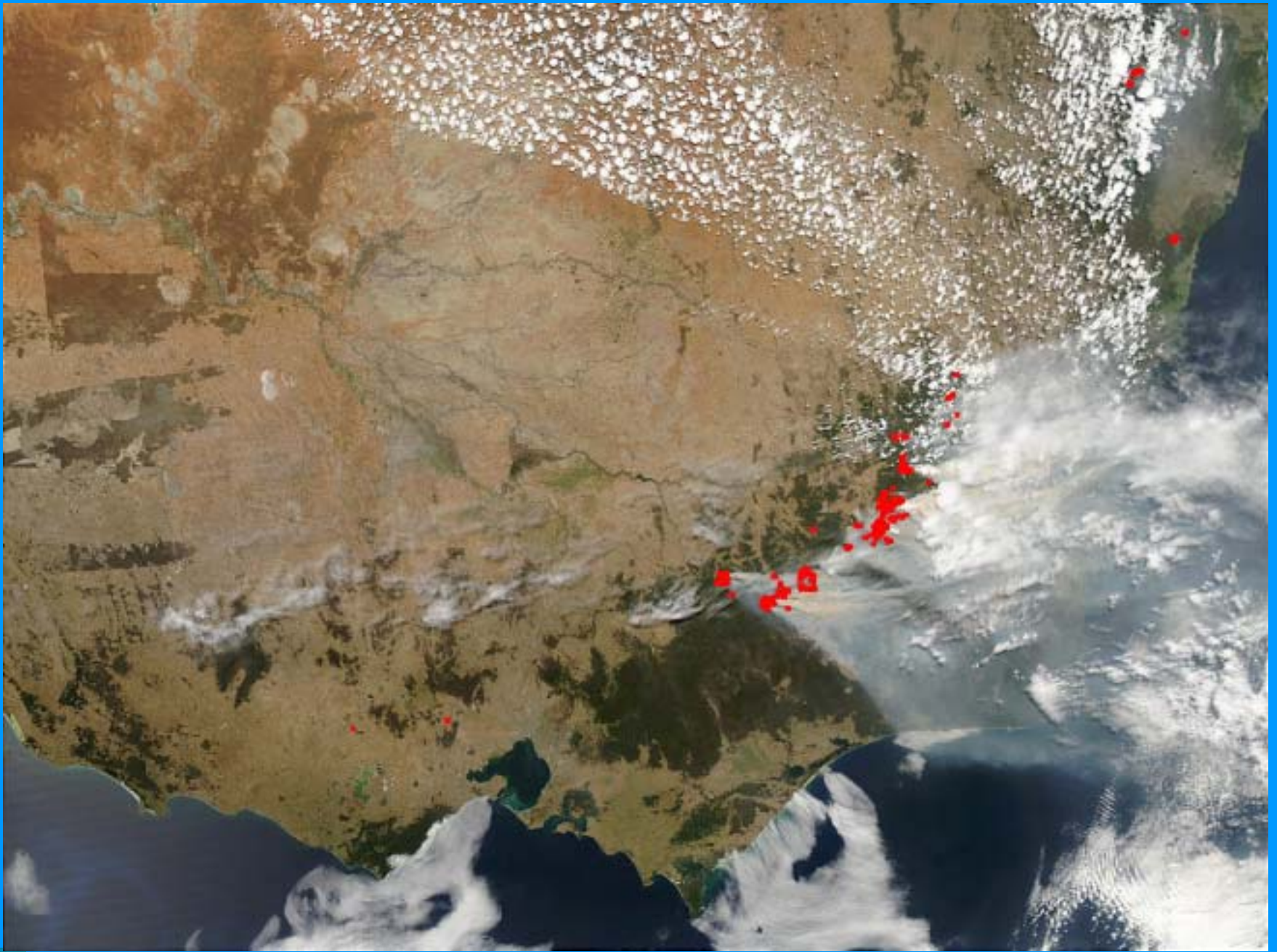


# Main Instrument: MODIS

## MODerate resolution Imaging Spectrometer

- 36 bands (2 @ 250m, 5 @ 500m, 29 @ 1km)
- Land and vegetation properties
- Aerosols, water vapour
- Cloud properties (phase, altitude)
- Ocean colour, sea surface temperature
- <http://modis.gsfc.nasa.gov>





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# Application areas

- Flood monitoring
- Dust storm monitoring
- Fire mapping
- Volcanic eruption plumes
- Weather forecasting
- Ocean dynamics and condition
- Vegetation condition
- Snow condition, sea ice cover



