



Radar@Sea



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Performance of the National Network of LAWR X-Band radars in El Salvador during the 1500 mm rainfall in October 2011

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Hydrology

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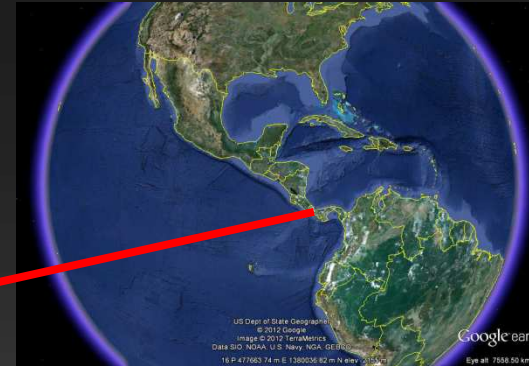
Background



- Hurricane Mitch, 1998:
 - 240 dead
 - 861 mm of rainfall
 - 10.000 affected
- Tropical Storm Ida, November 7-8, 2009 and the following (unnamed low pressure in the Pacific)
 - 198 dead
 - 355 mm of rainfall
 - 7.428 evacuated

Background

- Tropical storm Agatha 2010, May 24
 - 12 dead
 - 400 mm rainfall
 - 140 landslides



E-mail of June 2, 2010:

”..... I need to stress that time is of the essence because the rainy season has already started and with a bang. Tropical storm Agatha - the first of the hurricane and tropical storm season - hit us on Friday. Although we responded well I realized we have to improve very quickly our short term forecasts with a weather radar.

Although I have been told that under our conditions an C-band traditional custom-made radar would be more appropriate I have discarded for the time being that possibility, not only due to its cost, but basically because I am unwilling to wait for months for the system to be commissioned.

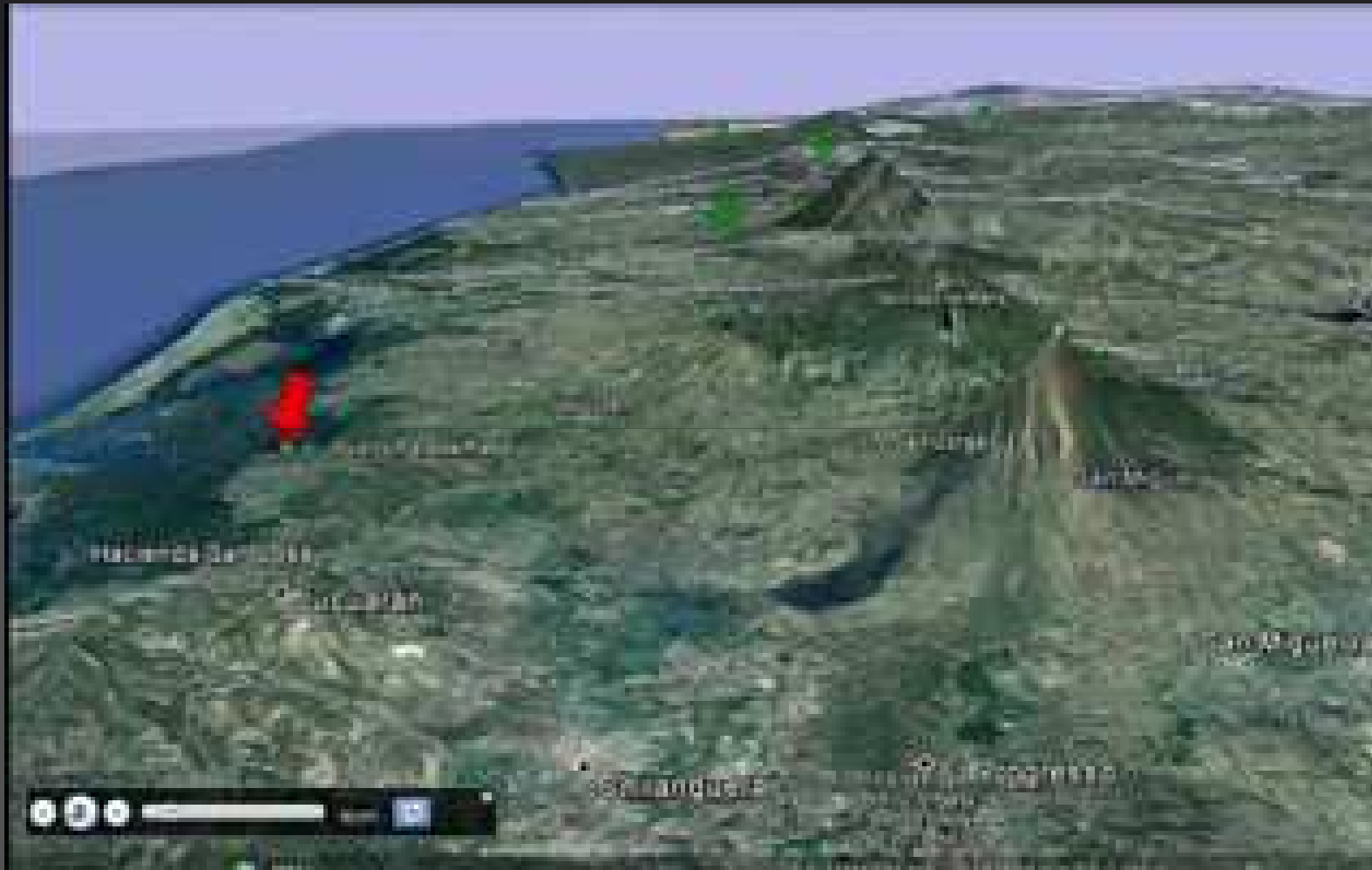
Best regards and I hope to hear from you today,

