Lirima

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Zinave National Park: Mozambique

A Digital VHF Communications Network Design Case Study

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Locality

Central Mozambique

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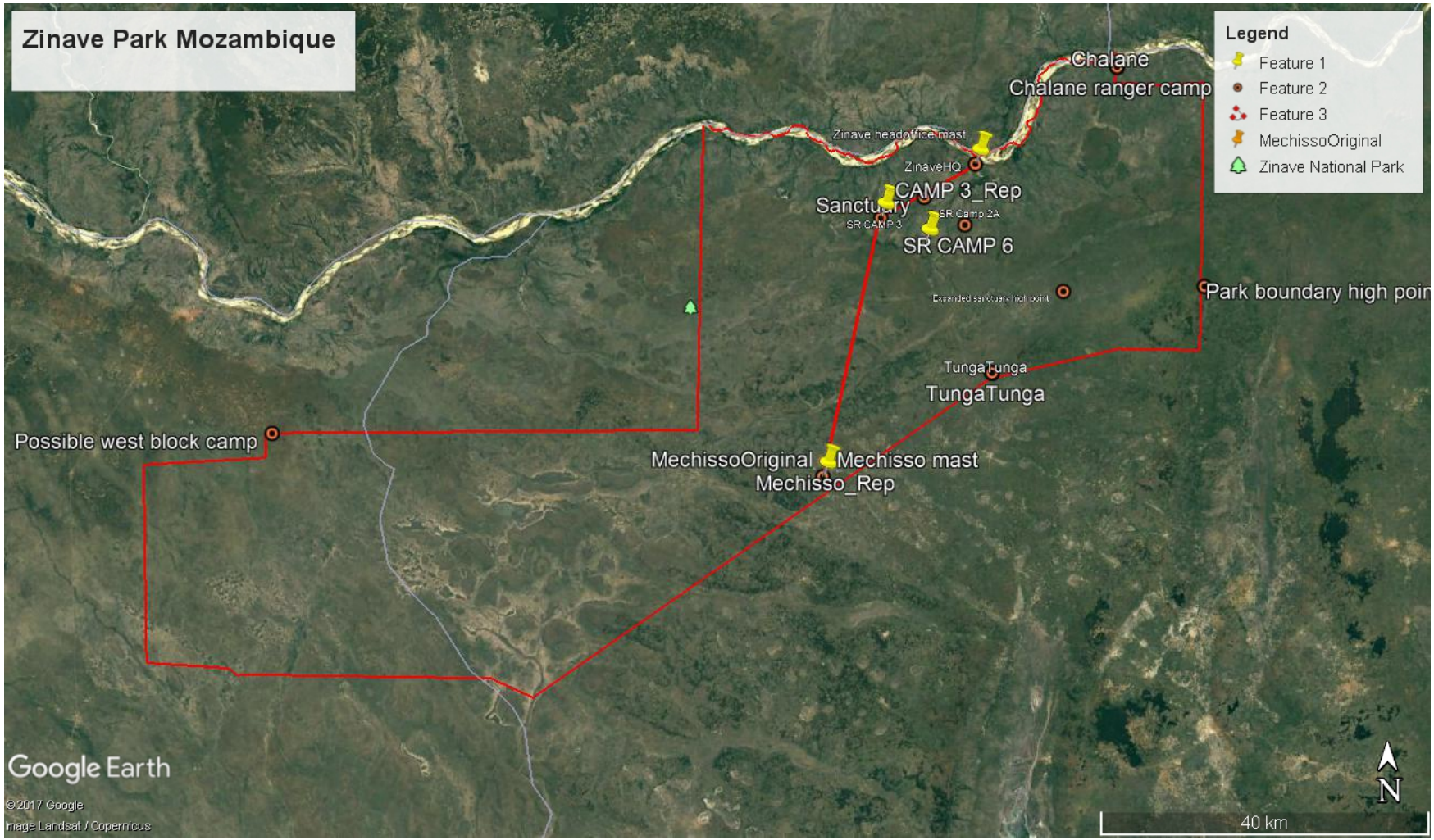
Locality (2)



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Background

General:

- Zinave Park in Mozambique is being re-established, wildlife stabilised and increased
- Infrastructure improved and developed for tourism
- Supported by the Peace Parks Foundation in SA and other International partners
- Subtropical environment with heavy summer rains sometimes
- Park requires an efficient voice communication system for parks management
- Not feasible to cover the entire park, so focus on core areas

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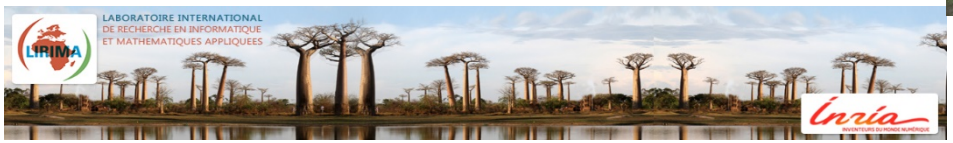
Topography

- Terrain is very flat with no mountains or high ground
- Vegetation subtropical/tropical with seasonal floodplains
- High trees and shrubs

Topography (2)



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Topography (1)

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Design Options (1)

High Frequency Radio
2 – 30 MHz

Advantages:

