Dissemination of Real-Time and Post-Mission value added GNSS data – A Global Operator's Perspective

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Workshop on the Applications of Global Navigation Satellite Systems, Suva, Fiji

24 – 28 June 2019

- when it has to be **right**

Leica Geosystems

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Outline

- Introduction
- History and Trends
- Australia – use case
  - Coverage
- Fiji – current situation
- Real time and post processing GNSS data dissemination

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HxGN SmartNet – Correction Service

- Cloud based service to provide **centimeter-level** accuracy to GNSS rovers via mobile internet **in seconds** with **24/7/365 availability**

- Largest network with over 4,500 Reference Stations world-wide available in 22 countries is providing **Open Standard GNSS correction** for RTK positioning

- Over 13 years experience in the correction service market with a globally experienced team

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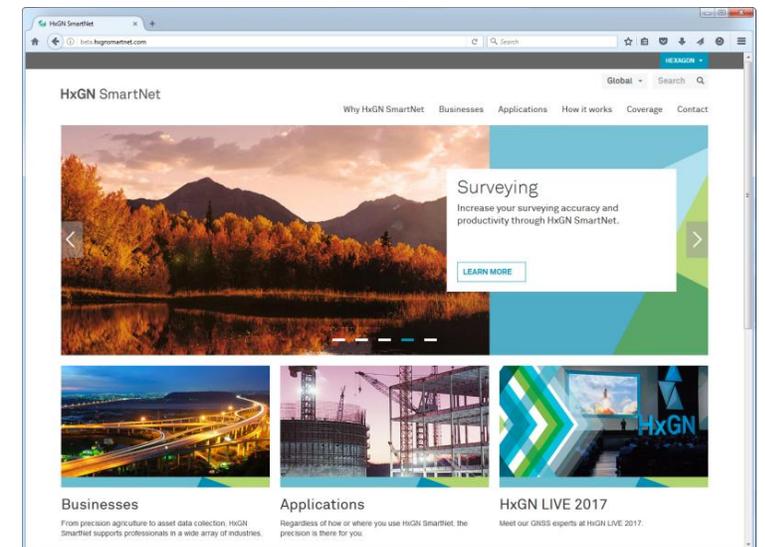
Evolution to HxGN SmartNet

From single base solution to a world-wide network correction services build on technology from Leica Geosystems

- 2000	2001 - 2005	2006 - Today	Future

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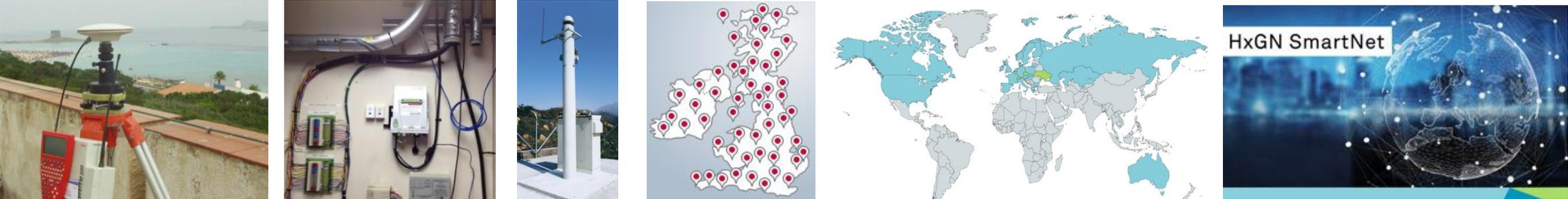
HxGN SmartNet Applications & Businesses

Land Surveying   Agriculture   Machine Control & Construction   GIS   Utilities   UAV

Automotive   Agriculture   Logistics   Telecoms   Asset Data Collection   IoT Applications

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HxGN SmartNet: Commercial Service Offering

Commercial service offering differs from country to country (market driven)

B2C offering

- Real time correction data streams as
  - Flat rate subscription
  - Consumption-based subscription
- Download of post processing products (RINEX files, Online Post-Processing, etc.)
- Mobile app and web page access

B2B offering

- Enterprise subscription models (Consumption or based on the number of users)
- Integration of API for automation of subscription administration
- Integration of API for post processing automation (using X-pos technology)

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Industry Trend 1

Dual Frequency GNSS introduced to the mass market

- Evolution of low cost chipset from single to dual frequency (at same low price)
- First Xiaomi Android phone with Broadcom dual-frequency chip
- Access to GNSS raw data via Android operating systems
- Possibility to utilize correction data for RTK positioning
- Main limiting factor for precise positioning: GNSS antenna in mobile phones
- Second limiting factor: number of channels for GNSS signal tracking

Platform

Horizontal ↑

Horizontal ↓

Vertical
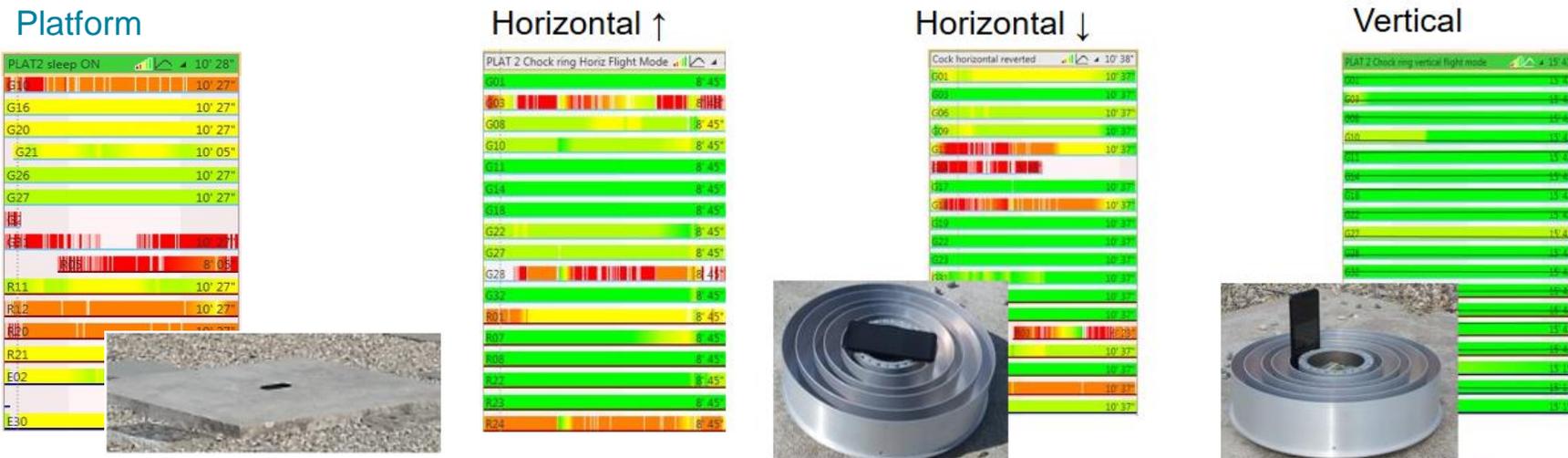
Industry Trend 2

SSR vs RTK

- SSR (State Space Representation): correction data format that transmits the error of the relevant GNSS sources
  - Clocks Orbits, Ionosphere, Troposphere, etc.
  - No standard established
  - Broadcast capability for larger area at low bandwidth
- RTK (OSR – Observation Space Representation): correction data format that transmits the errors as a lump sum
  - Widely implemented on dual-frequency GNSS hardware and **standardized via RTCM**
  - Usually used with individualized data streams for rover (iMax, VRS, SB)

Estimation of SSR parameters		
SSR ➜ OSR	SSR output	SSR output
GGA · RTCM	SSR	SSR
	SSR ➜ OSR	
RTK Rover	RTK Rover	SSR Rover
Today	Future	

