**Australian Government**

Geoscience Australia

The Use and Integrity Monitoring of IGS Products at Geoscience Australia (GA)

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Presentation Overview

- **Applications of IGS products**
    - Brief review of the GA applications of IGS products
    - Including a review of the GA online GPS processing application (AUSPOS)
- **Our experiences with IGS product use**
- **Our Quality control (integrity monitoring) of IGS products**
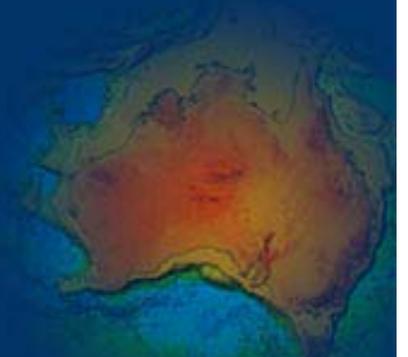
IGS Products at GA

- **What IGS products do we use?**
  - **GPS data (RINEX)**
    - **observation/navigation**
  - **GPS satellite ephemerides (SP3)**
    - **Ultra-rapid, rapid, final**
  - **Earth Orientation Data (ERP)**
    - **rapid, final**
  - **Coordinate/velocity solutions (SSC)**
    - **IGS combined cumulative solutions**
  - **Network meta-data**
    - **IGS.SNX**
  - **IGS antenna phase centre models**
   - **PHAS_IGS.01**
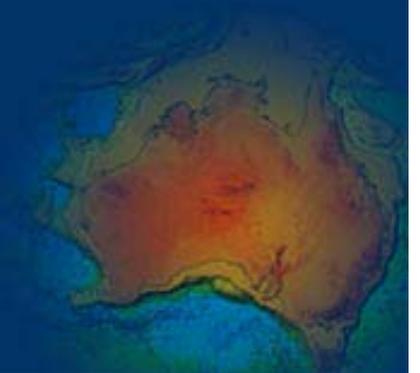
Applications of IGS Products

- **What the IGS products are used for in GA?**
    - **Spatial data infrastructure (eg. Datum)**
    - **Regional tectonics and ITRF densification**
    - **Satellite altimeter calibration**
        - **GPS buoy solutions**
    - **Absolute sea level monitoring**
        - **crustal motion at tide gauges**
    - **ITRF to Geocentric Datum of Australia (GDA) coordinate transformations**
   - **Web based positioning services (AUSPOS)**
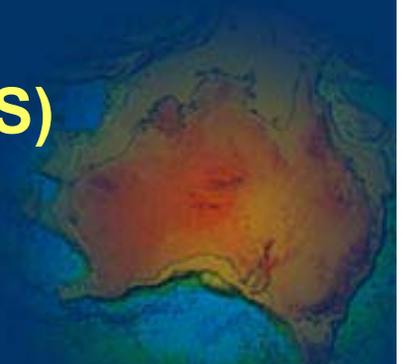
Example Application - AUSPOS

- **Web based positioning service (AUSPOS)**
  - **Internet based GPS processing service**
  - **Makes use of IGS product suite**
    - **Orbits, ERP, SSC**
  - **Provides precise positioning within the Australian region (or globally)**
  - **Designed to service Australian government and survey industry**
    - **however now used by a diverse group of users**
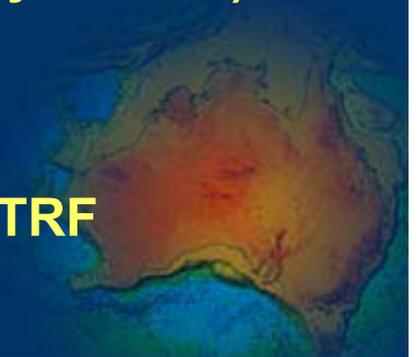 - **26,000 + user RINEX files processed since 2001**
  - **1400 + unique users since 2001**
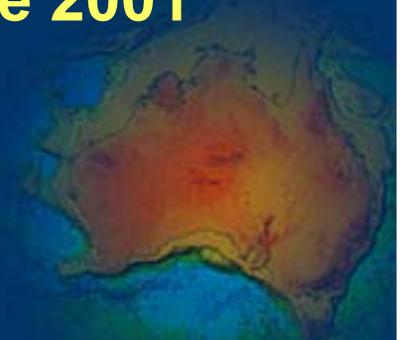
Example Application - AUSPOS