- Unlimited coverage
- No repeater stations required
- New digital design eliminates many practical problems

Disadvantages:

- Antenna size
- Propagation still influenced by solar and other atmospheric activity
- Expensive

Design Options (2)

VHF & UHF Radio
130-170 / 420 – 470 MHz

Advantages:

- Excellent voice quality
- New digital implementation emulates mobile phone functionality
- Highly convenient

Disadvantages:

- Coverage limited by topology and repeater placement
- UHF more limited than VHF
- Infrastructure expensive
- IP links required between repeaters

Design Methods & Considerations

- Coverage (propagation) prediction by using a DEM (Digital Terrain Database) with resolution 30m x 30m
- Intersite data links designed using the same database
- Different sites investigated
- Placement guided by terrain and practicality
- Solar supplies required
- Maximum coverage the objective
- Budget constraints, as usual
- Park offices at Zinave HQ, Tunga-Tunga & Mechisso
- No other infrastructure

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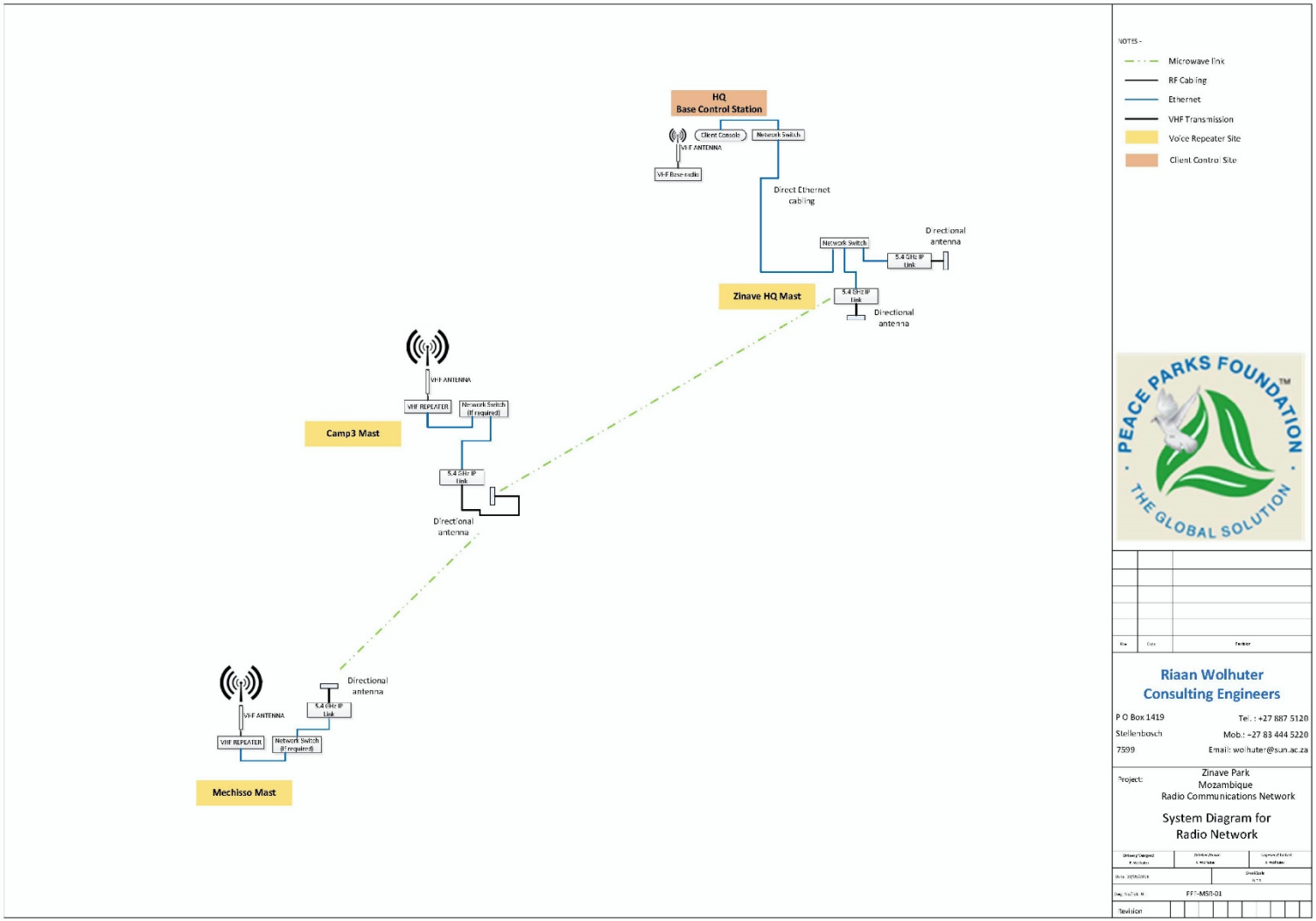
System Design