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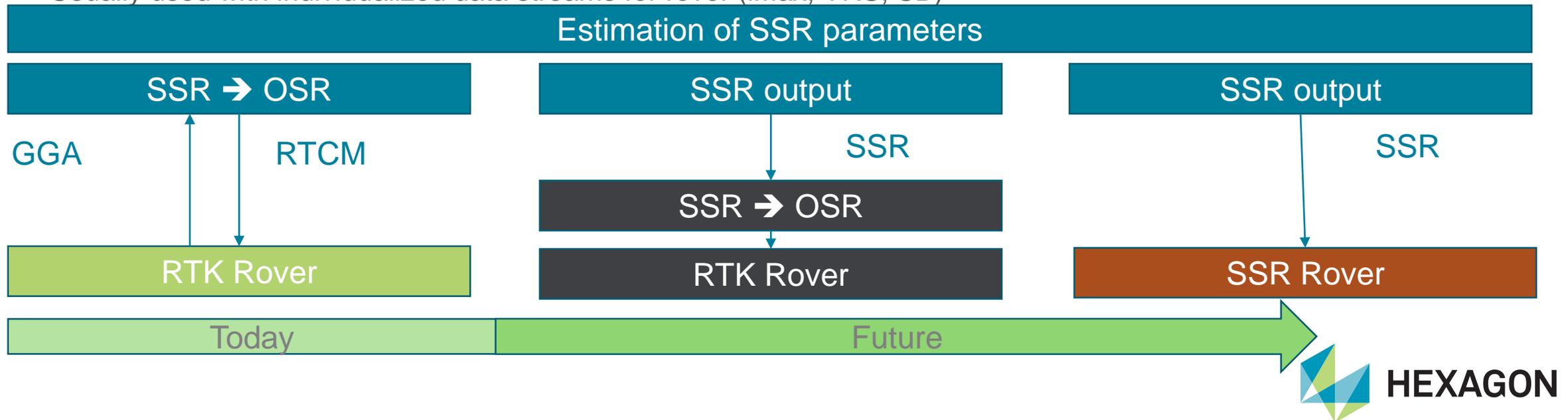
Industry Trend 3

GNSS on the road

3cm
Local

30cm
Continental

- Long history of autosteering with GNSS guidance systems (&IMU)

- Accuracy requirements on the road are lower but reliability becomes the key requirement (failure rate: <0.00000001%)

- Technology: SSR with Integrity on a pan-continental level and sensor fusion

- Automotive requires to serve a very high number of users (broadcast)

- Connected Car ➜ Assisted Driving ➜ Autonomous driving

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Industry Trend 4

Stretch the station separation of the network

- Higher station density is required during high solar activity to estimate the ionosphere correctly

- RTK positioning requires dense network of ~75km (limitations on the rover side)

- Positioning with SSR technology can further stretch the station spacing (reduction in convergence time at the rover)

- Network design for good or bad times?
  - Saving potential : ~3/4 of base stations
  - Station separation 75km…120km…240km
  - Consideration on redundancy for individual station failures

Solar Cycle progression – Sunspot number

Legend:
- Monthly mean Sunspot Number
- Monthly Smoothed Sunspot Number

Source: www.spaceweatherlive.com

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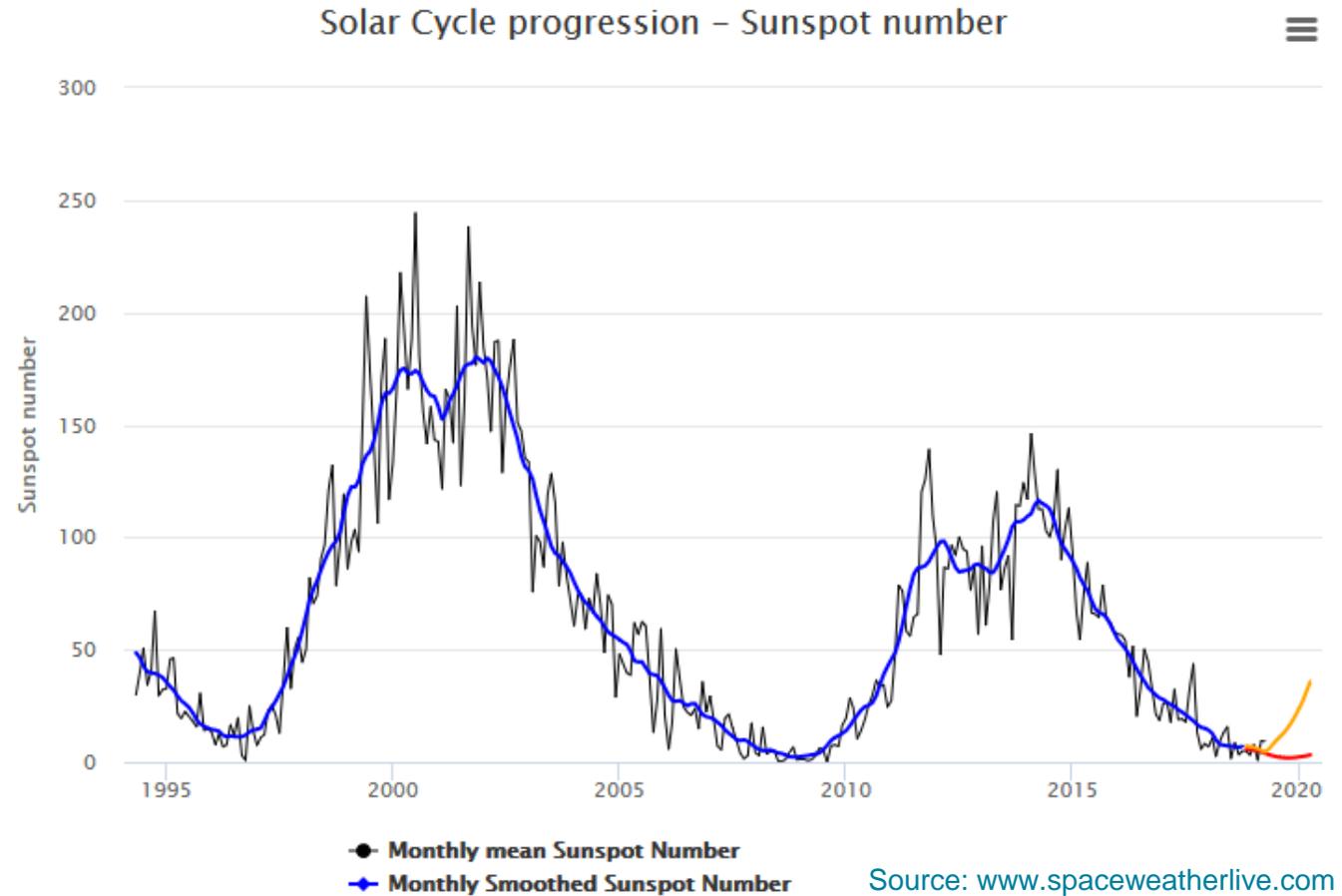
Conclusion on Industry trends

Things will change … but slowly

RTK will remain the most important technology in the classic GNSS market for the next 5 years (at least)

- Large user base (that will modernize slowly)
- Fastest and most accurate GNSS positions

SSR will come!