*Herman Rosa Chávez
Minister of the Environment and Natural Resources
Government of El Salvador”*

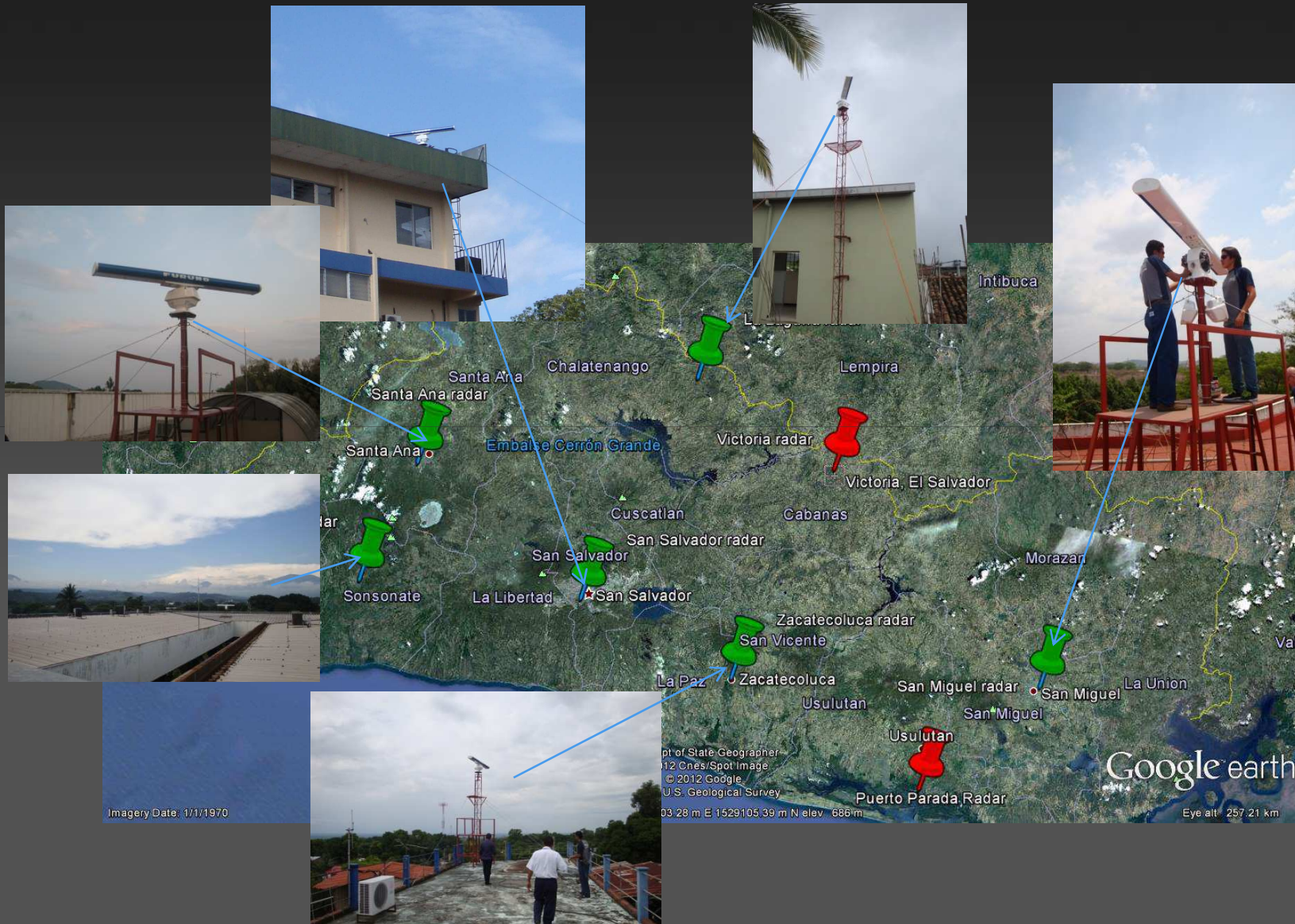
The radar network



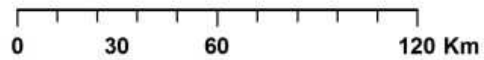
Elevations exaggerated 3 times



The X-band radar network



Radar network 60 km



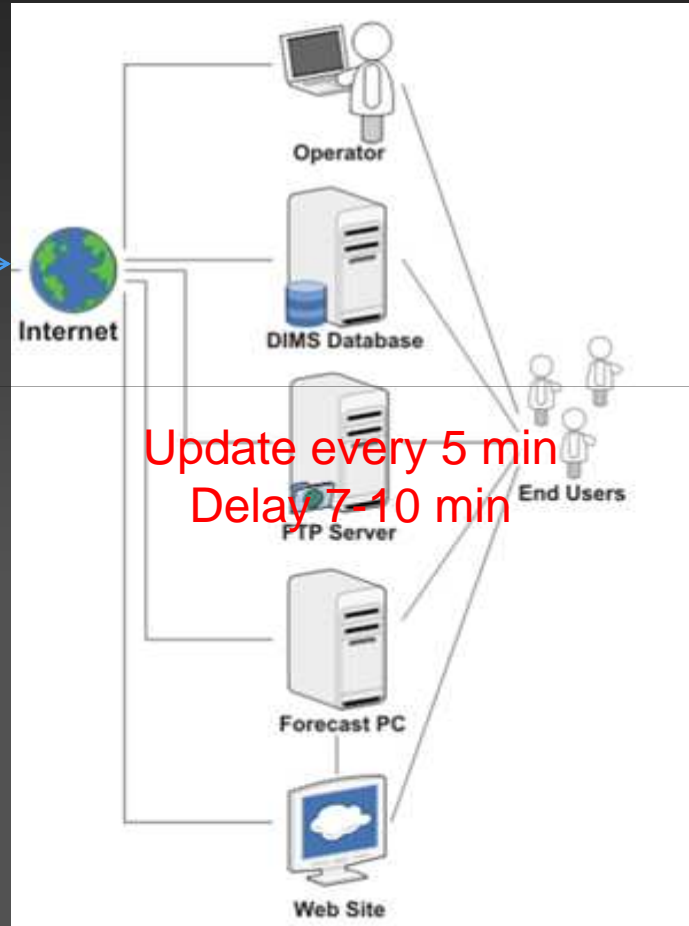
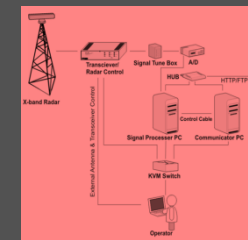