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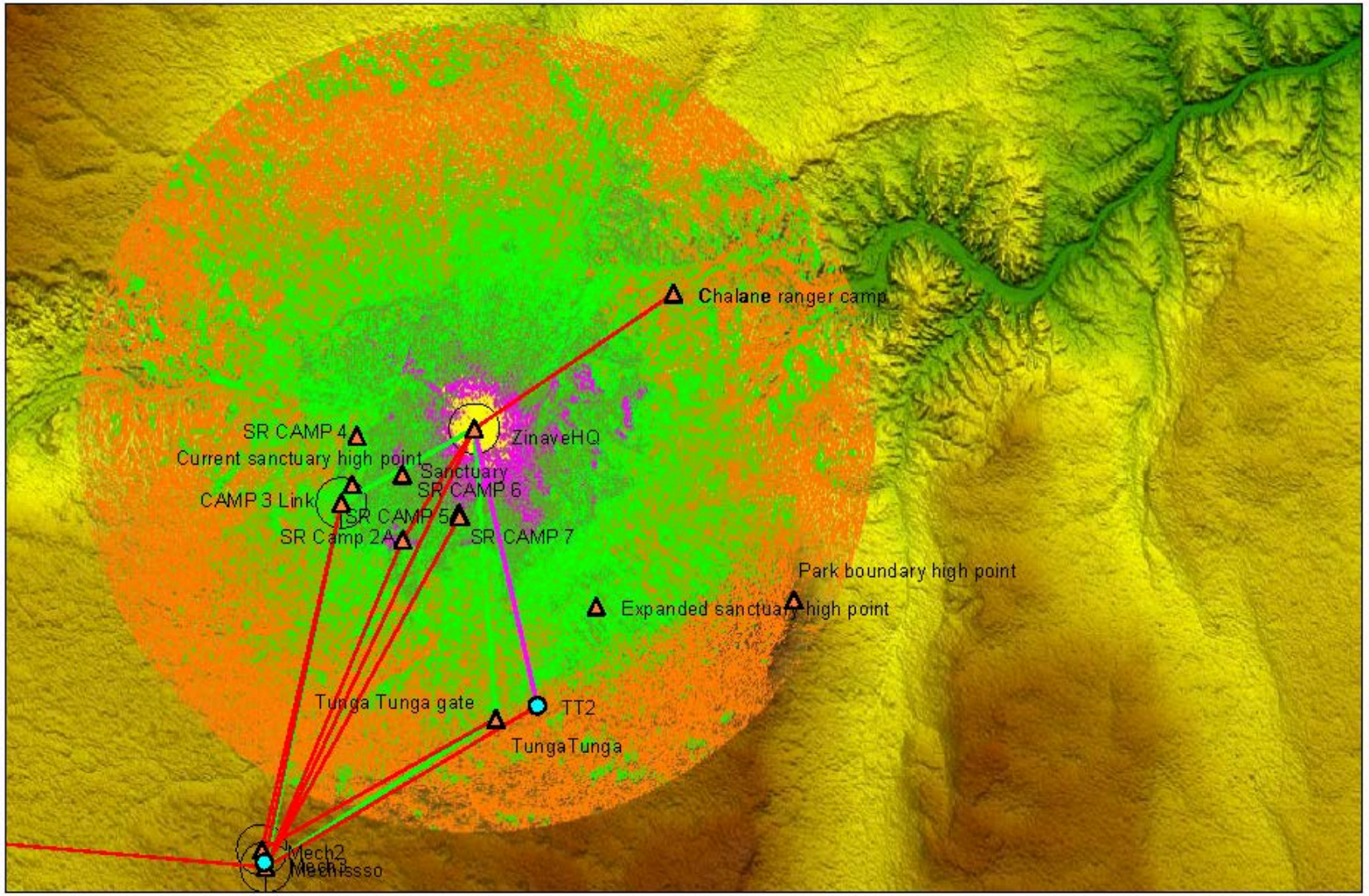
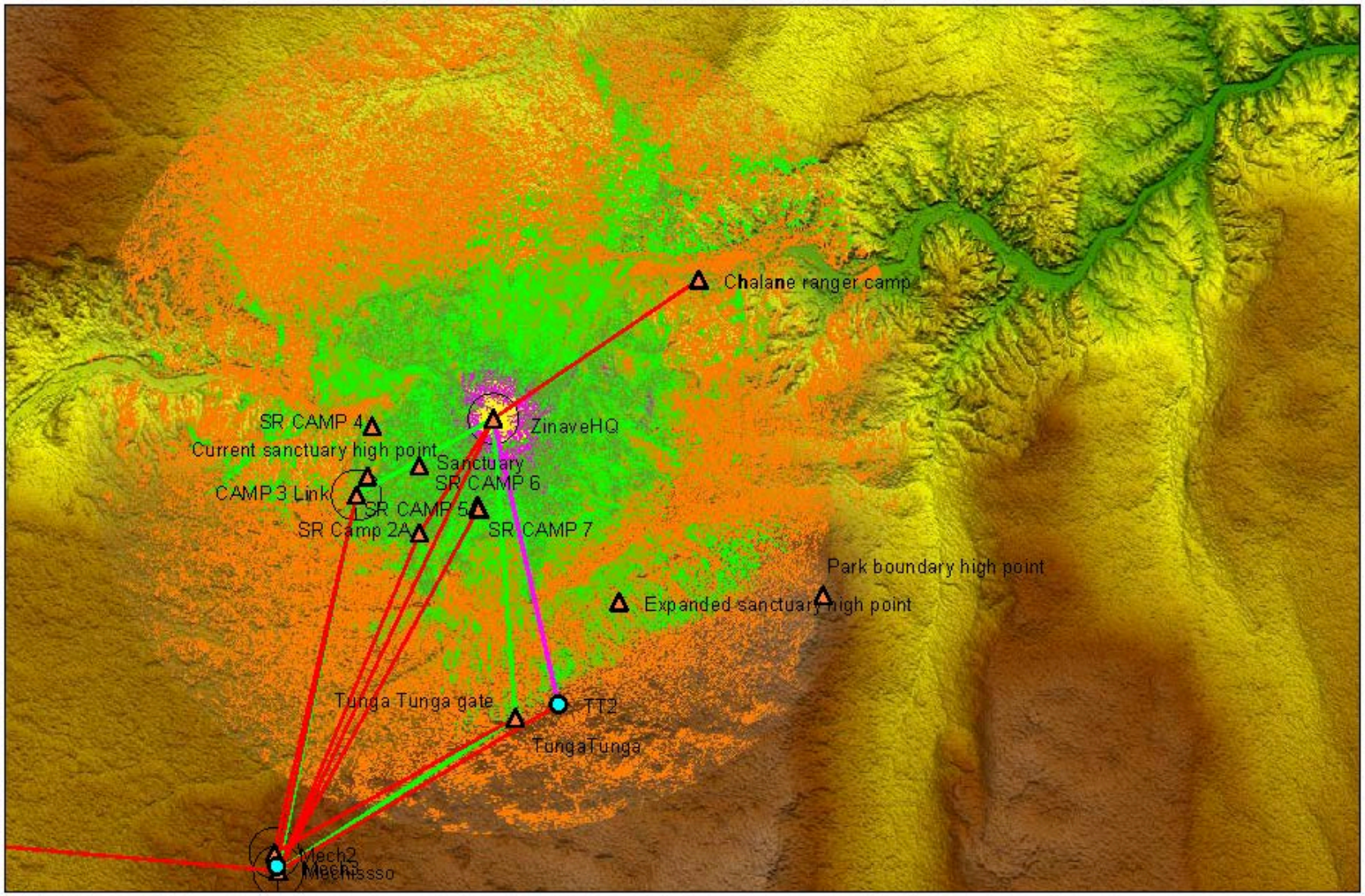
Cover from Zinave HQ