- Standardization will be the main driver
- Introduction first for mass market application (cars, mobile phones, and other new 'rovers')
- Low bandwidth and cheap broadcast capability will be the striking arguments for SSR
- More flexible on station separation

Cheap broadcast capabilities will be the main argument for service providers

- Cloud dissemination vs Native carrier dissemination via 3GPP

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Correction Service on a worldwide scale build on over 4,500 reference stations

North America

1300+ STNs

Europe

2500+ STNs

Russia

350+ STNs

Australia

600+ STNs

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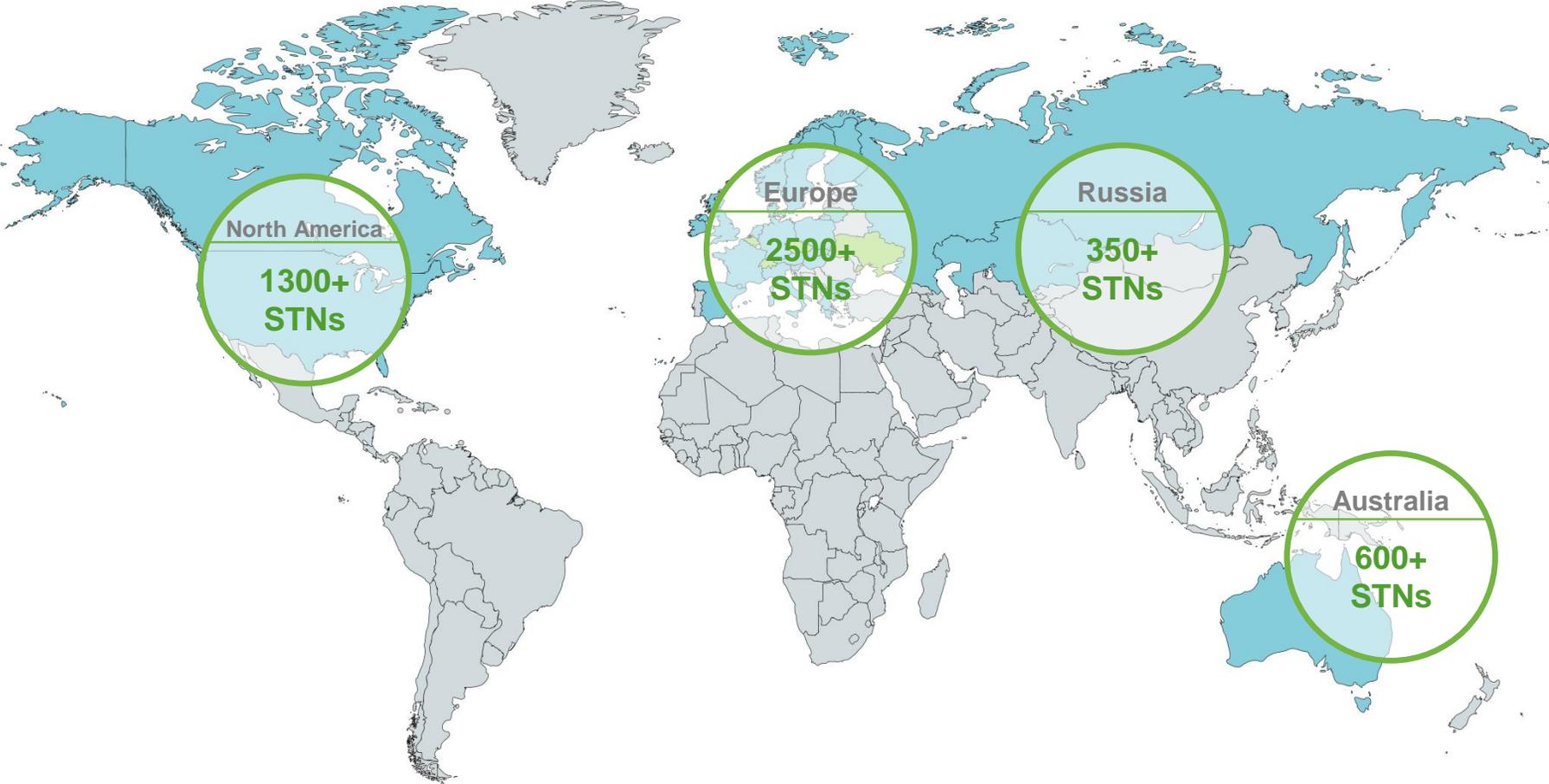
HxGN SmartNet - Australia

- Largest provider of CORS service (670+) in Australia since 2009.

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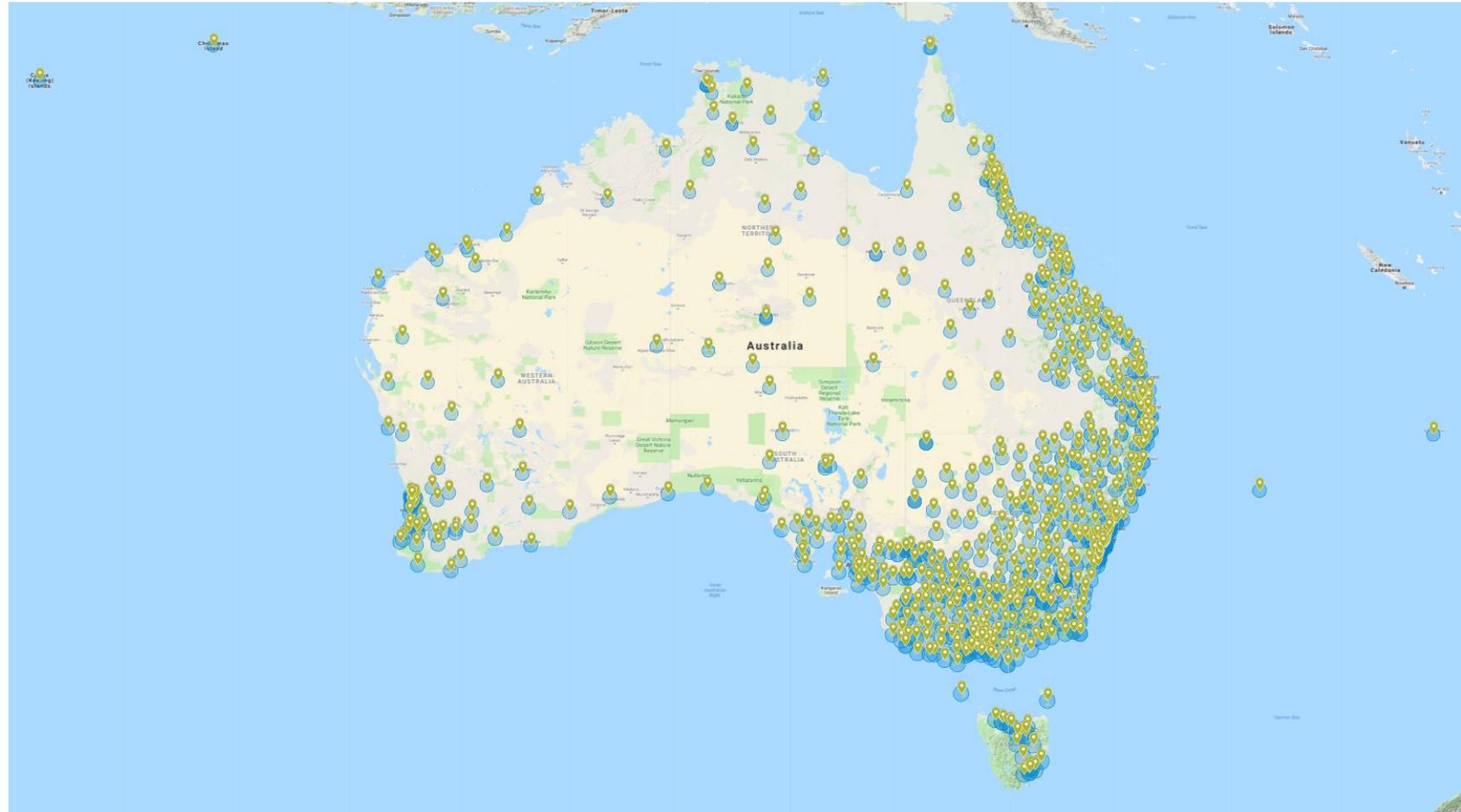
HxGN SmartNet - Australia