- **Why do we use IGS products for AUSPOS?**
  - Survey control is often sparse in Australia (often several 100km away)
  - Ease of access to geodetic infrastructure is important for the user.
  - Access to the Geocentric Datum of Australia (GDA) can be provided by long baseline GPS processing against the Australian Regional GPS Network (ARGN) within the ITRF then by transformation to GDA
  - The IGS products provide the most accurate and least resource intensive method to do this (within Australia)
  - AUSPOS provides a simple web interface between the user with GPS data, the GPS processing engine and the IGS product suite
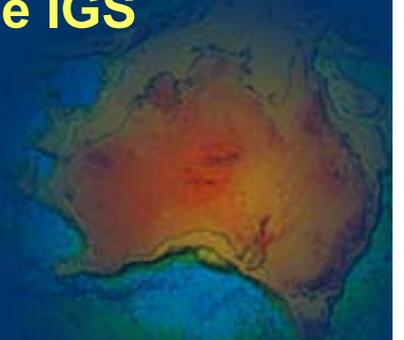
AUSPOS User Applications

- **What are the applications for AUSPOS?**
  - **survey and cadastral applications**
    - remote sensing and aerial photography survey 'control'
    - offshore oil rig motion
    - mineral exploration and gravity surveys
    - Coordinated cadastral system
  - **geodetic infrastructure**
    - geodetic network quality control
    - maintenance of GPS networks (network quality control)
    - precise coordination of DGPS base stations
  - **Access to the reference frame**
    - precise positioning in developing countries (ITRF densification)

AUSPOS GPS Processing Strategy

IGS: orbits, ERP, SSC, RINEX, IGS.SNX, PHAS_IGS.01

www.ga.gov.au

Processing engine

(Microcosm)