VHF Coverage (Subtropical)



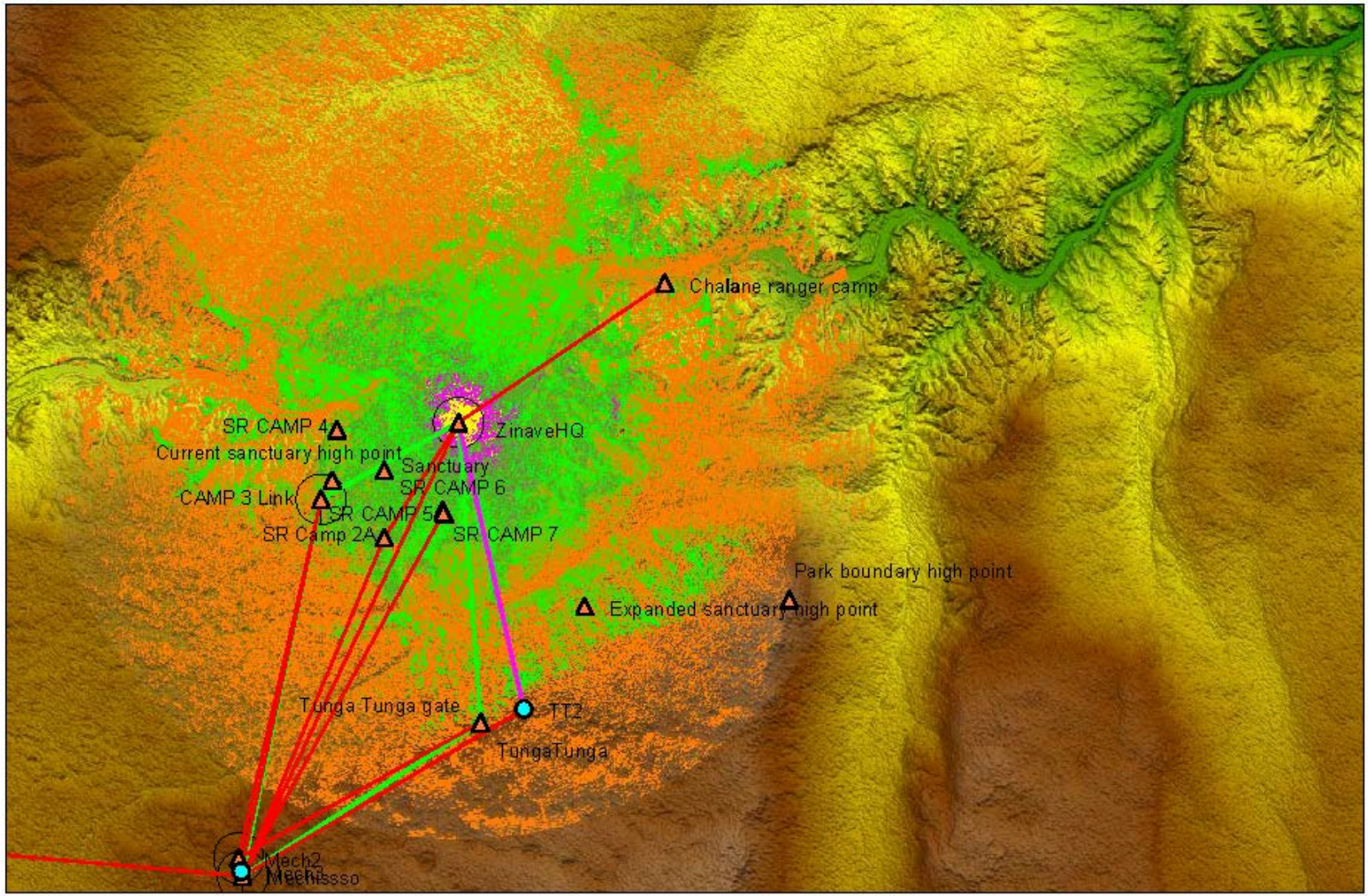
UHF Coverage (Subtropical)