- Coverage – Victoria (125 sites)
  - Agreement with DELWP VIC = 116
  - GA = 1
  - HSN = 8
  - Integration of cross-border sites (SA & NSW)

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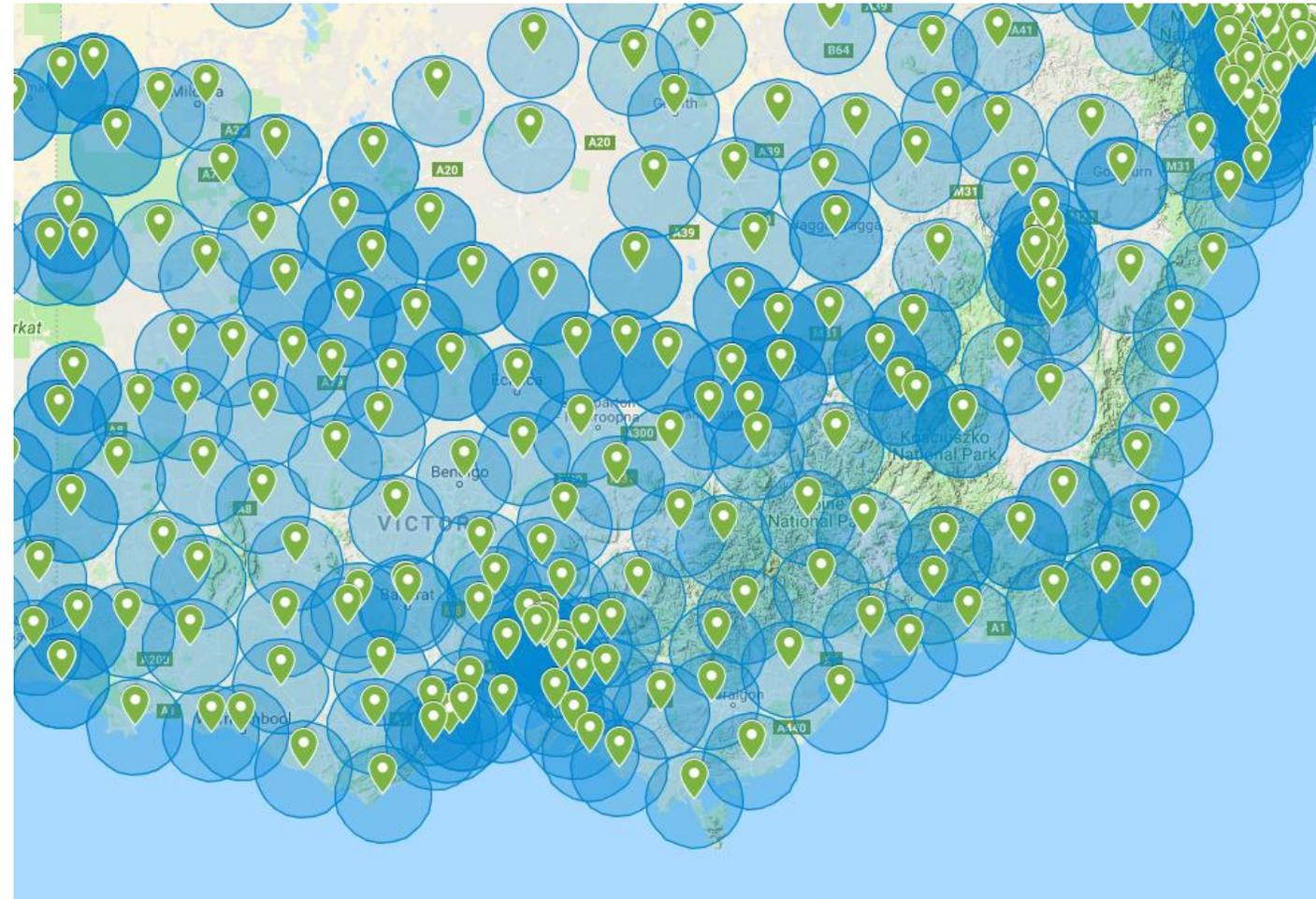
HxGN SmartNet - Australia

- Coverage – New South Wales (228 sites)
  - DFSI-SS = 180
  - GA = 11
  - HSN = 37
  - Continuous coverage from SA and VIC through to QLD

HxGN SmartNet - Australia

- Coverage – South Australia (54 sites)
  - GA = 12
  - HSN = 42
  - Coverage is expanding
  - Offer cross border service – SA & VIC

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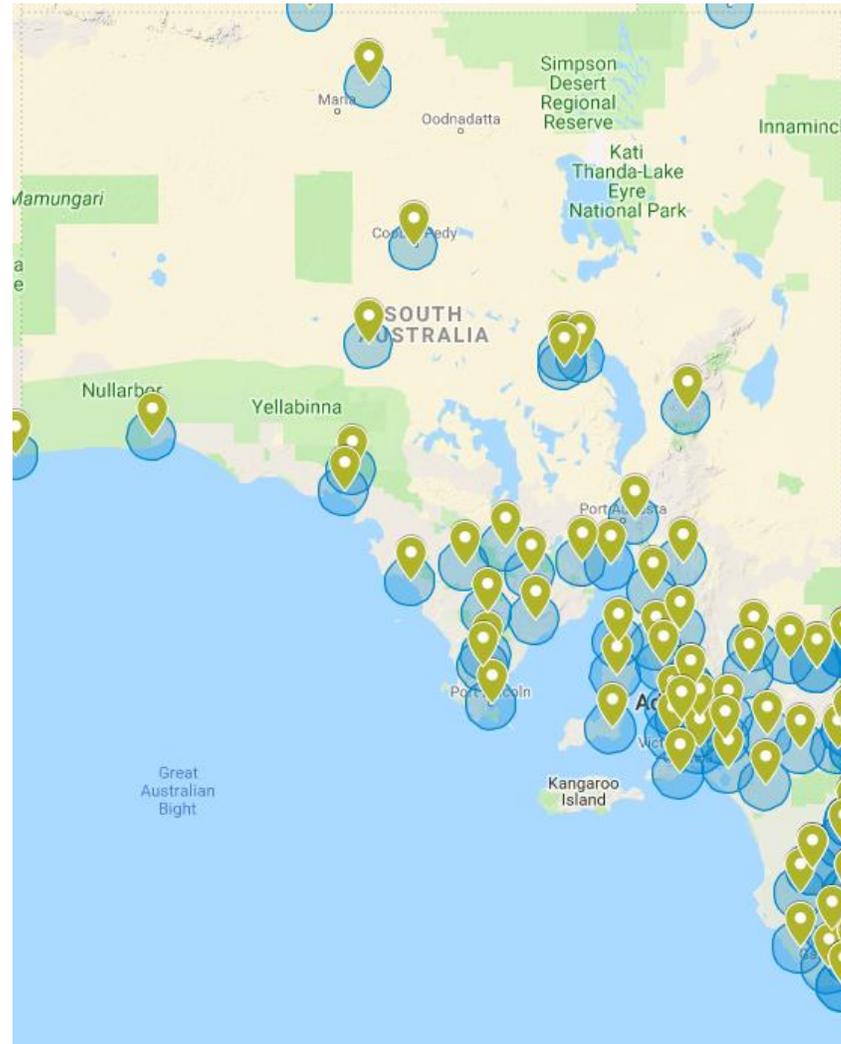
HxGN SmartNet - Australia

- Coverage – Tasmania (23)
  - GA = 10
  - HSN = 13
  - Predominately Ag usage in North
  - Plans to expand coverage between the main towns

