

# Pacific Rainwater Harvest Using Spatially Enhanced Image Data

**Pacific Islands GIS and Remote Sensing User  
Conference**

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SCALING UP PACIFIC ADAPTATION (SUPA)



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Pacific  
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SPREP  
Secretariat of the Pacific Regional  
Environment Programme



USP  
THE UNIVERSITY OF THE  
SOUTH PACIFIC





# Prediction of Water Shortage

**Periods of low rainfall will increase world wide. Prediction is important, factors are:**

- **Rainfall of last months**
- **General rainfall prediction**
- **Water consumption**
- **Harvest potential**
- **Actual harvest**

# Rainwater Monitoring and Prediction

- Rainfall measurement facilities on the island
- Rainfall prediction conducted in Palau capital with long experience

**weatherbase**

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## ANGAUR ISLAND, PALAU

Home > Oceania > Palau

Elevation: 20 feet   Latitude: 06 54N   Longitude: 134 09E

Köppen Classification: Tropical Rainforest Climate



MONTHLY  
ALL DATA

MONTHLY  
SUMMARY

FEEDBACK

# Water Consumption

- **Drinking water**
- **Shower**
- **Toilet**
- **Cloth washing**
- **Pigs and pets**
- **(Car washing)**



**~ 150 litres / day**

# Elements of Rainwater Harvest

- **Rainfall** → **OK, data available**
- **User** → **OK, data available**
- **Tank** → **OK, data available**
- **Downpipe** → **OK, data available**
- **Gutters** → **OK, data available**
- **Roofs** ..... ?

# Tanks, Gutters, Downpipes

ROOF_ID	AREA	TANKID	TankVol	FirstName	FamilyName	WaterSt	Gutter	DownPipe
T03-R009	76	005	70	Missionary's house		Yes	GOOD	GOOD
T03-R012	202	002	750	Gulibert	Guest	Yes	NOCO	MISS
T05-R005	208	038	1,500	Silang Family		Yes	GOOD	GOOD
T06-R001	245	043	1,000	Tangelbad		Yes	DAMA	DAMA
T06-R006	210	008	55	Natus	Misch	Yes	GOOD	GOOD
T06-R007	74	021	1,000	Tomei		Yes	GOOD	GOOD
T06-R010	142	022	75	Elizabeth		Yes	GOOD	GOOD
T07-R001	133	042	2,000	Faith	Swords	Yes	GOOD	GOOD
T07-R006	238	029	500	Carlus	Ramon	Yes	GOOD	GOOD
T07-R010	122	016	700	Osiabol/Catholic church		Yes	GOOD	GOOD
T07-R016	284	018	300	Vera	Setsuo	Yes	GOOD	GOOD
T08-R003	199	030	150	Etang	Lewis	Yes	GOOD	GOOD

# Database

- Database can connect all elements
- Database can analyse all elements

File Home Create External Data Database Tools Help Tell me what you want to do

MainForm x AngaurWaterTankSurvey\_02 x

## Rainwater Harvest

Village Angaur

Houses in Village:	41
Houses Rainwater Harvest Facility:	17 41 %
Houses Rainwater Harvest working:	13 32 %
Houses damaged Rainwater Harvest:	4 10 %
Houses NO Rainwater Harvest:	24 59 %

Navigation Pane

House_ID	002	Rainwater harvest:	Yes	Harvest damaged:	Y
Name	Gulibert		GuestHouse 1		
Gutter Condition	Not connected to tank				
Downpipe Condition	Missing				
Tank Volume [Gallon]	750				
Tank Type	Concrete				
Project	n/a				
Installation Year	More than 30 years				



