

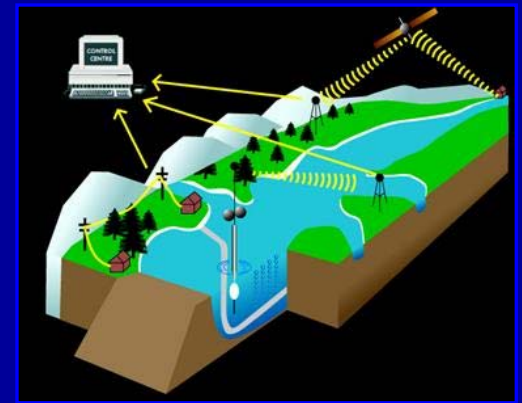
Environmental Measurements

Lessons from 25 years in the Australian Bush



Andrew Skinner

Environmental measurement is perceived as:



- Expensive & difficult to interpret
- Inexpensive and impossible to interpret
- Not undertaken
- Rugged and reliable and easy to interpret

*Pigmaei gigantium
humeris impositi
plusquam ipsi
gigantes vident:*

*If I have seen a little
further it is by
standing on the
shoulders of
Giants." Isaac Newton*

A painting of a forest path with autumn foliage. The path is a light, dusty trail that leads from the bottom center towards the middle ground, where it disappears into a dense grove of trees. The trees are tall and slender, with their leaves in various shades of red, orange, and yellow, suggesting a late autumn or early winter scene. The background is a soft, hazy landscape with more trees and a hint of a distant horizon. The overall mood is peaceful and nostalgic. The text "A trip down memory lane..." is written in a yellow, serif font, centered on the left side of the image.

A trip down
memory
lane...

The IBM 704 computer room at Lawrence Livermore, October 1956.

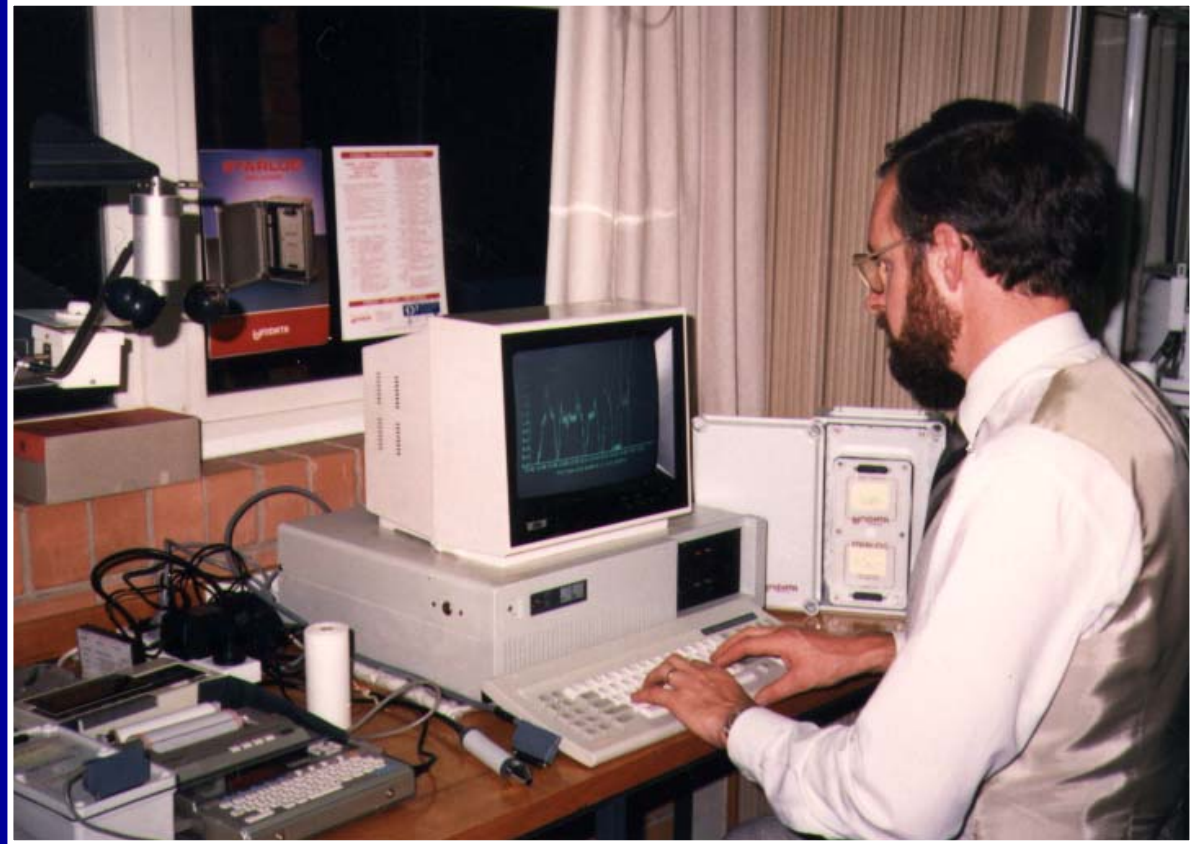


First IBM Personal Computer 1983



Twenty-four years of data logging...