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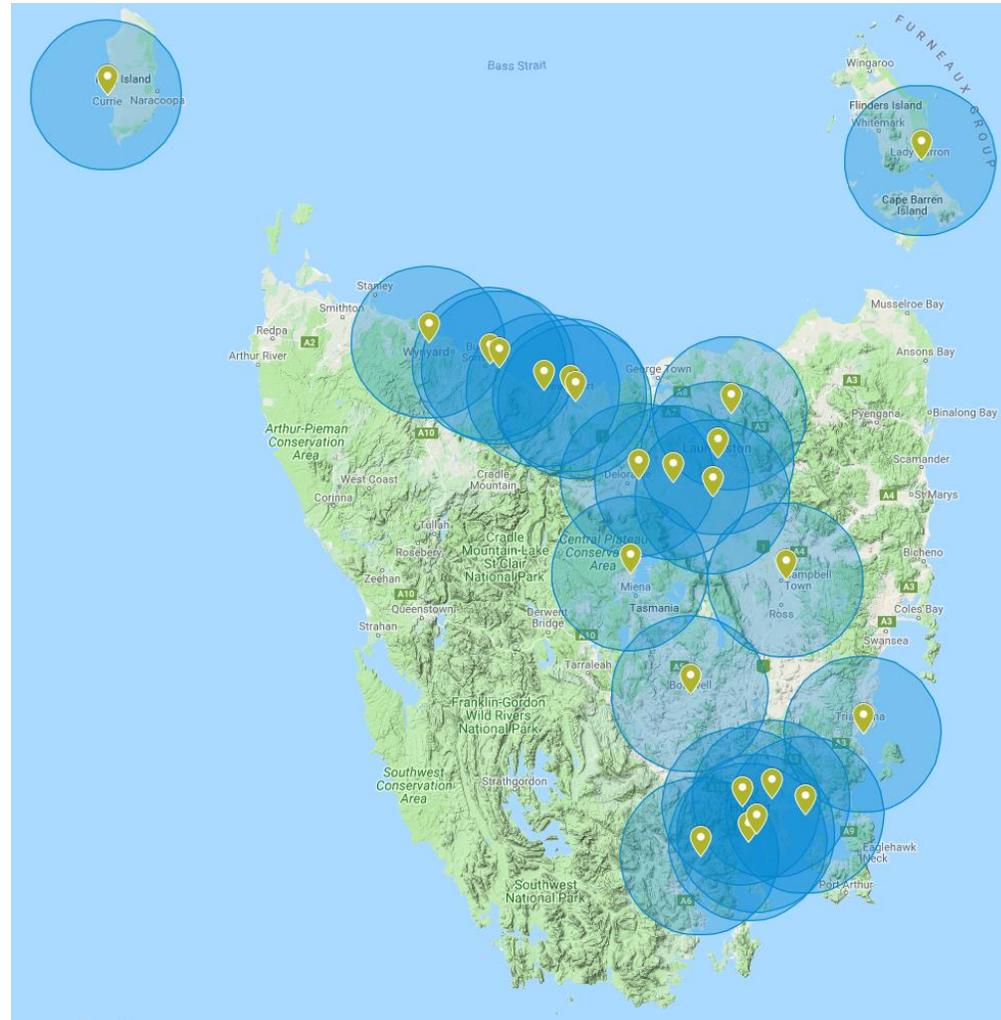
HxGN SmartNet - Australia

- Coverage – Western Australia and Northern Territory (96 sites)
  - GA (Land NT + LandGate) = 61
  - HSN = 35
  - Coverage is growing
  - Focus on expansion around metro Perth

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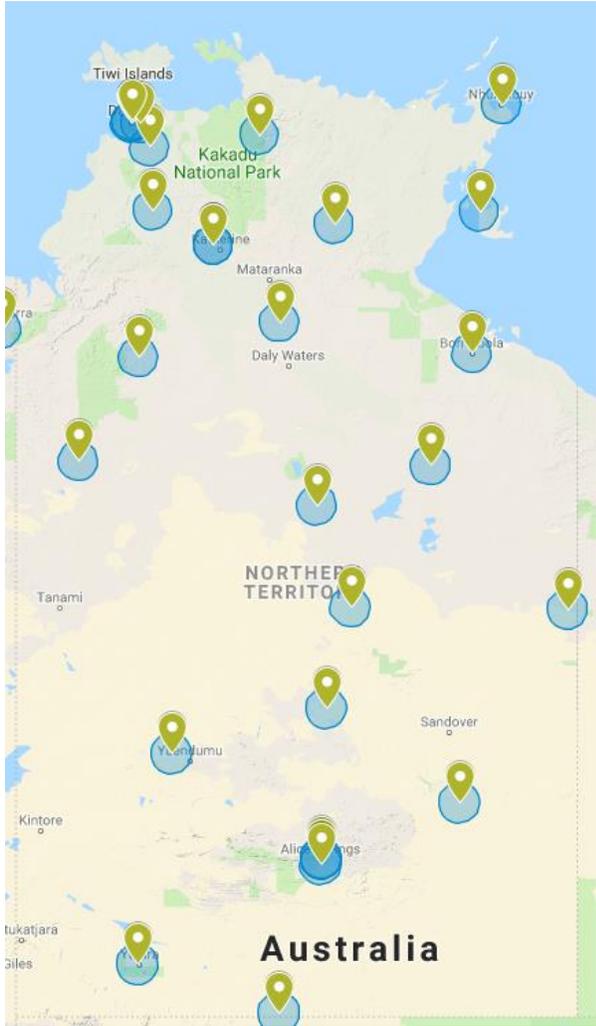
Fiji CORS Network

- Current Network – Base Stations
  - Geosciences Australia / South Pacific Community Sites
    - LTK
    - SUV
  - High Target Sites
    - LAB
    - TAV
    - NAB
  - Leica Geosystems
    - ROT
    - KOR
    - KDV
    - LAK
    - ONO
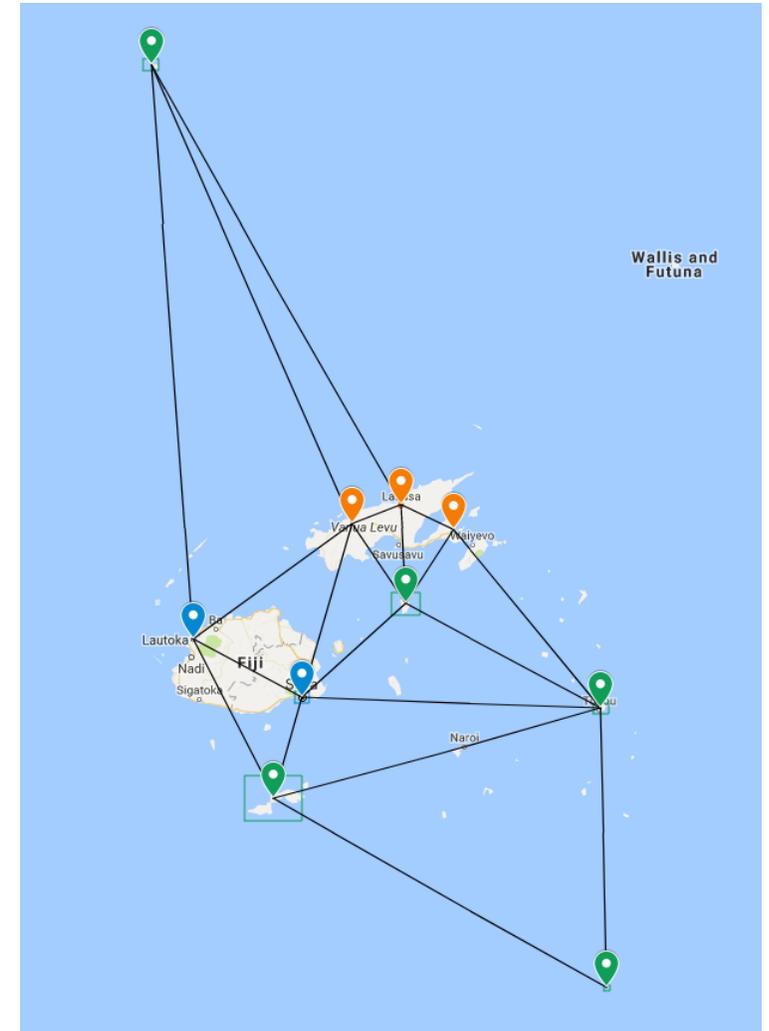
Fiji CORS Network