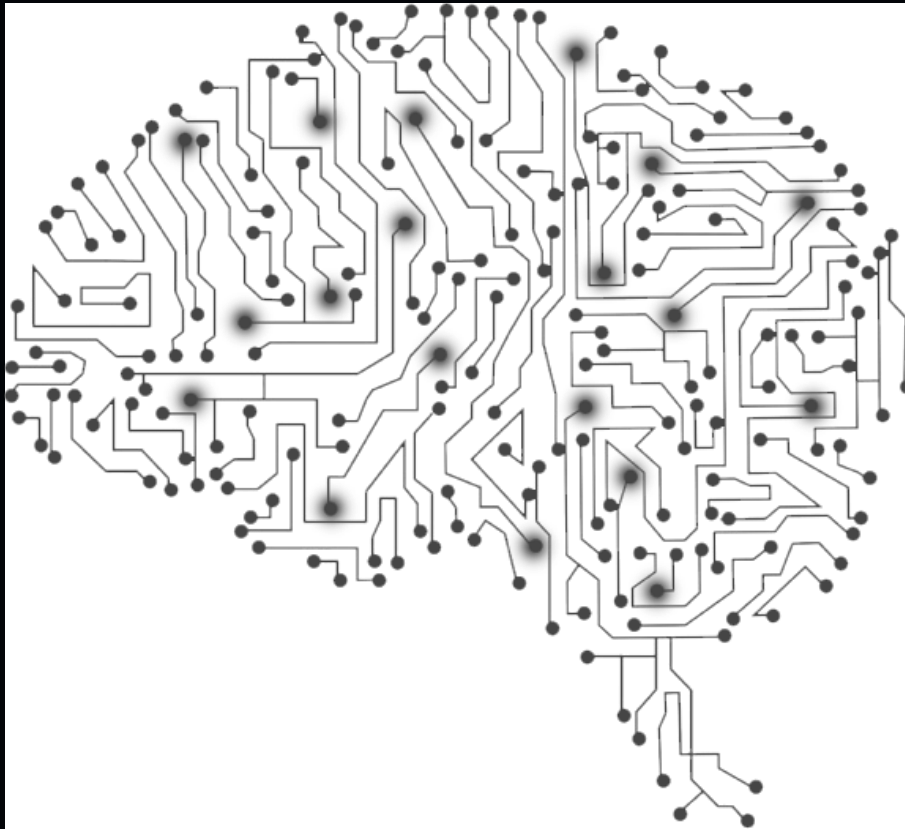
# WorldView 3 Image Data

- **30 cm resolution** → **15 cm through spatial enhancement**
- **Geometrically correct**
- **No data processing**
- **Direct GIS import and digitizing**