# AQUA: AIRS, AMSU, AMSR-E

- Atmospheric InfraRed Sounder: 2300+ channel profiler (14km x 1km spatial resolution) – huge data volume (JPL)
- Advanced Microwave Sounding Unit: temperature profiles (40 km res.)
- Advanced Microwave Radiometer for EOS: passive instrument, 6 channels, ppt rate, water vapour, sea surface winds, sst... - relatively small data volume (NASDA)
- <http://aqua.nasa.gov>





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# MODIS - What you need:

- A reason (application)
- A receiving station
- Processing software
- Processing hardware



# Receiving station systems:

- Costs are coming down ~US150-250K
- At least 6 manufacturers represented:
  - Seaspace (USA, 27 systems)
  - Scanex (Russia, 17 systems)
  - Integral systems (USA)
  - Environmental Systems & Services (Australia)
  - Kongsberg Spacetec (Norway)
  - Global Imaging (USA)
- Varying degrees of add-on application software support



# Software: 1. The Plan

- As originally conceived, all EOS data down-linked to a “product factory” at GSFC and distributed from there via DAACs (Distributed Active Archive Centres).
- Science teams developed code (49 PGEs) that assumed that processing environment.
- Very significant infrastructure and resources capable of processing many global products.
- A number of specific products designed to be good, globally, on average (MOD01, MODmm, MYDmm)



# Software: 2. The Reality

- Inadequate timeliness (7 hours average to get data into DAACs)
- Inadequate distribution infrastructure (outside US)
- Products that are good on average globally may be quite poor locally



# Software: 3. The Way Out

- Do it yourself using Direct Broadcast data acquired locally and either:
  - Duplicating the environment of the NASA product factory (eg USF Ocean Products, NOAA)
  - Developing an alternative processing package (IMAPP)



<http://directreadout.gsfc.nasa.gov>



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# IMAPP 1: Base Processing

- Convert from raw data (Level-0) to geolocated calibrated reflectances and radiances (Level-1)
- International MODIS AIRS processing package (IMAPP) at Univ. Wisconsin
- Liam Gumley et.al. development funded until 2006.
- Highly successful standalone system to L1.
- New option: GSFC has released standalone code to do L0->L1B and supports the new more calibration frequent parameter updates.



## IMAPP 2: AIRS/AMSU/AMSR-E

- U. Wisc. Have just released executables as part of IMAPP for processing AIRS and AMSU to L1B
- Source code to follow.
- AMSR-E code currently in integration.
- Goal is complete suite of L0->L1B



# IMAPP 3: L2 Products

## *New MODIS Level 2 Products in 2004:*

- Aerosol Optical Depth (MOD04)
- Land Surface Reflectance (MOD09) *WASTAC*
- Sea Surface Temperature (MOD28): *Beta Ready*
- Cloud Optical Properties (MOD06\_OD)
- Snow and Sea Ice Detection (MOD10, MOD29)
- Scene Classification (Clouds and Land Surface)

## *New MODIS Utilities:*

- Thermal Infrared Destriping
- Guide to converting IMAPP L1B format to DAAC format



# Other L2 Products: 1

- DRO Group releasing PGEs to enable users to develop their own L2 products
- Targeting linux
- Simplified execution environment
- Standalone code (reduced toolkit dependencies, scripts to get ancillary data)



## Other L2 Products: 2.

- About 6 out of the 49 PGEs have been ported.
- See DRO Portal for details of released codes (incl. Fire and NDVI).
- The Ocean Products will not come via this route (insufficient resourcing to enable this).



# Hardware Approaches

- Linux Linux Linux, mostly in clusters. (Cheap and robust) Both IMAPP and the released PGE codes are targeted at this platform.
- USF runs the NASA Ocean code on a Linux Cluster.
- Monolithic SGI processing boxes to replicate the machines at the GSFC processing centre. (Expensive ongoing)



# NPP & NPOESS

- NPP Launch October 2006
  - NPOESS Preparatory Project: risk reduction
  - 5 Years mission lifetime
  - 10.30 am descending orbit
  - 150 GB/day globally (similar to terra/aqua)
  - NO encryption capability
- NPOESS 2008
  - Operational system replacing POES (AVHRR et al)
  - 3 satellite constellation
  - Selectable encryption





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- The Direct Readout Group at GSFC is our input channel to these missions.
- They are working to ensure that:
  - DB software is released before (!) launch
  - DB transmission is compatible
- Find out more at the Direct Readout portal: search for NISGS (NPP In-Situ Ground System)