- Future
  - Base stations currently being installed
    - More Base Station
    - Upgrade of stations
  - Networking Software Installation and Operation
    - What software
  - Business Model
    - Public Private Partnership
    - Publicly operated.
  - Expected adoption by the industry / private and public sector
    - Operation and maintenance

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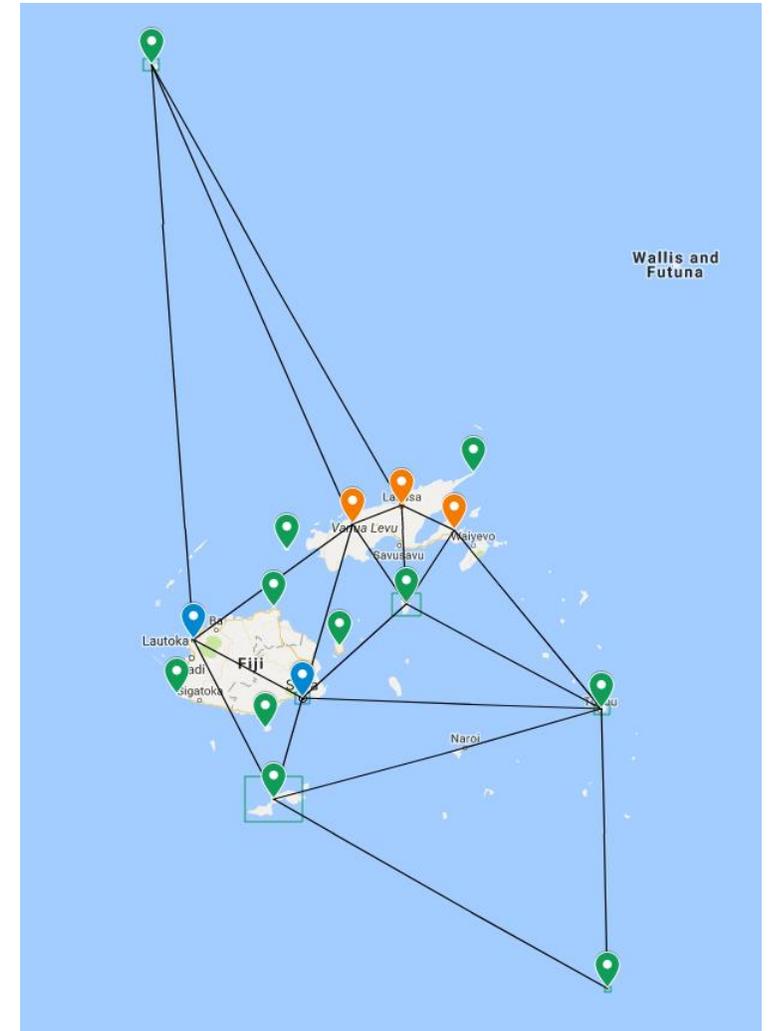
GNSS Data Dissemination

- Seems simple
  - Get data from base stations
  - Provide to end users
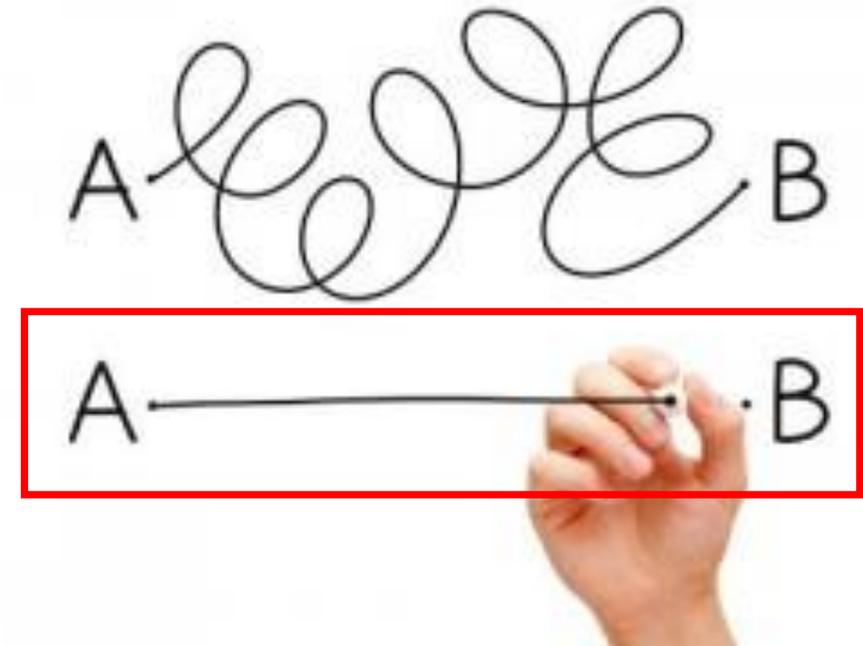
GNSS Data Dissemination

- Extensive Network
  - 670+ sites
- Range of Users
  - Different applications
    - Agric
    - Survey
    - Machine Control
    - UAVs
    - Utilities finding
    - PPK users
  - Different geographical regions
    - State
    - National

- Real Time Data
  - Most users
- Post Processing Data
  - PPK users
- Processing Methodology
  - Network
    - MAC
    - VRS
    - FKP
    - SSR
- GNSS
  - GPS only
  - GPS+GLONASS
  - Everything
- Datums
  - GDA94
  - GDA2020

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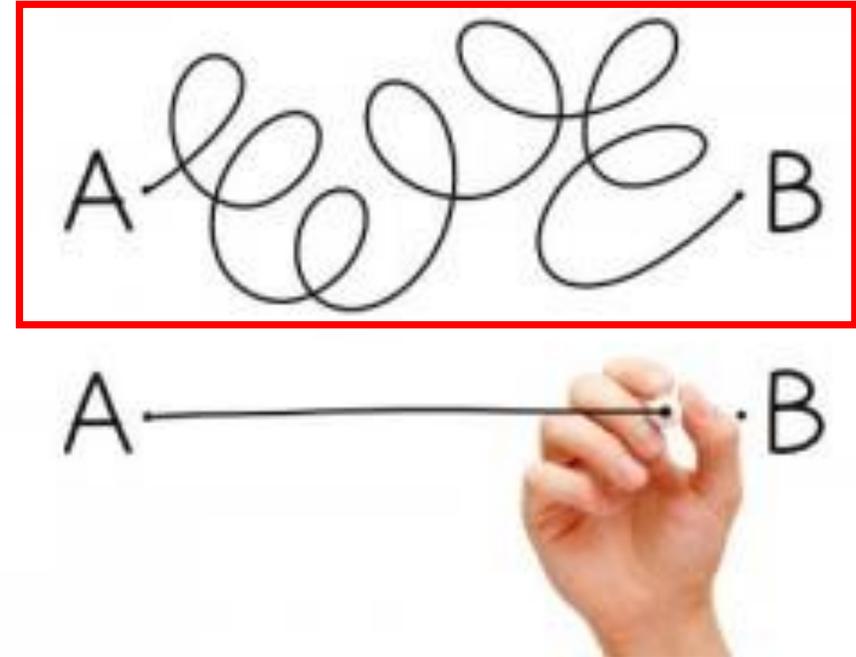
Real-Time Data Dissemination