IGS

IGS

IGS

User

AUSPOS Input/Output

AUSPOS Australian Usage
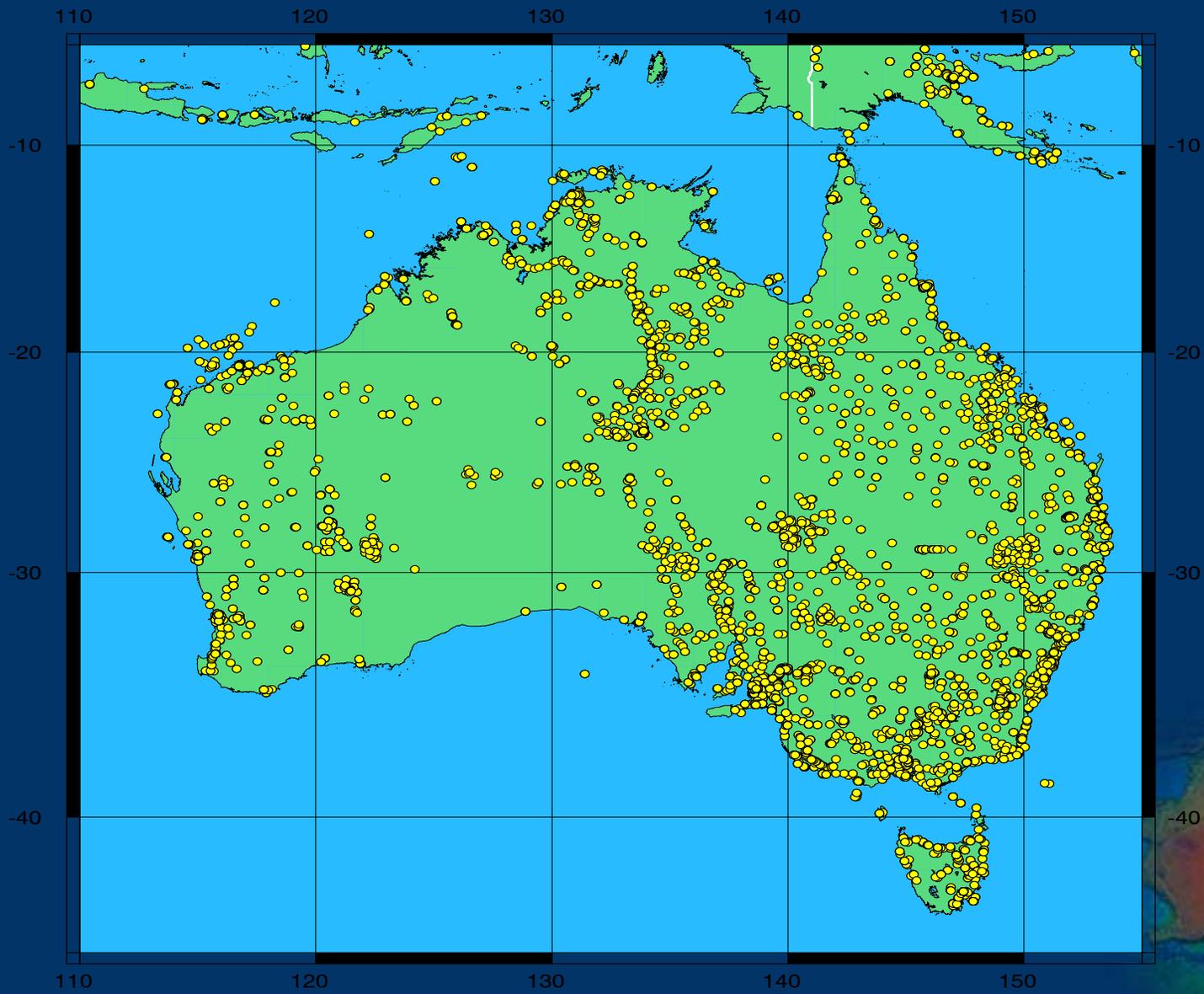
AUSPOS Global Usage