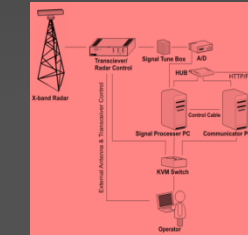
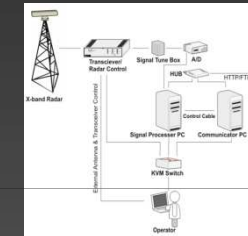
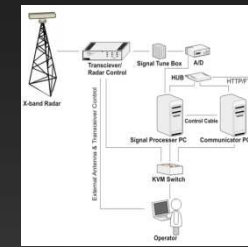
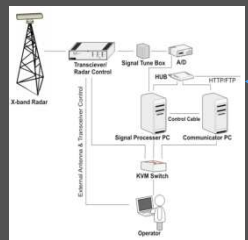
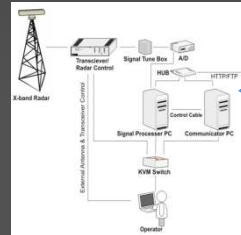
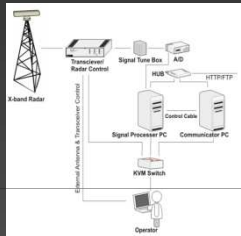
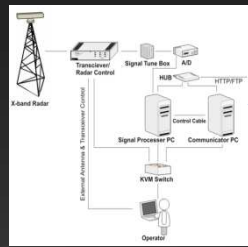
Cobertura de Radares Meteorológicos (60Km)