- Mid 1980's
- IBM-XT 4.7Mhz
- 360kb floppy's
- No laptops
- 8k logger memories
- Tape recorders
- Poor graphics
- Basic + Lotus123
- Noisy printers



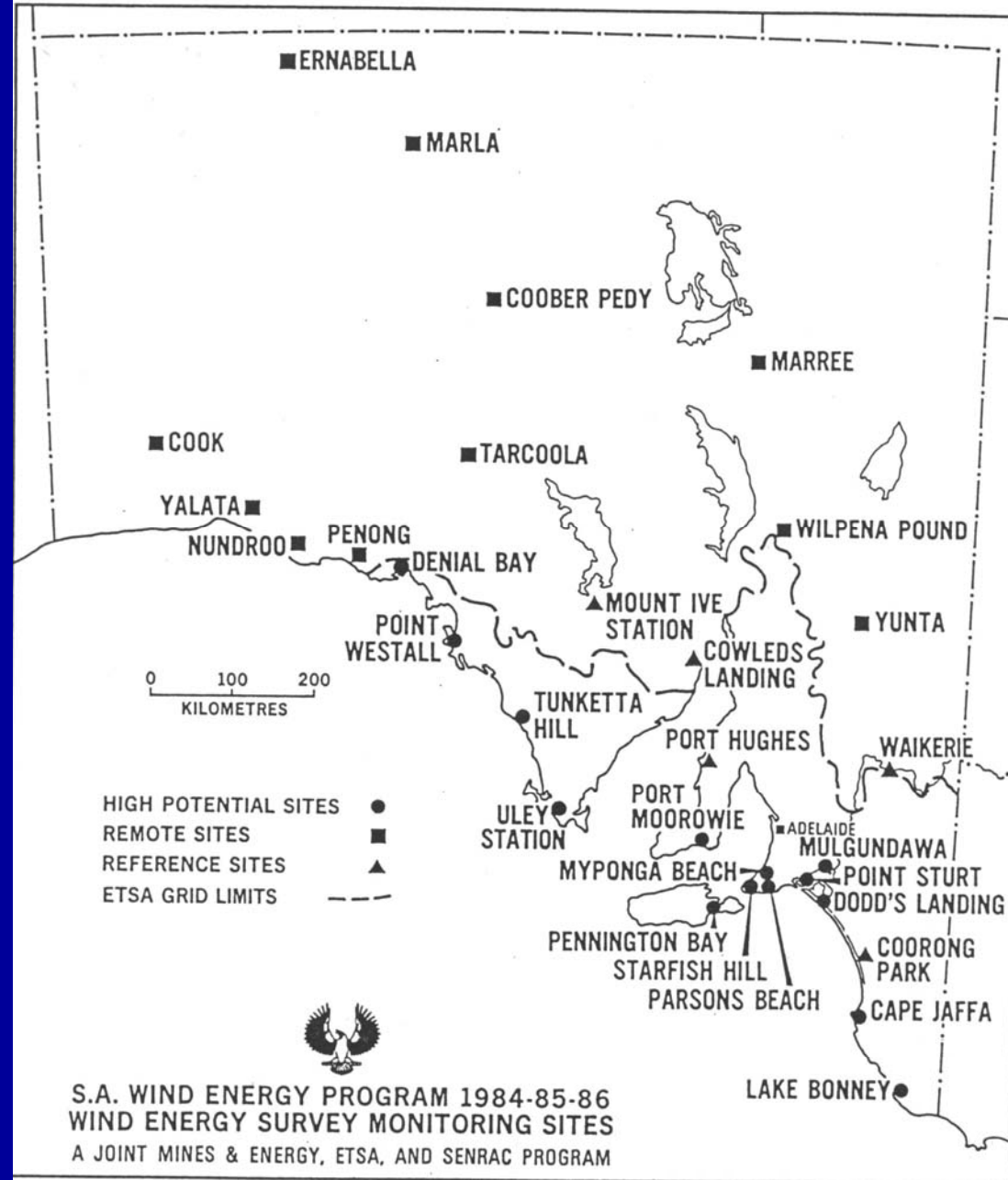
No telemetry until late 1980's

S.A. Wind Energy Program

1984 - 1987

Wind Energy Survey Monitoring Sites

This project lead to the
establishment of
**Measurement
Engineering Australia
(MEA)** as a data logging
applications
engineering firm
specializing in
environmental
monitoring



FRONTISPIECE

SOUTH AUSTRALIAN WIND ENERGY SURVEY MONITORING SITES

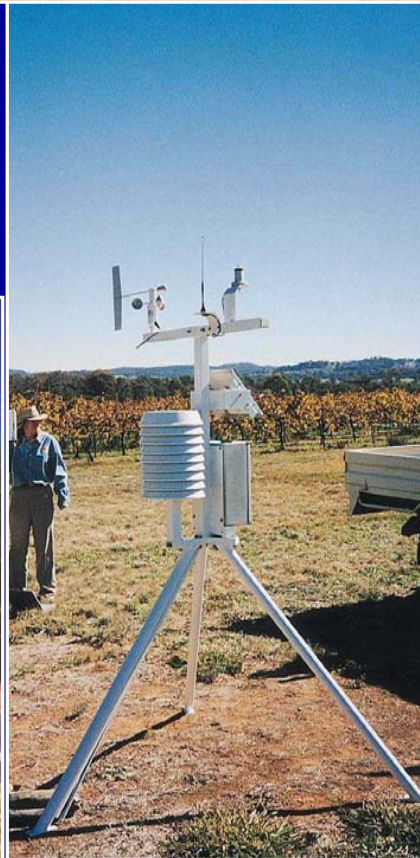
150kW Nordex wind energy turbine
established at Coober Pedy in far-north
South Australia as a result of the 1984-
1987 wind energy survey



Trials in the bush...Tilpa NSW



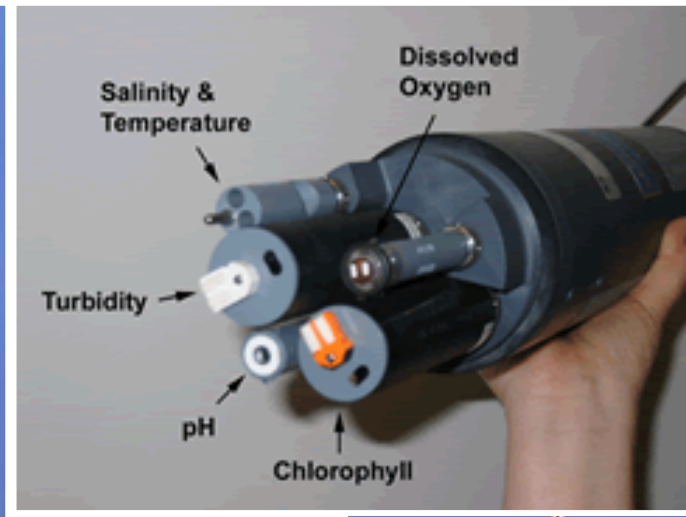
MEA Custom Weather Stations



MEA Soil Moisture Products: Overview



Serially-connected sensors...