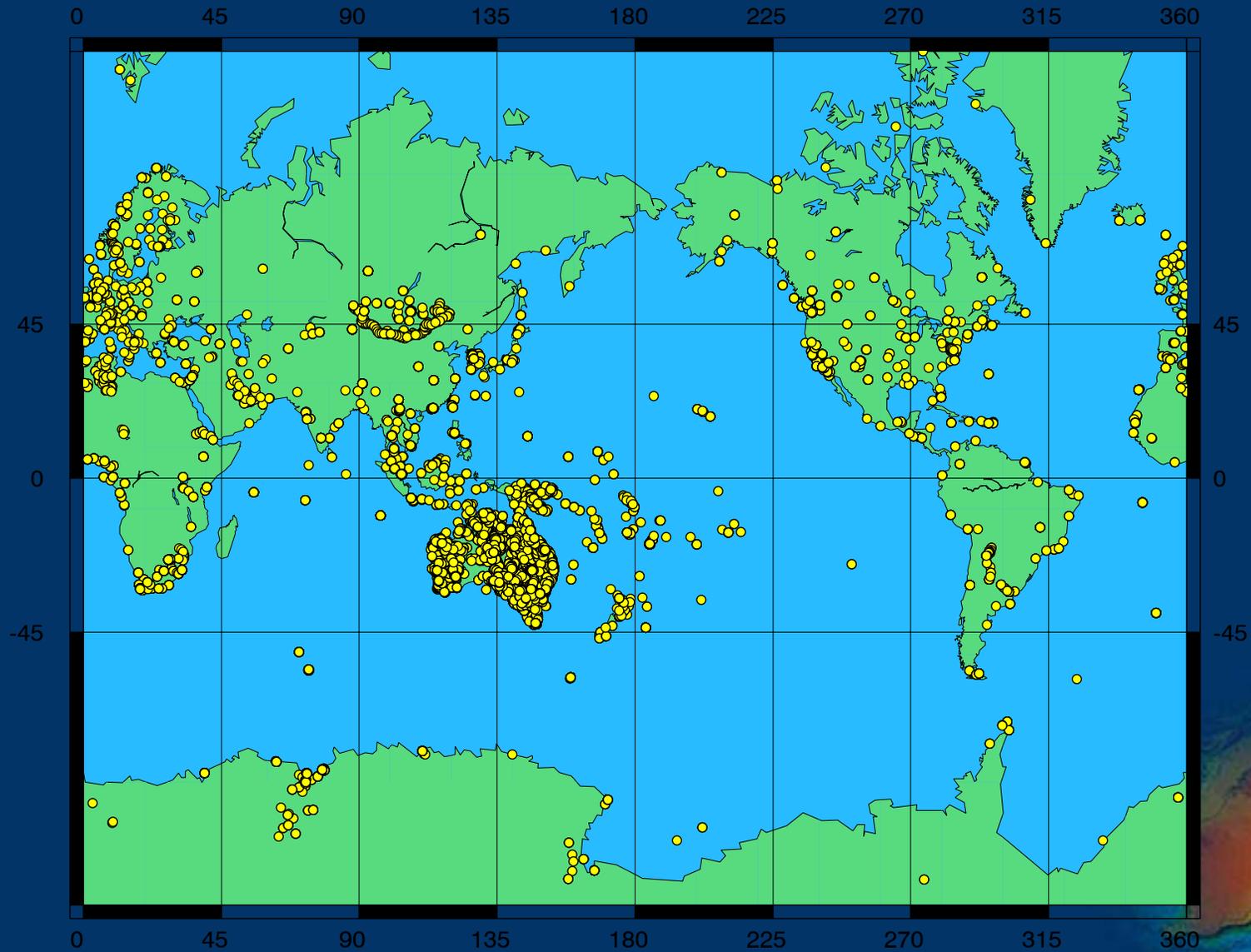
AUSPOS Files Processed
(per month)
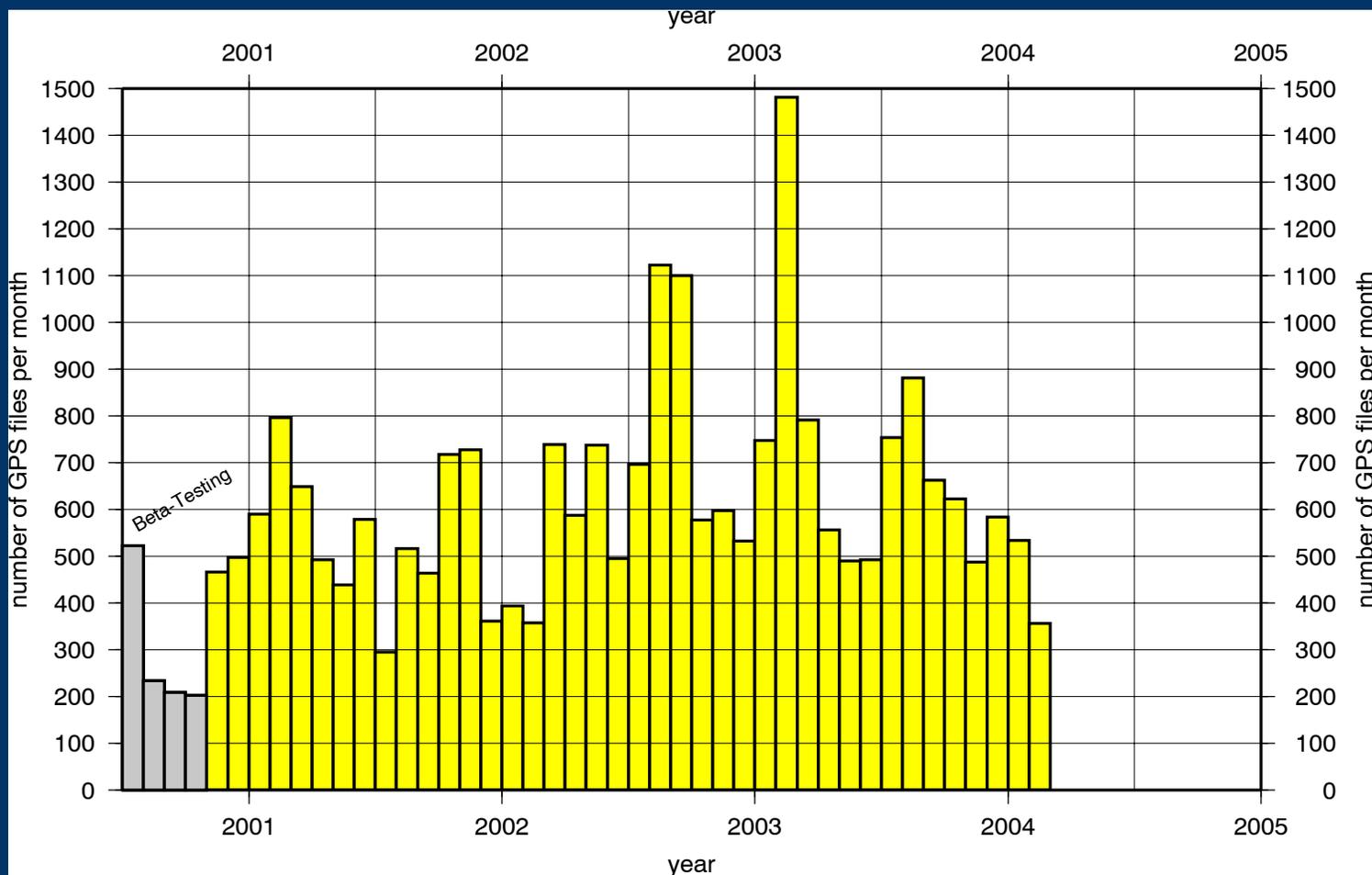
IGS Product Experiences