Cover from Zinave HQ



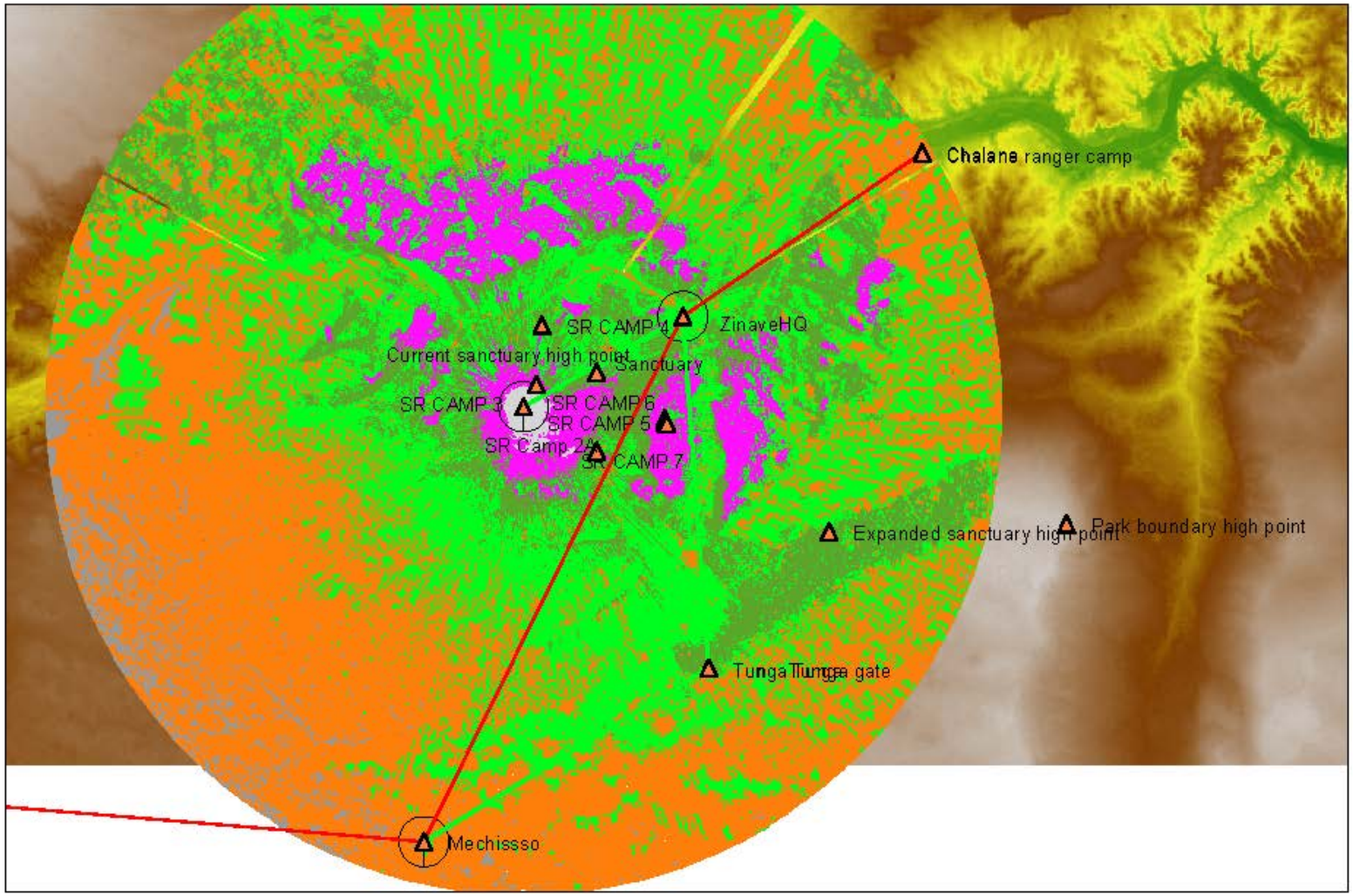
UHF Coverage (Dry trees)