Frost monitoring in barley - logging plus some control



Data retrieval without telemetry: -

- Local display
- Pick up logger or EPROMS
- Direct cable 500m
- Memory cards
- USB sticks, PDA's
- Luggables, laptops, portable computers



Luggable and Laptop Computers



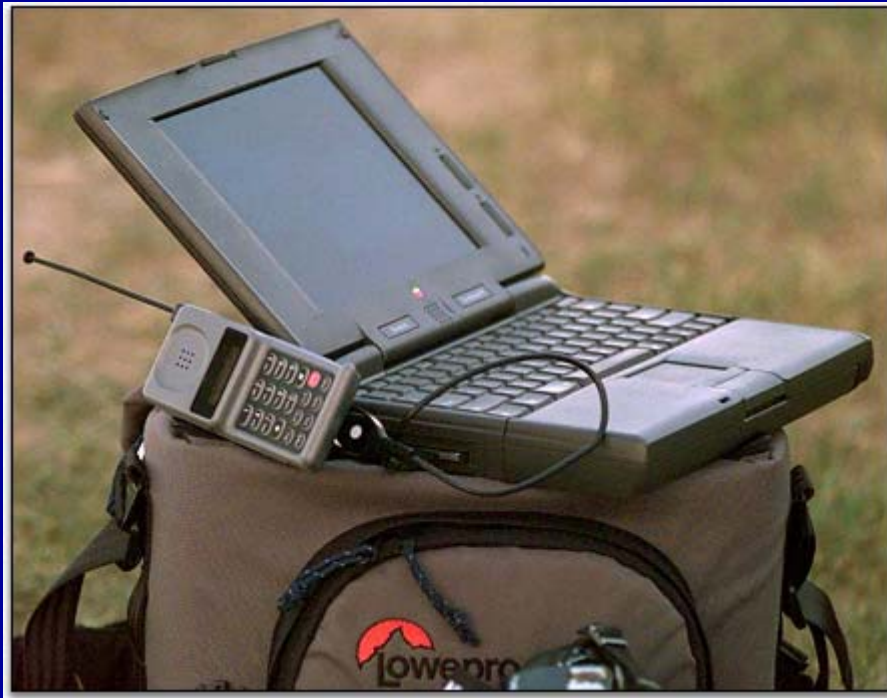
Osborne 1, ran CP/M, connections for printer & modem. Small 50 character screen. Circa 1984



Sharp 40Mhz circa 1989, at Leigh Creek South Australia



Analog cell phone - “the brick”



(7.5V NiCad Battery)

(AC Wall Charger)

(Vehicle Charger)



MOTOROLA INC.
FCC ID: IHDT5TN2 EE 3
CANADA: 109 182 193C; TYPE:SFKA
832/2412 CHANNEL OPERATION
MODEL: 89011WNC8B
MSN: 179GZL1226

27

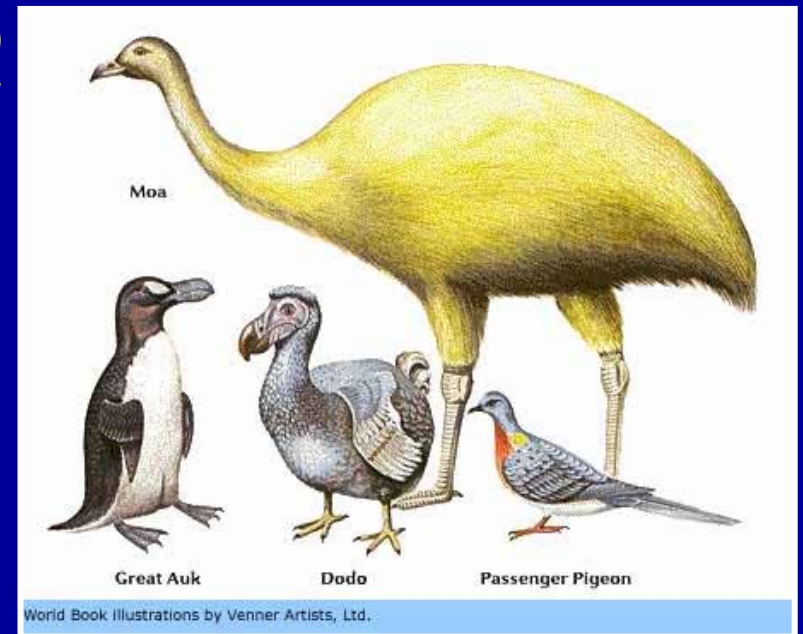


Analog phones still needed an
analog modem





...in the dust-bin of history!