- ## IGS Data centres issues
  - ### On several occasions some IGS data centres have been unavailable
  - ### This has been largely overcome by the redundancy in the IGS data centres
    - #### But has required software to automatically switch between data centres when an IGS centre is offline
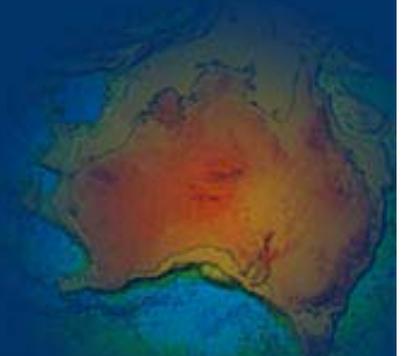
Quality Control of IGS Products

- **Quality control of RINEX data**
  - **Part day RINEX files**
    - **Automatically checked and excluded as required**
  - **Bad RINEX data**
    - **ARGN network is monitored by GA during IGS RNAAC processing however this is around two weeks after observation**
    - **Poorly performed stations are excluded from automated applications such as AUSPOS**
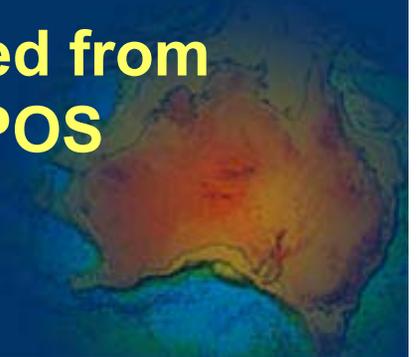
Quality Control of IGS Products

- **Quality control of orbit (SP3) Data**
    - **Automatic orbit model fit analysis when product is first used**
    - **Later routine regional solution conducted by analyst includes IGS SP3 orbit product assessment**
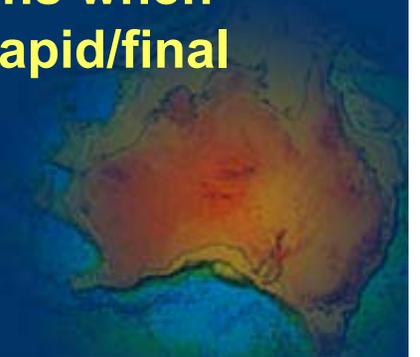   - **Quality of ultra-rapid product is an issue for some positioning applications**
        - **AUSPOS users note the differences in solutions when comparing solutions that use the ultra-rapid/rapid/final products**

Quality Control of IGS Products

- **Quality control of ERP data**
    - Is not currently checked for quality apart from basic format adherence

- **IGS.SNX**
    - Is not currently checked for quality apart from basic format adherence but its quality is essential for GA applications
   - Differences remain between RINEX headers and the IGS.SNX file; the IGS.SNX is currently adopted as truth
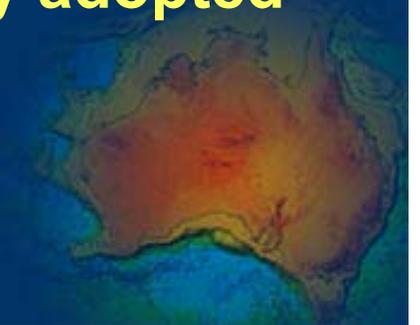
IGS Product Experiences

- **Missing products**
  - From time to time IGS orbit (ultra-rapid and rapid) products have been missing from data centre archives
- **Corrupt navigation data files**
  - Disrupting automatic pre-processing of RINEX observation data
  - Overcome by software to clean the IGS navigation file
- **Earthquakes and station coordinate jumps**
  - Require immediate flag of an incident at a station so as to allow automatic exclusion of a station for a particular period
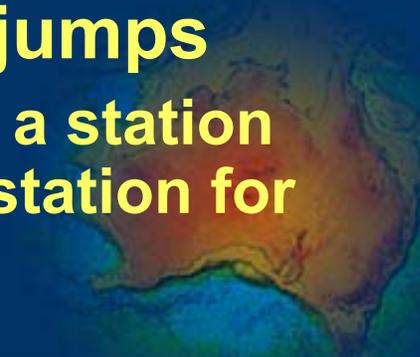
Conclusions

- **Generally only limited Integrity monitoring is performed/required on the IGS product suite used at GA**

- **Any future IGS integrity monitoring system needs to be easily accessible by automated processing systems such as AUSPOS**

- **IGS data and products remain critical components of the Australian national geodetic infrastructure**