Cover from Zinave HQ



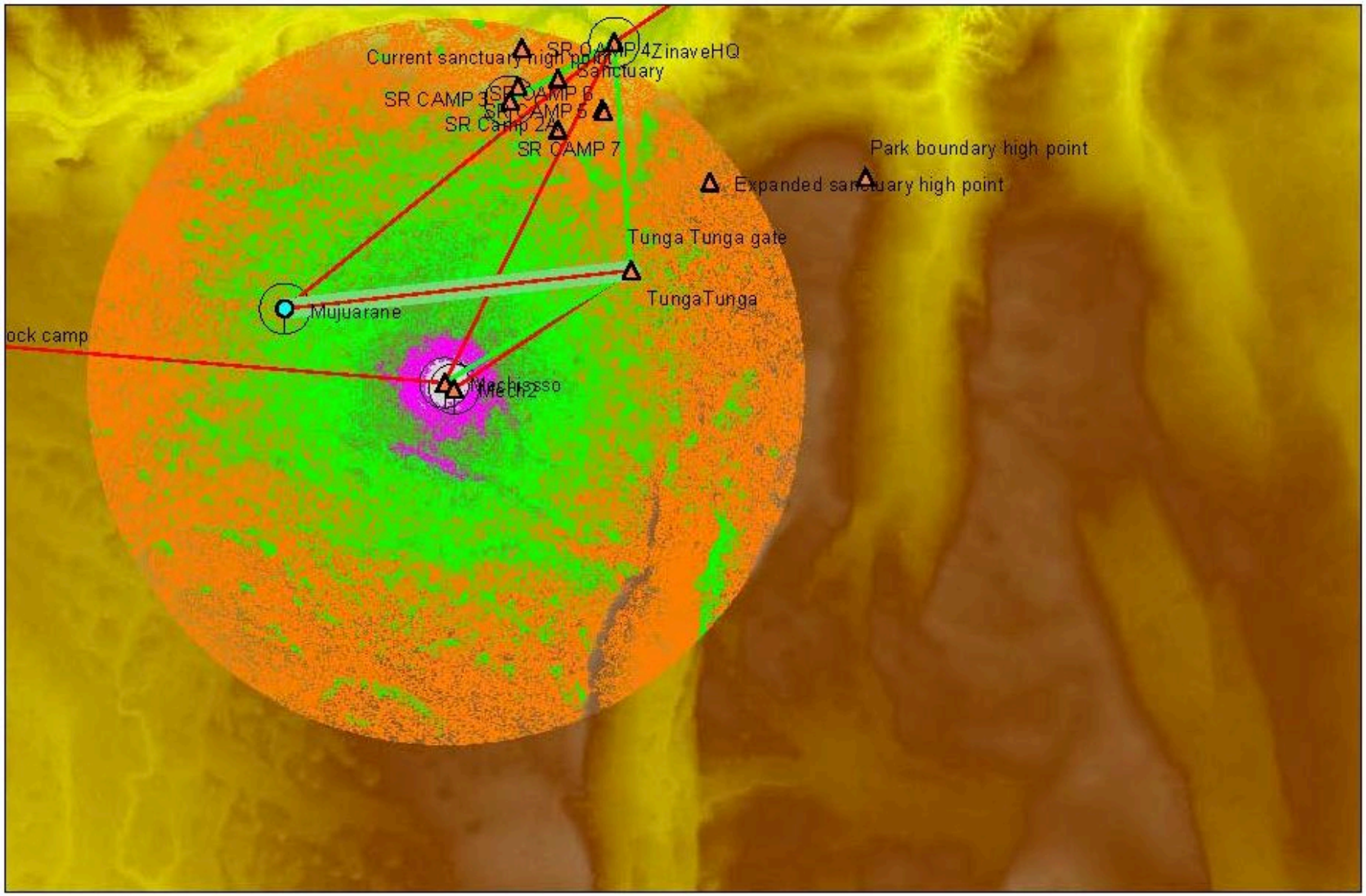
VHF Coverage

Cover from Ranger Camp 3



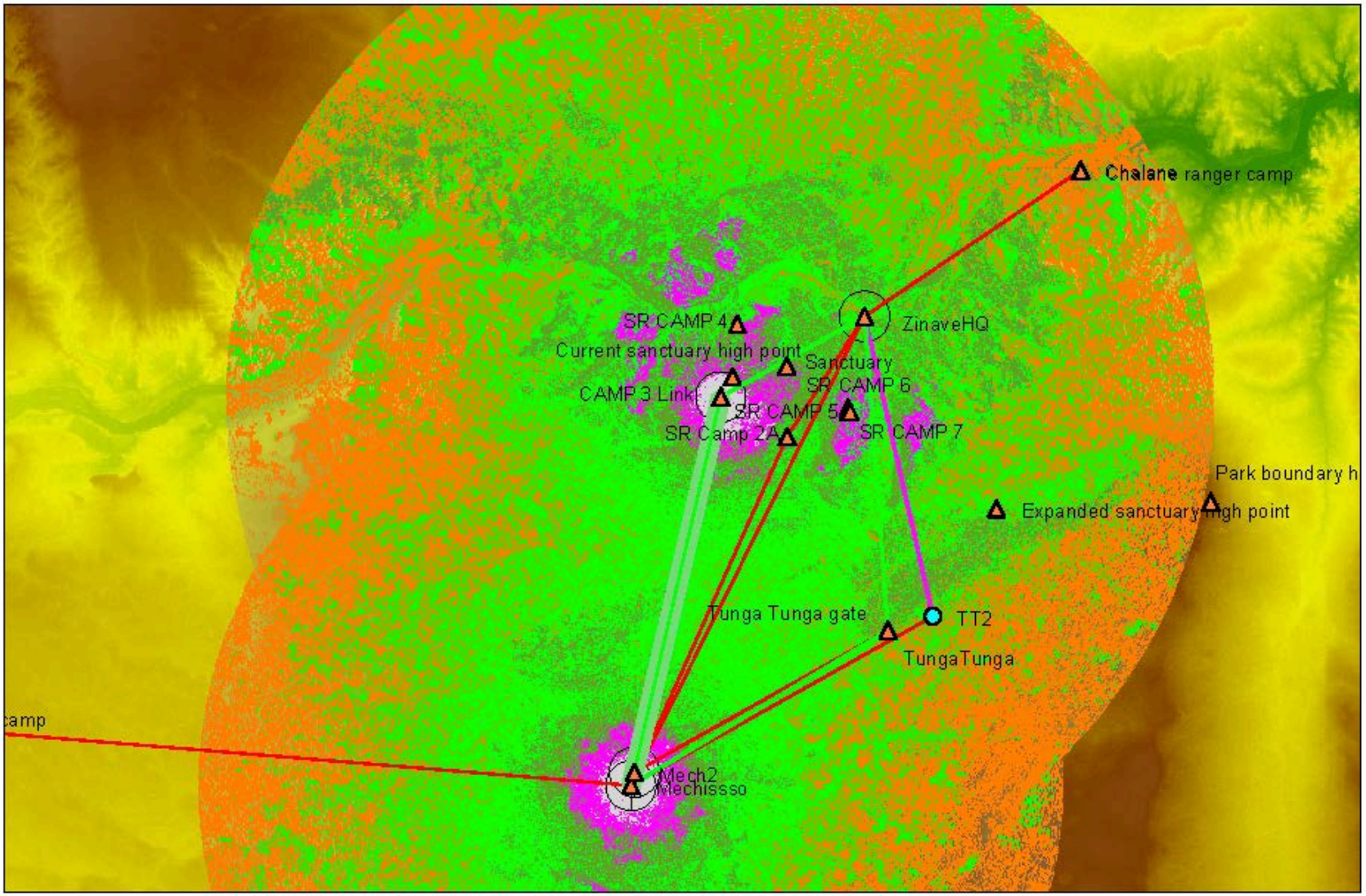
VHF Coverage