LAWR 25 Specifications

- Peak power 25 kW
- Pulse length 0.8 – 1.2 μ sec
- Spatial resolution
 - 500x500
 - 100x100
- Range
 - 60 km for forecast
 - 20 km for QPE
- Image frequency
 - 1 or 5 minute
- Beam width
 - H: 0.95°
 - V: $\pm 10^\circ$
- Continuous scanning

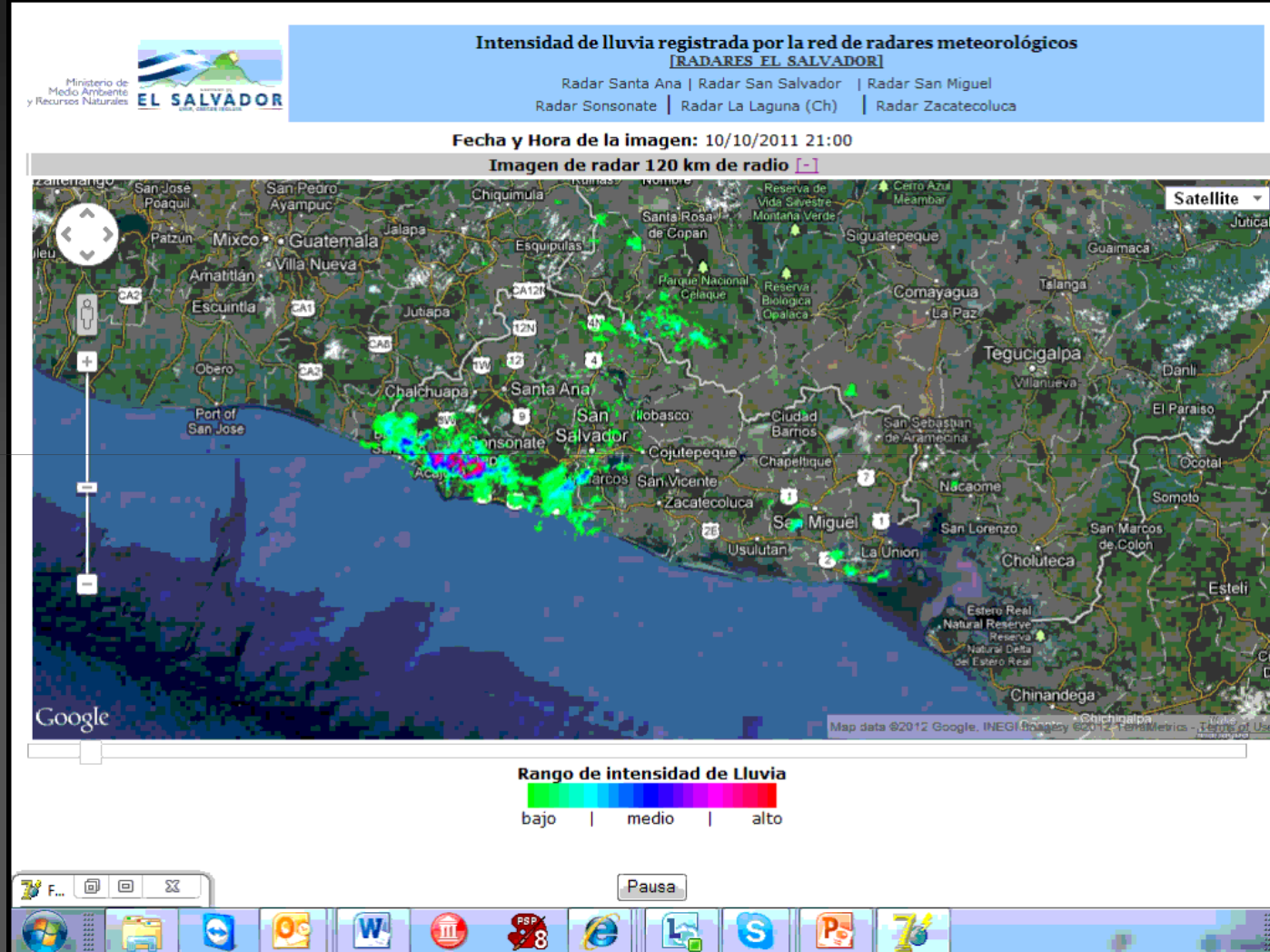


LAWR network



Update every 5 min
Delay 7-10 min

The event 10-18 of October 2011



Output fitted for smart phones

Imagen de radar 60 km de radio