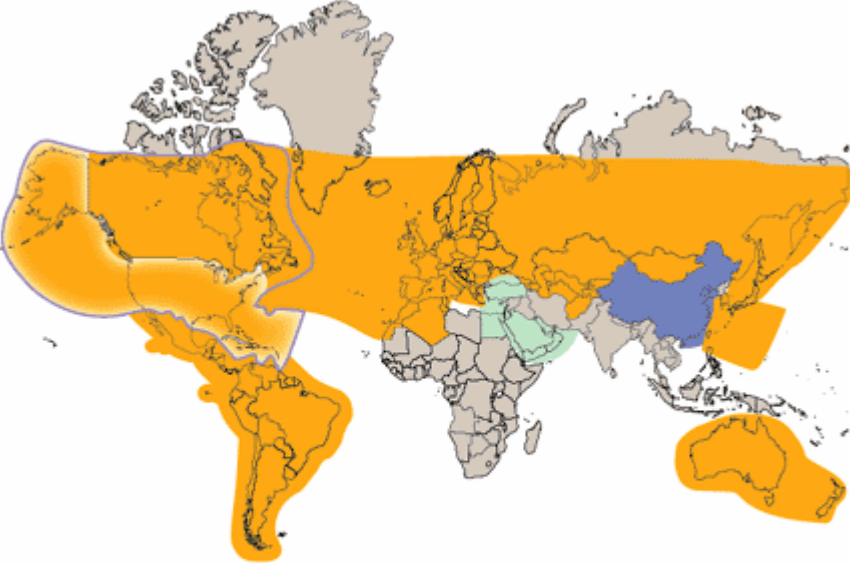


Cellular
phones-
originally
for voice

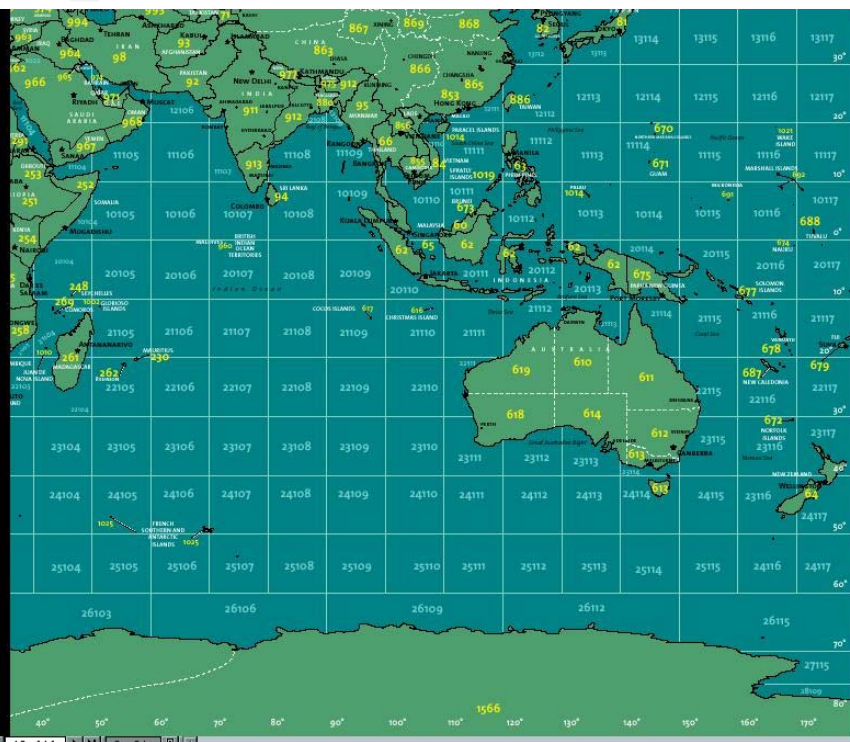


Cellular phone telemetry:





- Current Roaming Coverage Area
- Projected Roaming Summer 2002
- Home Service Area
- Projected Roaming Autumn 2002
- Data Services/Internet Access