Cover from Mechisso



VHF Coverage

Combined Cover



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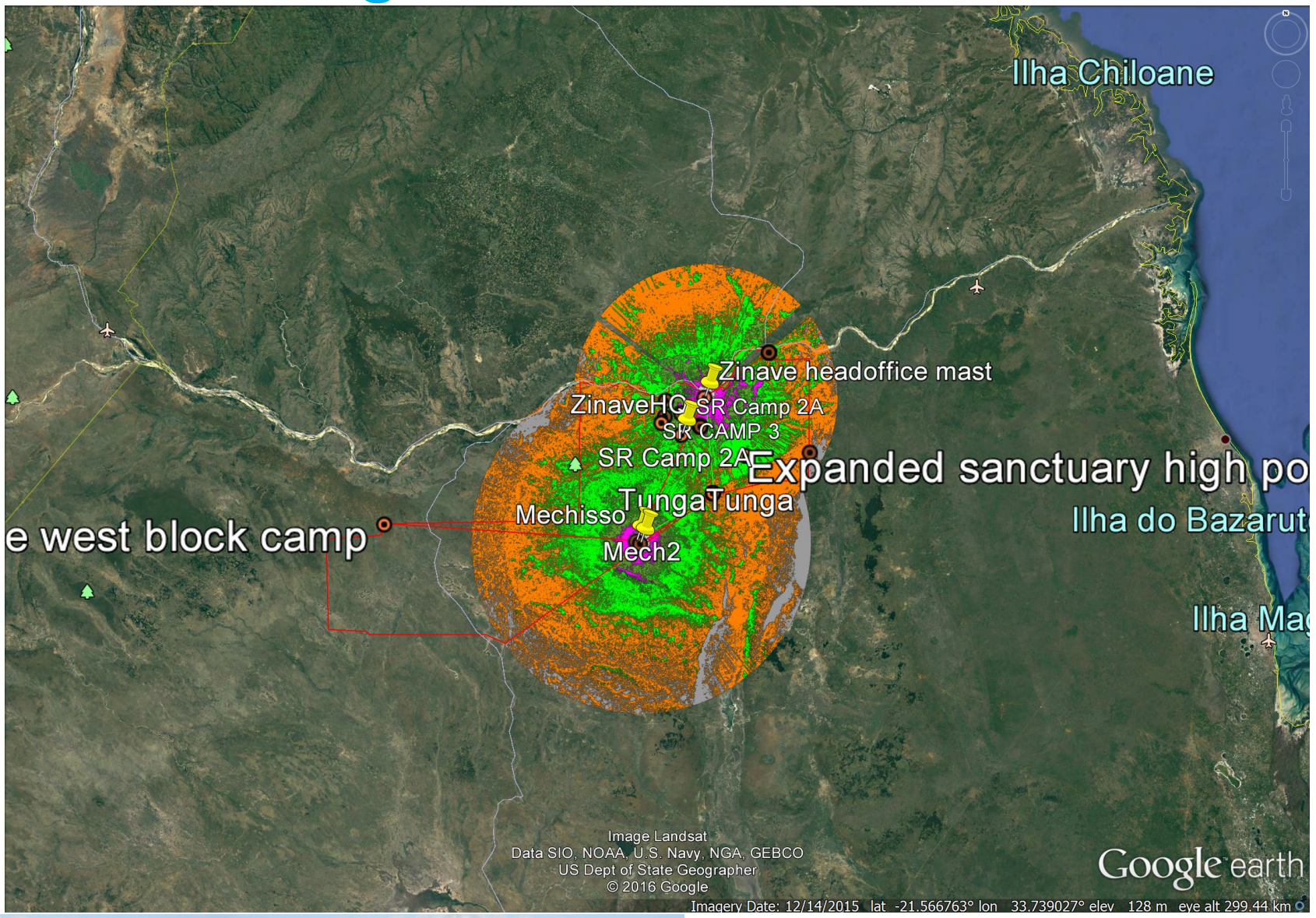
VHF Coverage