- Application Based Division
  - Survey and everything else except some GIS
  - Agric
  - Some GIS
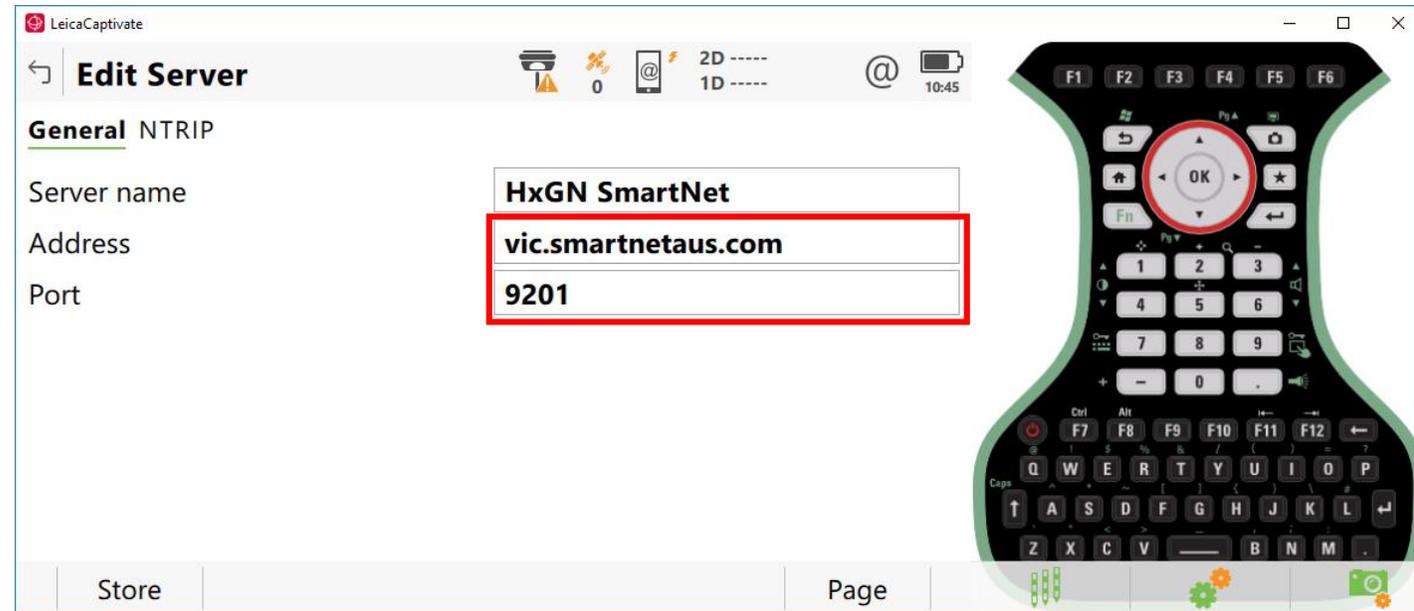
Real-Time Data Dissemination

- Geographic Based Division
  - Single State License => Following Post Code
    - Most users
      - NSW
      - VIC
      - QLD
      - SA
      - WA
      - TAS
      - NT
  - National License
    - Some users
    - Will need to change port number when move states
- Currently working on an ubiquitous National and possibly Global solutions
  - Change settings automatically when crossing borders

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← **Edit Server**   2D ----- 1D -----   10:42

General NTRIP

Server name	**HxGN SmartNet**
Address	**www.smartnetaus.com**
Port	**18101**

Store   Page

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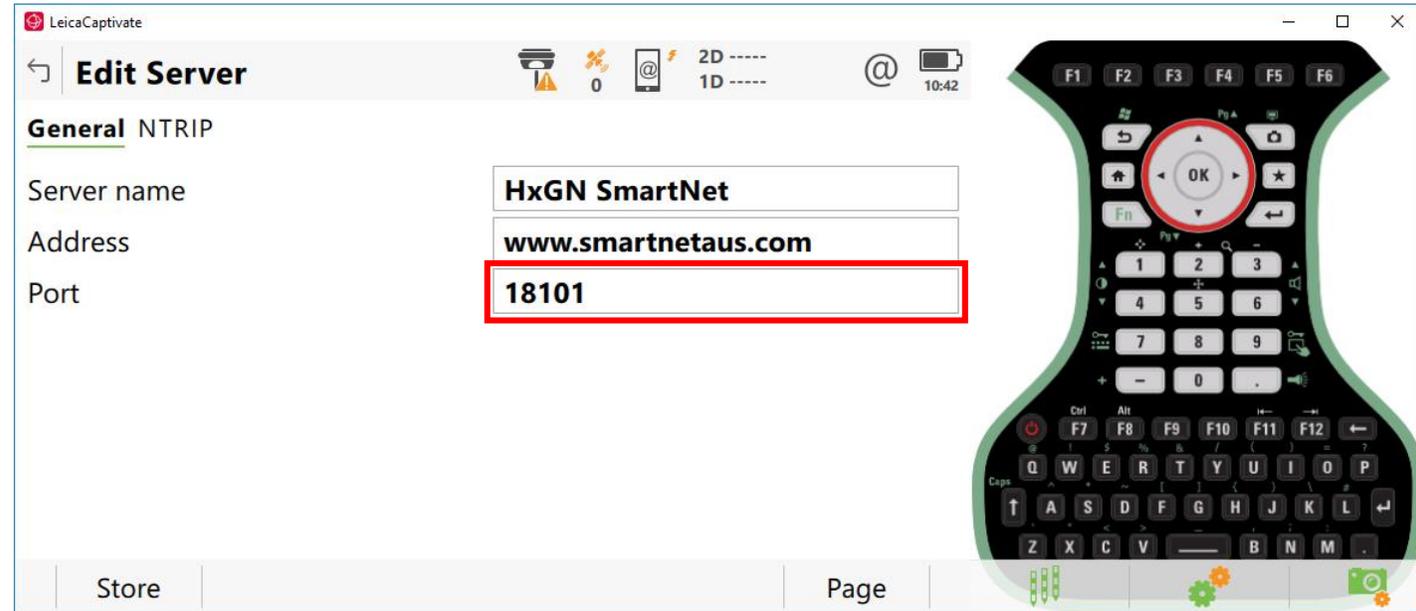
Real-Time Data Dissemination

- Formats
  - Mount Point Names
    - MSM
    - RTCM 3.x
    - RTCM 2.3
    - CMR+

- Correction Methodology
  - Mount Point Names
    - MAC
    - VRS
    - iMAX
    - Others

- Datums
  - Identifier

Fiji CORS – Real Time Data Dissemination

- DNS Name = fj.hxgnsmartnet.com
  - Ports
    - Survey = 9101
    - GIS = 9102
    - Agric = 9103
    - MC = 9104

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Edit Server   2D ----- 1D ----- @ 21:54

General NTRIP

Server name	**HxGN SmartNet - Fiji**
Address	**fj.hxgnsmartnet.com**
Port	**9104**