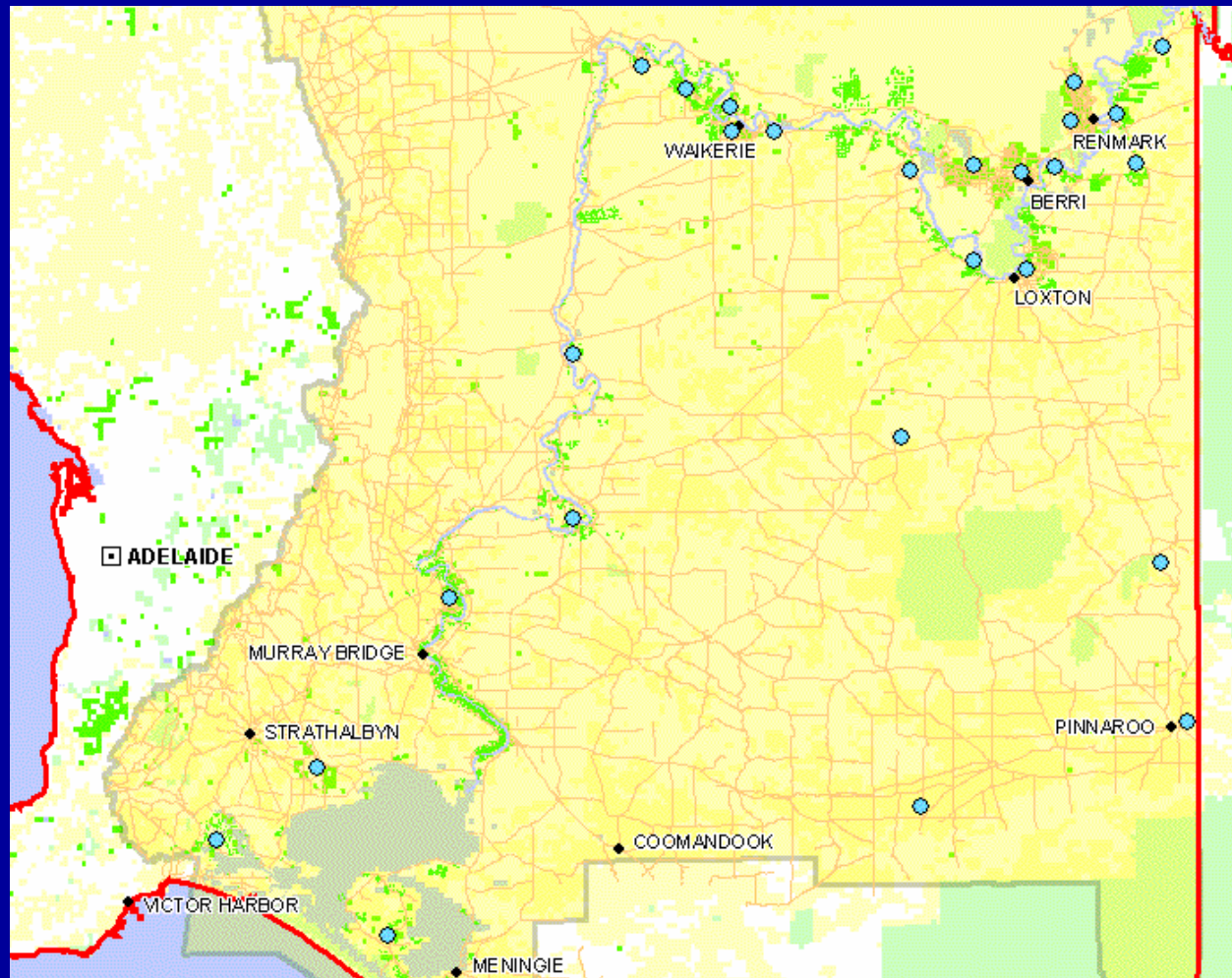


Satellite telemetry



MEA weather station network: 2200 growers

<http://www.rivermurray.sa.gov.au/AWMN/awsview.php>



Automatic weather station network -MDBC - packet data connection



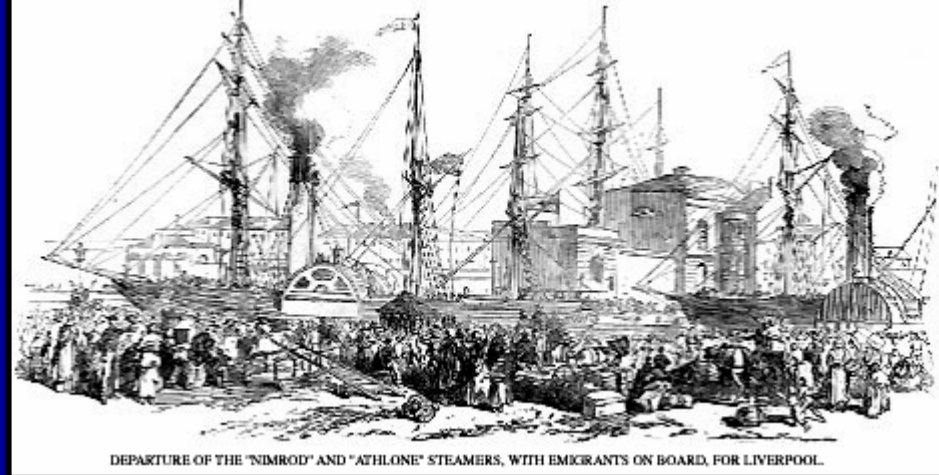
MEA's long-term test yard...



‘Digital Data Layer’ Cell Phone Telemetry: Fetch or Deliver?



Packet Data delivers
data to servers over the
Internet...



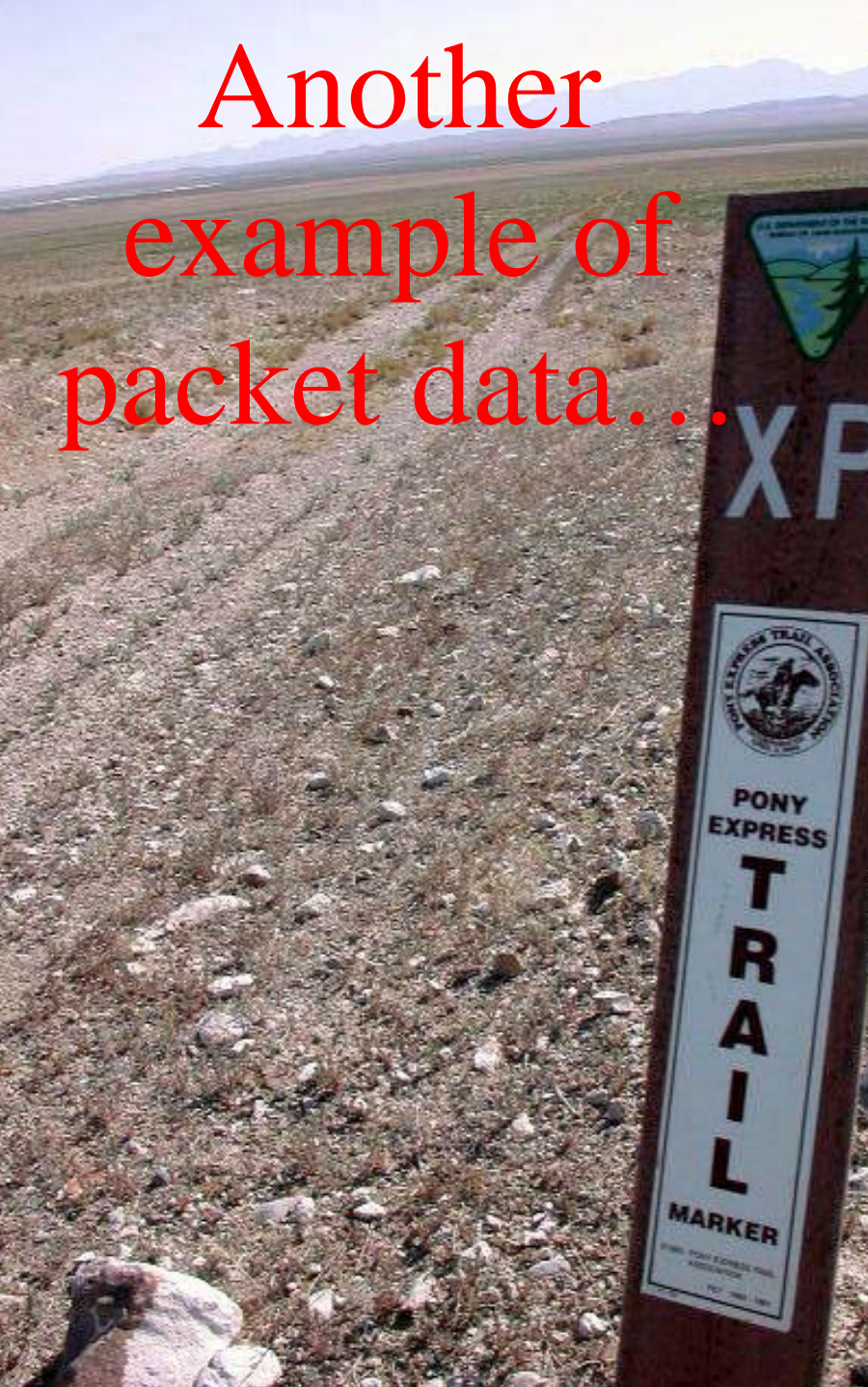
DEPARTURE OF THE "NIMROD" AND "ATHLONE" STEAMERS, WITH EMIGRANTS ON BOARD, FOR LIVERPOOL.