Combined Cover



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Link design

- We need Microwave links between Zinave HQ - Camp 3
- Camp 3 – Mechisso
- Utilise ISM band 5.7 GHz equipment
- Design using Pathloss© propagation toolset

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Link design

Pathloss

F = 5800.00 MHz K = 1.33 %F1 = 100.0, 60.0

	CAMP 3 Link	ZinaveHQ
Latitude	21 28 44.29 S	21 25 14.79 S
Longitude	033 45 07.55 E	033 51 46.90 E
True azimuth (°)	60.76	240.72
Vertical angle (°)	-0.34	0.25
Elevation (m)	139.84	67.63
Antenna gain (dBi)	28.00	28.00
Antenna height (m)	15.00	19.00
TX loss (dB)	0.00	0.00
RX loss (dB)	0.00	0.00
Diffraction loss	0.00	
TX power (dBm)	5.00	5.00
EIRP (dBm)	33.00	33.00
Receive signal (dBm)	-69.24	-69.24
Thermal fade margin (dB)	20.76	20.76
Effective fade margin (dB)	20.76	20.76

Multipath fading method - Vigants - Barnett
Rain fading method - Rec. ITU-R P.530-8/13 (R837-5)

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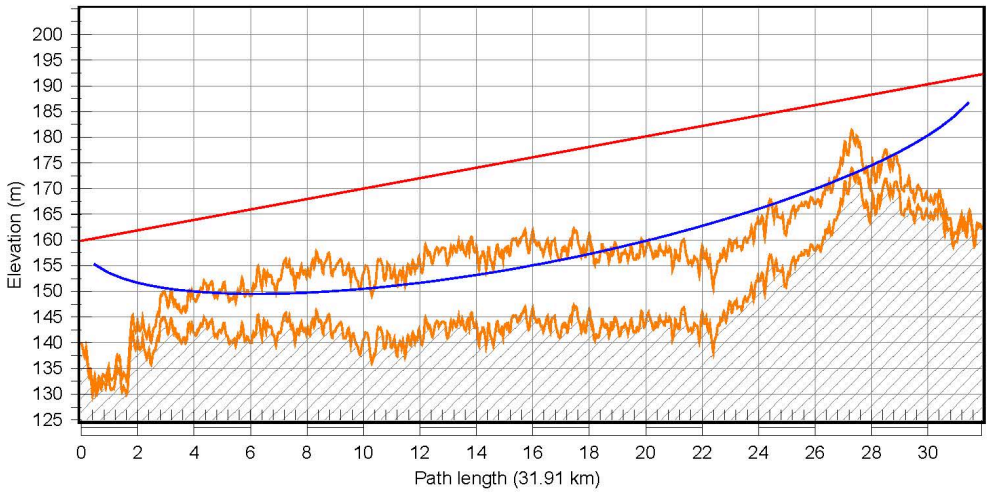
Link design

Camp 3 - Mechisso

Pathloss



F = 5400.00 MHz K = 1.33 %F1 = 100.0, 60.0

	CAMP 3 Link	Mechissso
Latitude	21 28 44.29 S	21 45 35.21 S
Longitude	033 45 07.55 E	033 40 58.67 E
True azimuth (°)	192.95	12.98
Vertical angle (°)	-0.05	-0.17
Elevation (m)	139.84	162.26
Antenna gain (dBi)	28.00	28.00
Antenna height (m)	20.00	30.00
TX loss (dB)	0.00	0.00
RX loss (dB)	0.00	0.00
Diffraction loss	2.13	
TX power (dBm)	20.00	20.00
EIRP (dBm)	48.00	48.00
Receive signal (dBm)	-63.58	-63.58
Thermal fade margin (dB)	26.42	26.42
Effective fade margin (dB)	26.42	26.42
Annual 2 way multipath availability (%)	100.00000	
Annual 2 way multipath unavailability (sec)	0.00	
Annual rain availability (%)	100.00000	

Typical Terrain

Typical Terrain

Typical Terrain

Typical Terrain

Present Status:
System is being installed. Completion end Oct

Discussions & Questions

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