Radar La Laguna (Ch) 60km

Radar San Salvador 60km

Radar Santa Ana 60 km

Radar Sonsonate 60 km

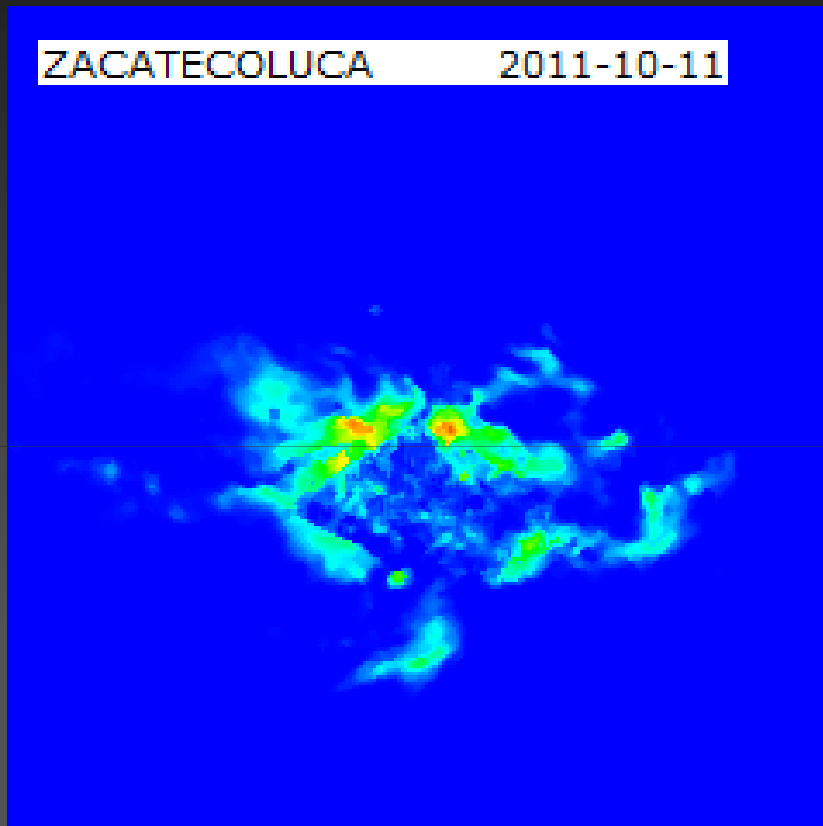
Radar Zacatecoluca 60 km

Radar San Miguel 60km

Fecha y Hora de la imagen:
15/06/2012 01:40

Url: <http://www.snet.gob.sv/googlemaps/radares/radaresSVn3.php>

ZACATECOLUCA 2011-10-11



The event 10-18 of October 2011



The event 10-18 of October 2011

1 million people are impacted directly.