Packet data via 'packet ships'



Another
example of
packet data...



Logger Memory - kilobytes or terabytes?



ftp Server

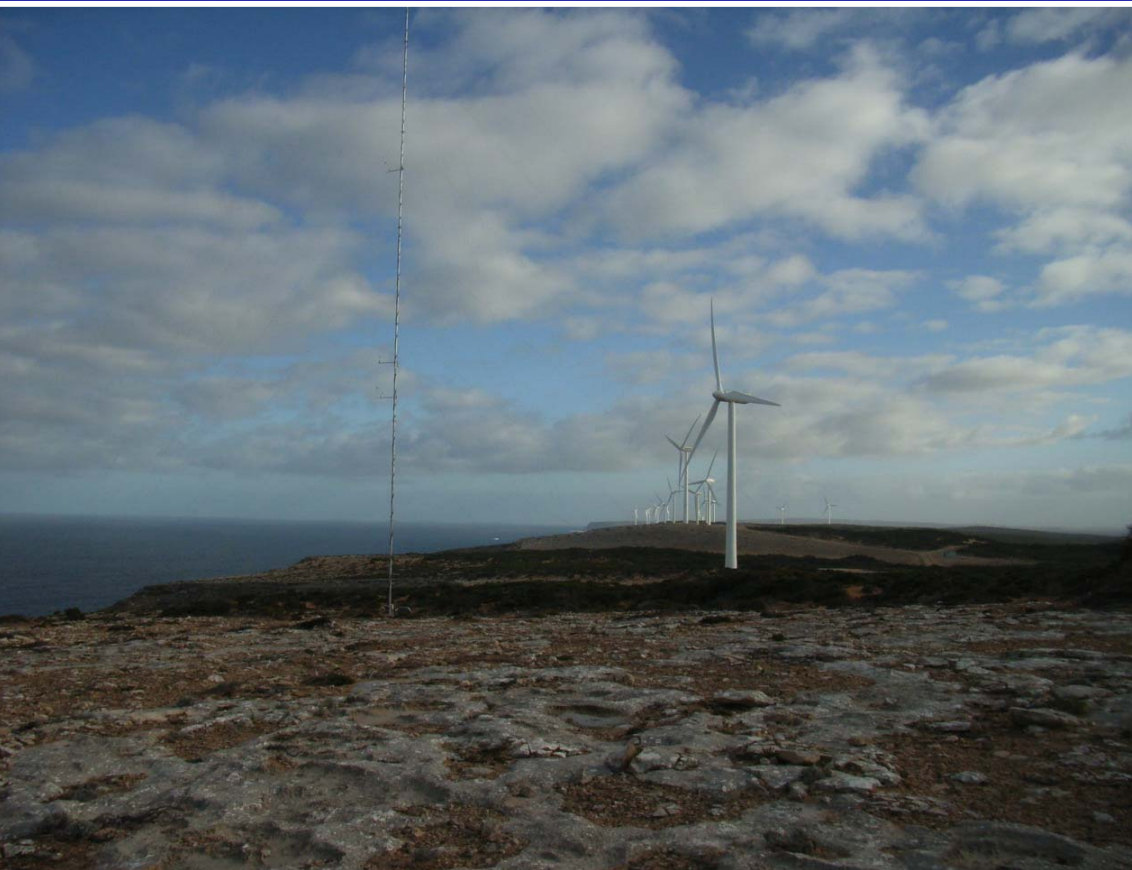


128kb x 10,000,000

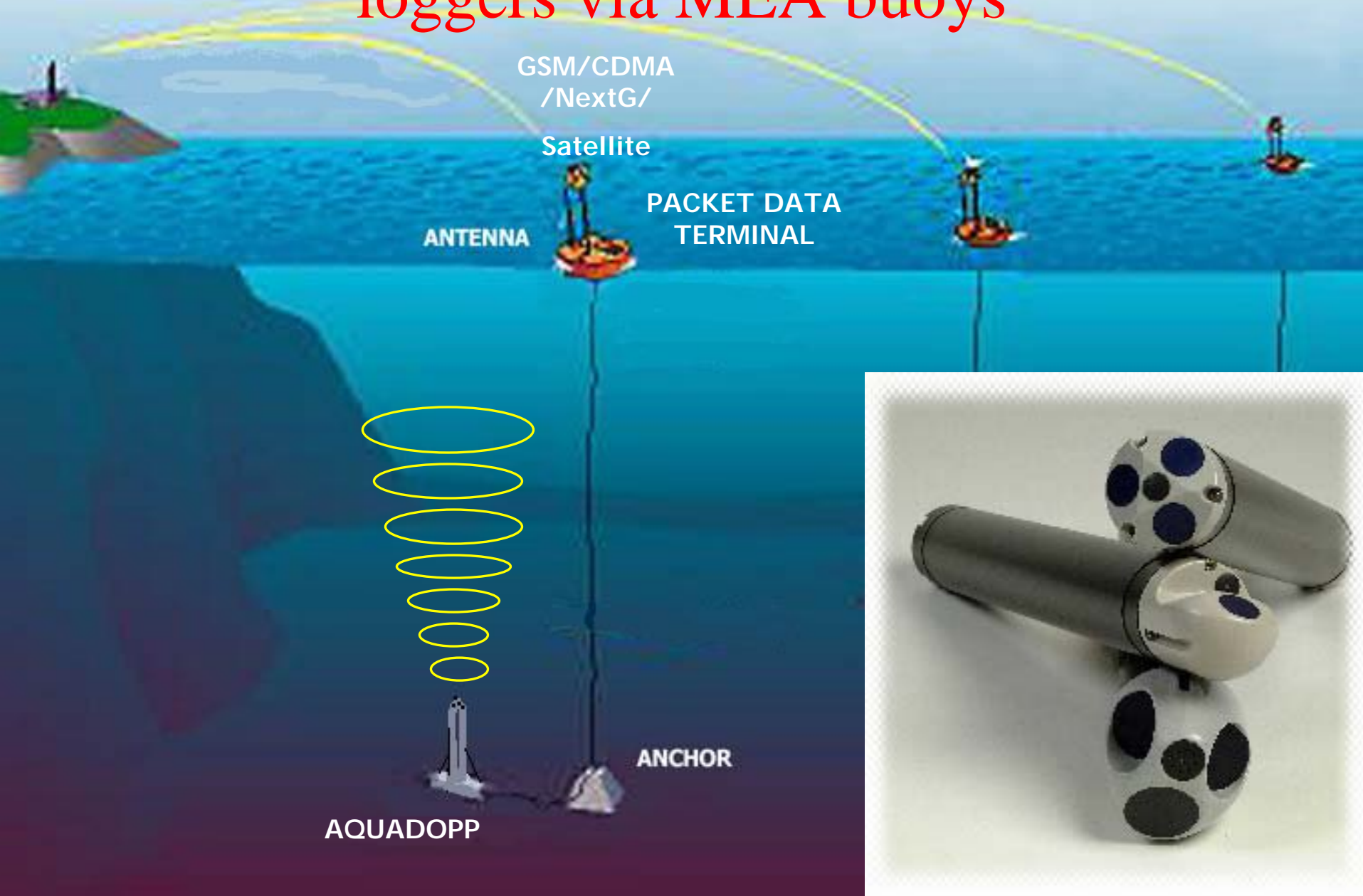
128kb



Wind speed data via a packet-data terminal



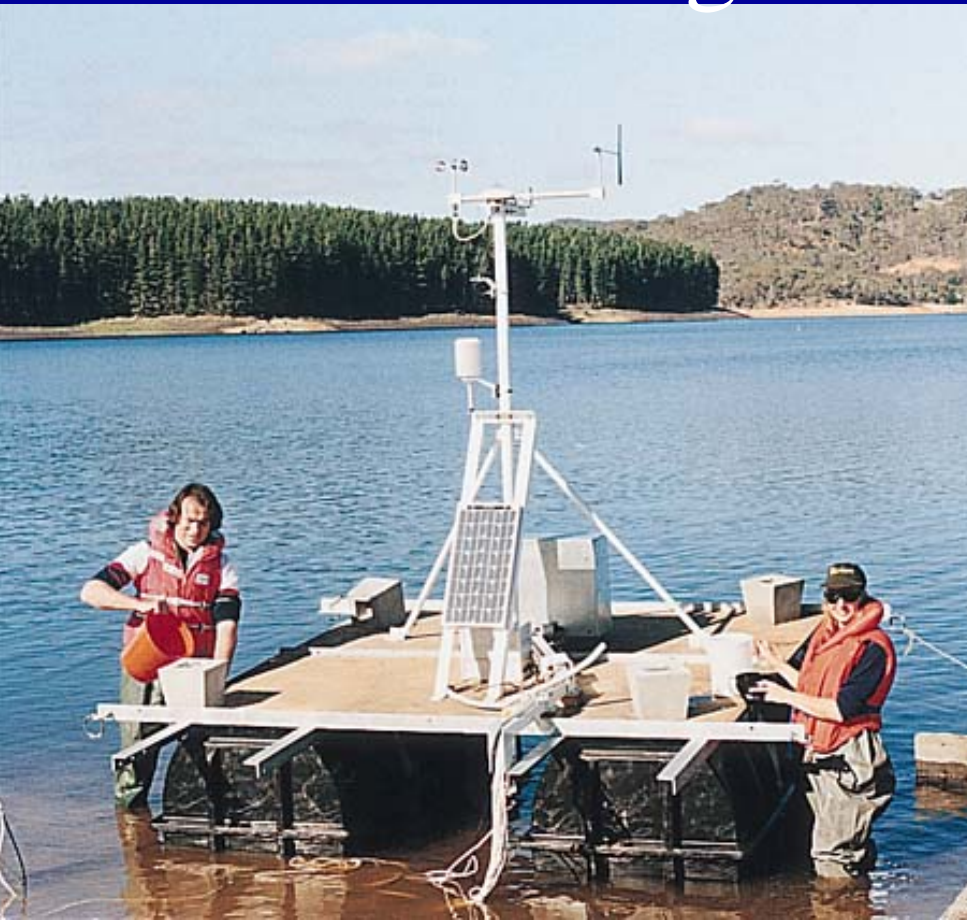