Store   Page

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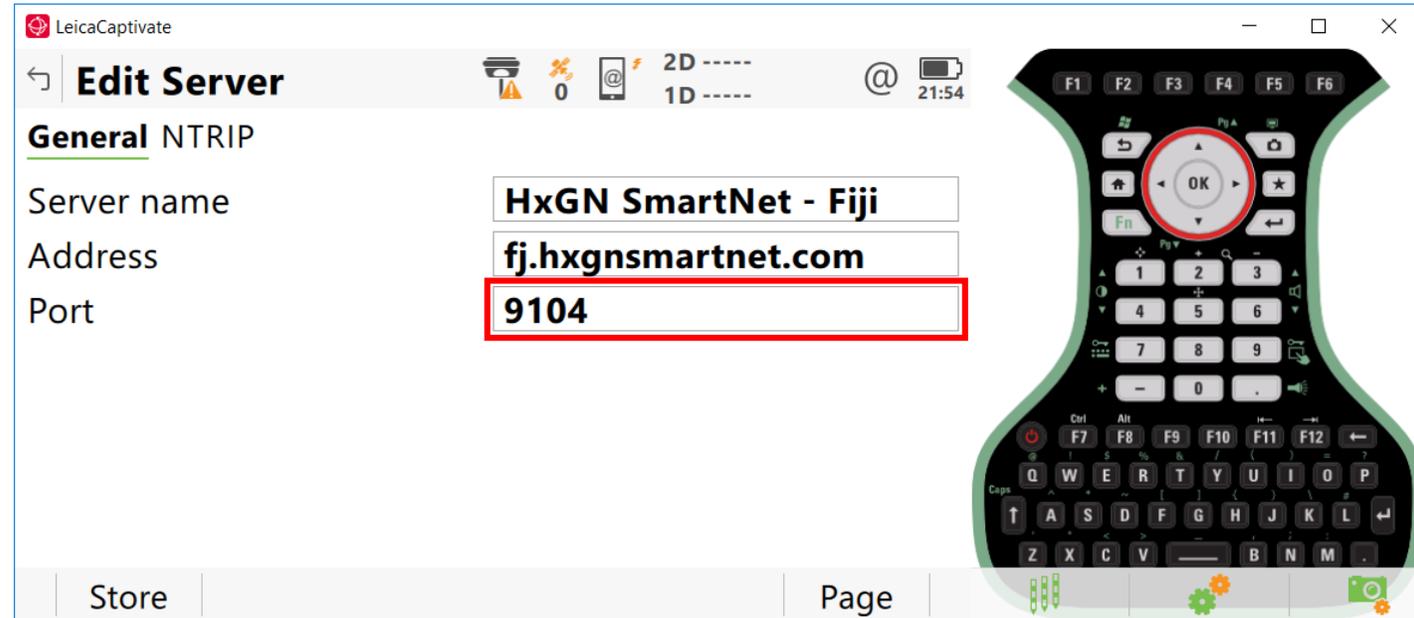
Post-processing Data Dissemination

- RINEX files
  - Multi-GNSS RINEX 3.XX from the new portal
  - RINEX 2.XX from the old portal
  - Basic QC information
    - Data completeness
    - Multipath

Post-processing Data Dissemination

- Virtual RINEX Request
  - Complete user input on one single page
  - Minimum user interaction
  - Fully automated generation of optimal virtual, non-physical data
  - Use of Virtual RINEX in Post-Processing has similar advantage like Virtual Reference Station corrections in Real-Time

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Post-processing Data Dissemination

- Online PPK Processing Engine
- X-POS Positioning Server
  - Leica Geosystems Infinity Kernel
  - Static or Kinematic
- Customised Processing Parameters
  - Single Base Processing
  - Loose Network Processing – Many base stations
  - Tight Network Processing – Combined network solution
- Detailed Reports
  - With full error ellipses and uncertainty values

HxGN SmartNet Multiple Reference Frames Support

- Maintenance of **multiple reference frames** in one installation
- Send out raw data and RTK corrections in a selected reference frame
  - allowing the rover user position directly in their chosen reference frame without the need for transformation.

HxGN SmartNet Web and App Tools

- HxGN SmartNet web access
  - More transparency into your subscriptions (logins, rovers, status)

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HxGN SmartNet Web and App Tools

- HxGN SmartNet app
  - Ideal for checking Site Status & Rover Credentials in the field
  - Network Status & NTRIP port connectivity
  - NTRIP login (username, password)
  - Mount tables
  - Subscription status

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HxGN Sm

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Tap here

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Back to country

Login

Want to learn more ab

Watch Tutor

Please find below detailed informa
SmartNet subscri

2000801_AUS_SU
LE-AHVGWBXUPN-1

Article Number
Status
Subscription period
Start Date
Renewal Date

Start date   Subscription A

2018-01-23   267 Days Rem

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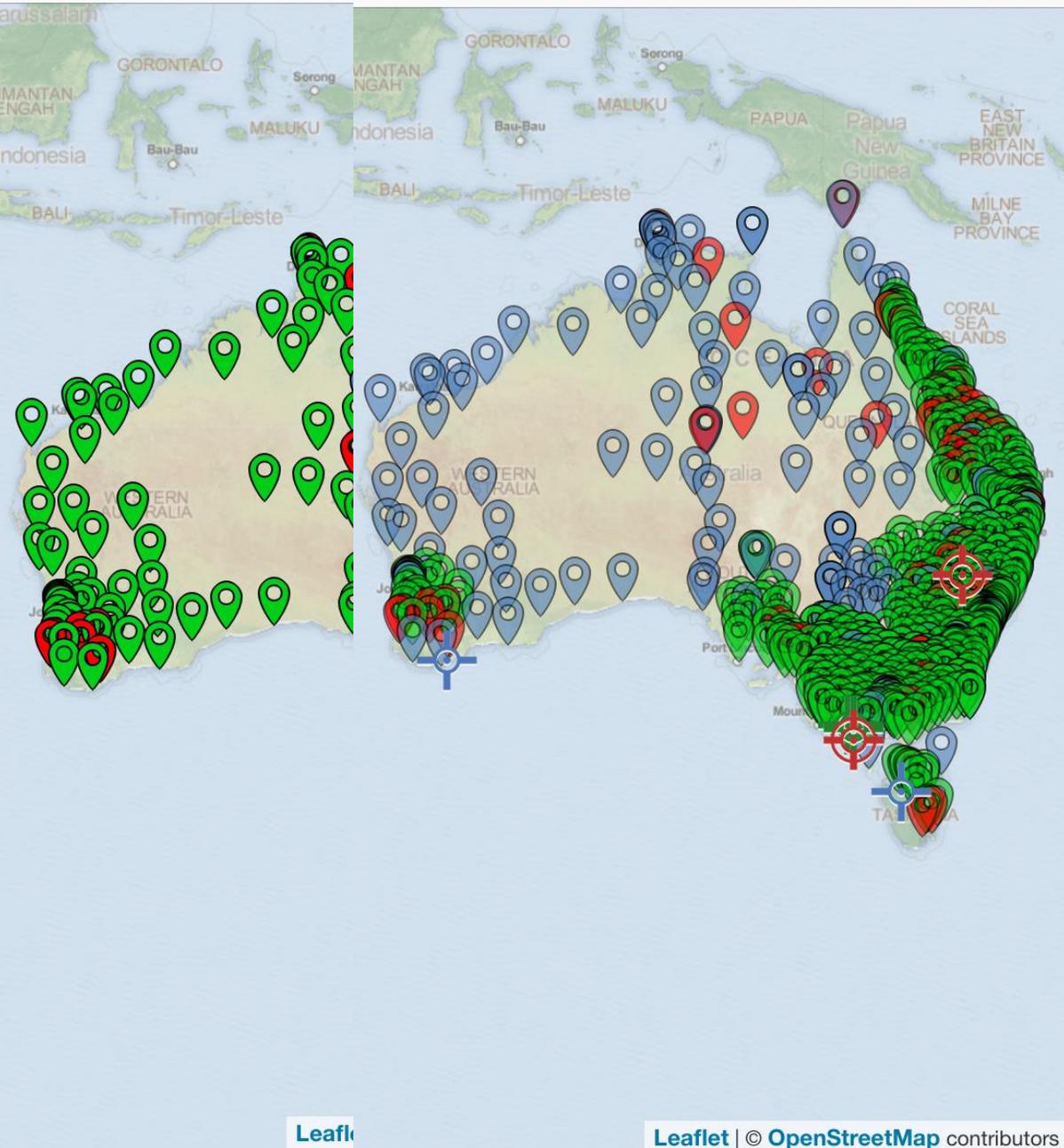
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Vinaka veka levu!

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