***Rainwater harvest potential can be estimated with satellite image data***

50 cm

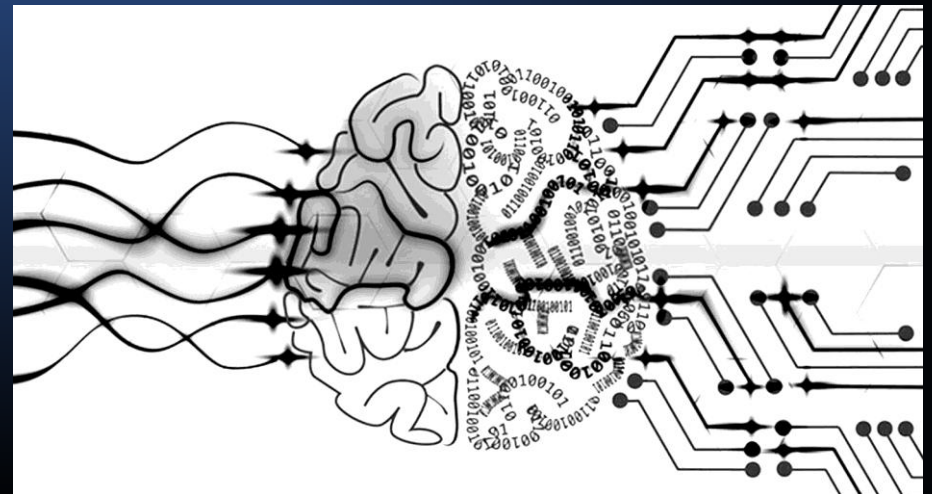




# Spatial data enhancement by BLUECHAM from 50 cm to 15 cm

## Artificial intelligence:

- **Contrast enhancement**
- **Edge enhancement**
- **Example data**



# 15 cm High Definition



50 cm



BLUE  
CHAM

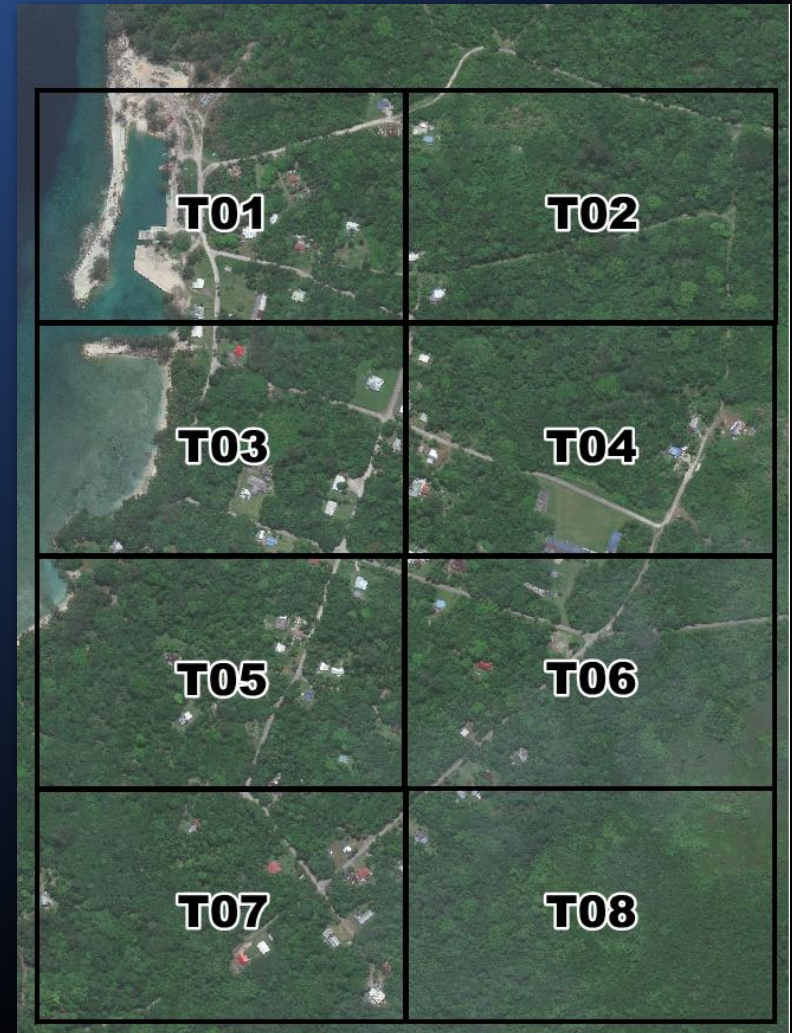
MAXAR

# 15 cm High Definition



# Practical Approach

- **Cutting image tiles**
- **Using unique IDs reflecting the image tiles**



# Digitising and Tank Allocation





# Database

- **Analysis roof area**
- **Link between rainwater harvest elements**

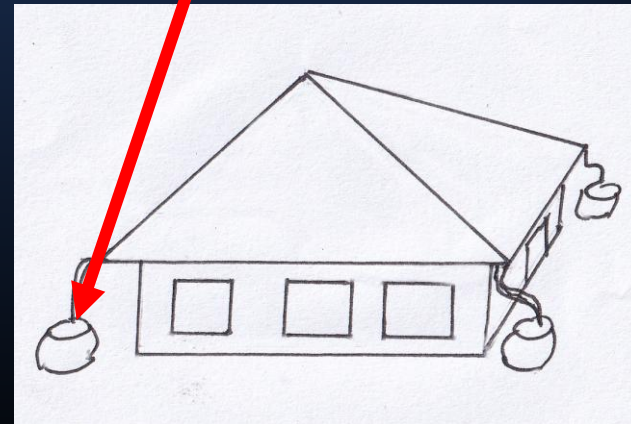
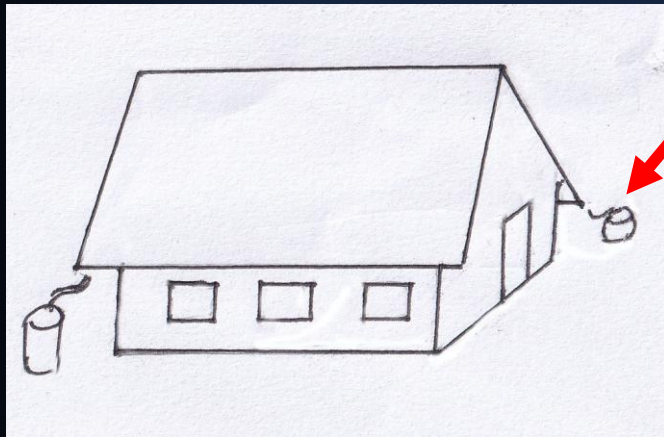
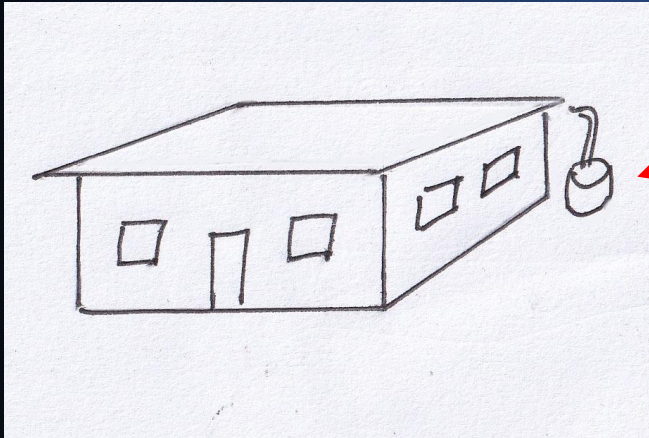
## Angaur Roofs

Number of roofs	101	Roof max [m2]	896	Roofs pandanas	1	35
Area sum [m2]	14,672	Roof min [m2]	13	Roofs metal	86	13,014
		Roof avg [m2]	145	Roofs unknown	13	1,415

Roof ID	Area [m2]	Type	Tank
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T01-R001	141	Metal	XXX
T01-R002	123	Metal	XXX
T01-R003	36	Metal	XXX

# More detailed survey necessary



**100 % capture**  
**50 % capture**  
**25 % capture**

# Calculation of Roof Catchment Area

- A. Field team estimates the percentage of catchment from the complete roof**
- B. The calculation is performed with 15 cm image data**



# Roof Capture with Drones

## Cost estimation:

- **Team (3 people 5 days DSA \$ 300/day)**
- **Drone (\$10,000 / 3 / 52 → \$ 64 /day)**
- **GNSS (\$15,000 / 3 / 52 → \$ 96 /day)**
- **Drone image processing 5 days 2 people**
- **Transport cost**
- **Salary, insurance**
- **= > \$ 5,000 to \$ 10,000**

# 15 cm Satellite Image

12 km<sup>2</sup>



**\$US 312**



**Thanks**