Packet data from Nortek current and wave loggers via MEA buoys



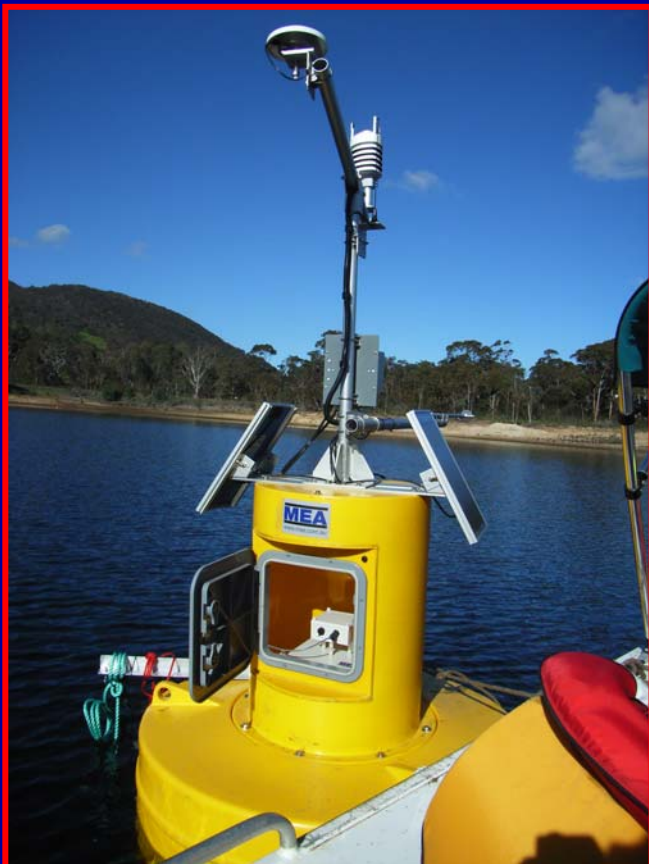
Measuring
snowfall:
Logging +
SCADA =
Belt + braces



Myponga Reservoir raft-based monitoring



Stratification measurement in urban reservoirs the Murray River



Sometimes we're all at sea...