2 000 square km (10% of the country)
are flooded

70% of municipalities (181 of 262), have
been impacted by rain



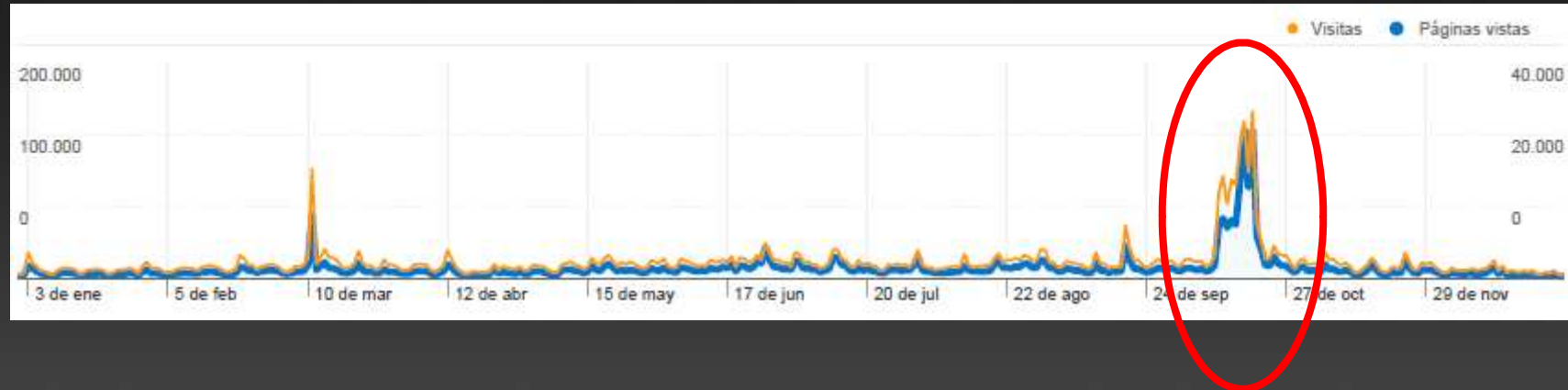
The event 10-18 of October 2011



- 32 deaths
- Evacuated 51.673 (more than 12 000 families)



Using the radar network



Web traffic on the days of emergency: 115,688 visits and 362,153 web pages accessed



Landslide warning

- The procedures for Evaluation of risk of landslides include:

- Accumulated rainfall 30 days
- Accumulated rainfall 15 days
- Accumulated rainfall 4 days



With this information an “INDEX” is created based also in terrain slope, type of soil etc.

Radar and raingauge data are used in the process of identifying these areas

Radar network performance in event



- Availability on radar
 - Santa Ana: 89.3 %
 - San Salvador: 99.9 %
 - Sonsonate: 99.0 %
 - San Miguel: 100 %
 - Zacateculuca: 99.9 %
 - La Laguna: 99.7 %

Future work

- Installation of additional two radars
- Calibration of all radars
- Implementation of automatic bias adjustment
- Preparation of MAR (mean areal rainfall) for existing flood forecasting models



Conclusion



“....Our hastily installed radars were extremely useful in this emergency as a visualization tool and they caught people’s imagination. You had them in all the TV networks and our internet traffic went through the roof. But we need to do much better than that. We have to calibrate the radars and we will have to find in some cases better locations so as to reduce noise (Zacatecoluca is particularly bad)...”

Herman Rosa Chávez

Minister of the Environment and Natural Resources

Government of El Salvador



Thank you for your attention