Oceanic salinity
and water quality
monitoring for
tuna farmers



Landfill project

An evapotranspiration landfill cover (native plants in 'scalp') being tested as an alternative to a traditional clay barrier landfill.



Highbury Dump - Methane Exudation Measurement



MEA automated evaporation pan

- Logs evaporation in mm/day
- Compensates for rainfall
- Automatic filling and emptying from a reservoir at 9am daily
- Telemetry optional, Magpie software
- Used in almond industry for irrigation scheduling when crop-factors are known





MEA Radio Field Station

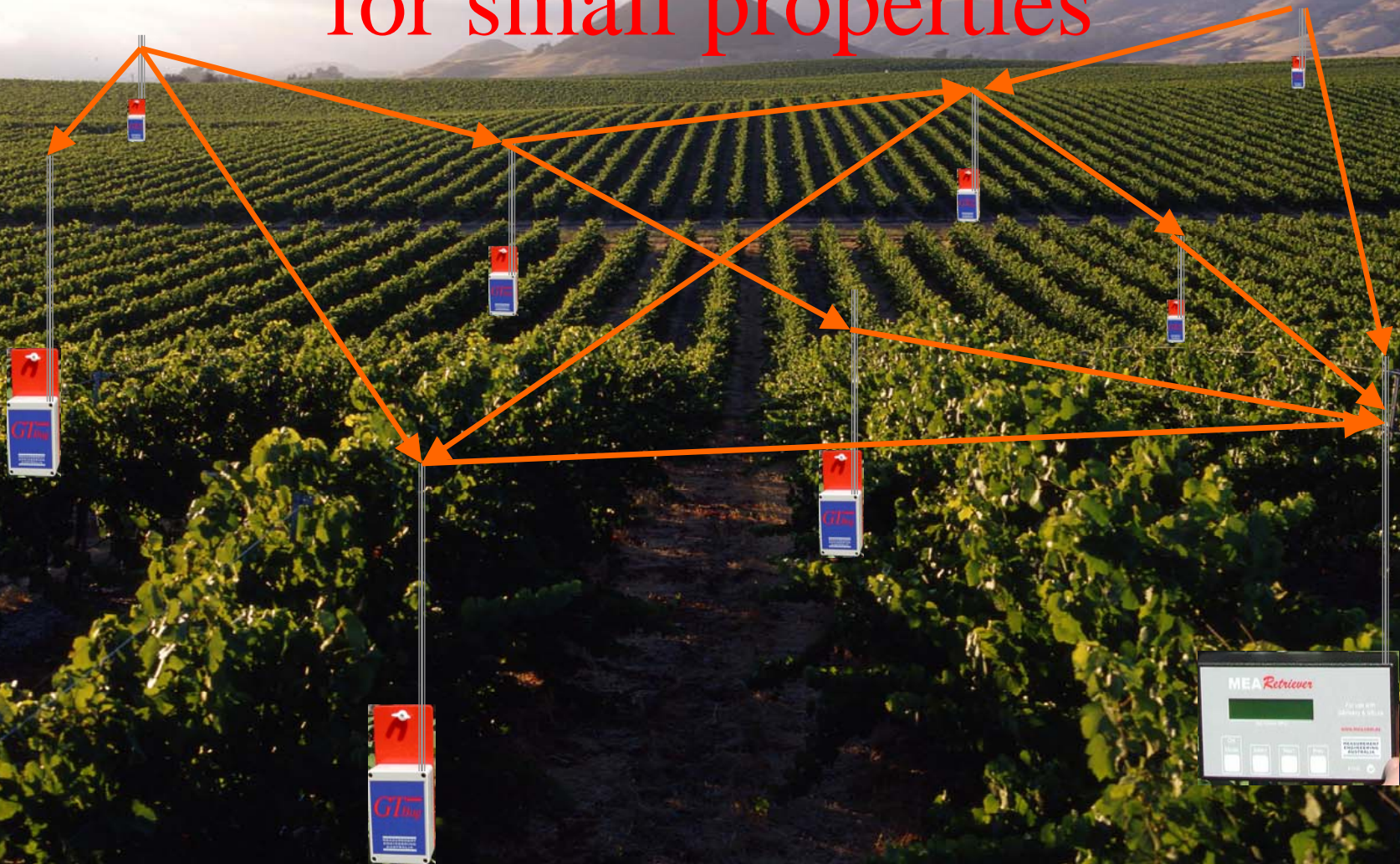




“GBug” - a four-channel radio-linked “shuttle” logger



Radio-networked 'Hopping Bugs' for small properties



Installation in the bush; a critical component.



Challenges keep coming...



12.11.2002

Things go wrong...never give up!



Where to from here?





"What a perfect day it was! A warm wind blowing in my hair, the sun shining from a clear, blue sky and some quite handsome sailors aboard. But somehow I had this odd feeling that something was missing."



Memories of a healthy river...

Impact of sustained low flows



In summary: Data logging and telemetry are well-developed; new sensors are the key to new measurements

- Plant-based measurements (CSIRO)
- Soil salinity monitoring
- Saline groundwater in-flows into our river systems
- Sensor networks that are web-enabled

