

# World-Wide Lightning Location Network (WWLLN) and GPS

possibility of weather and telecommunication hazards  
detection

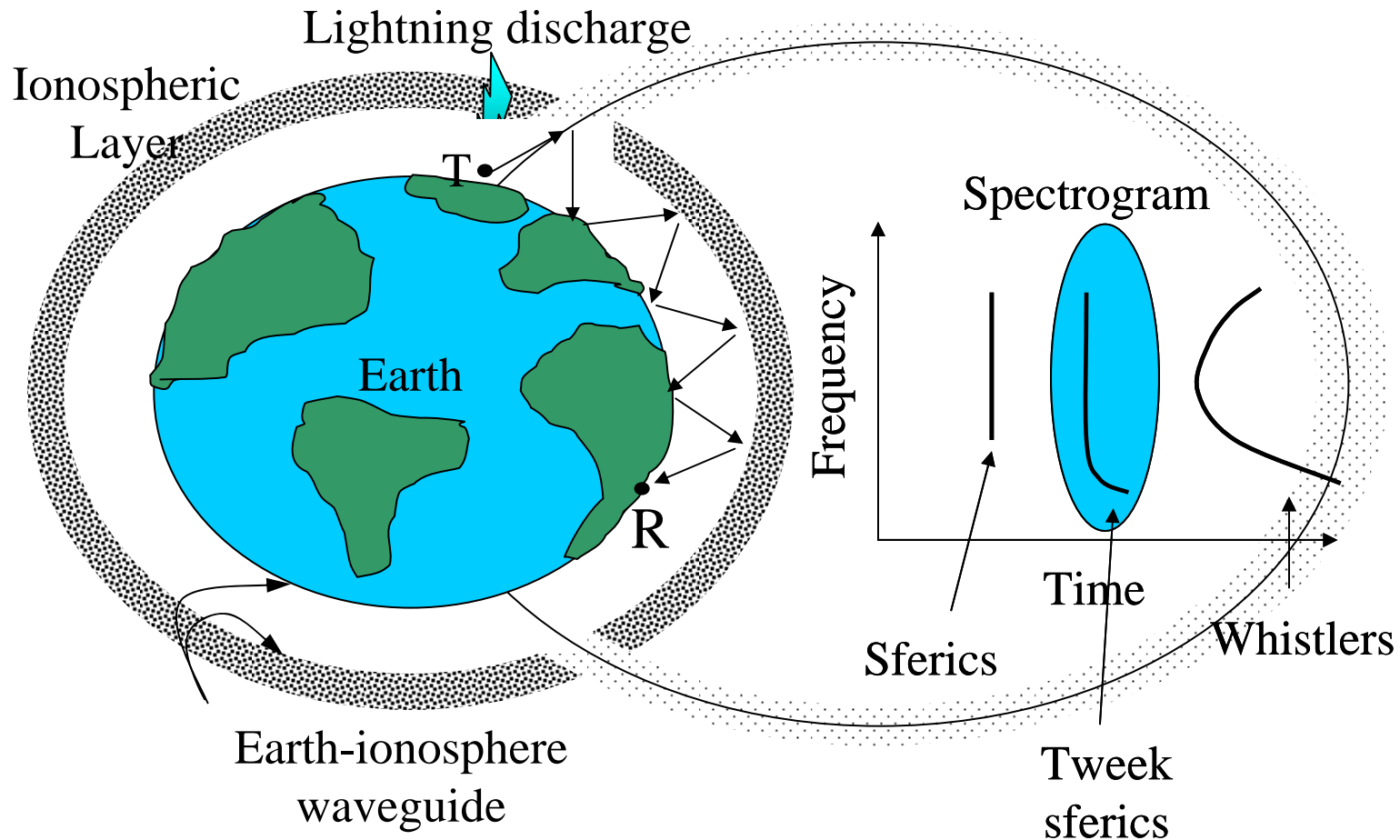
**Sushil Kumar**

**School of Engineering and Physics**

**The University of the South Pacific**

**Fax: +679-3231511: [kumar@usp.ac.fj](mailto:kumar@usp.ac.fj)**

# Propagation: Mechanism



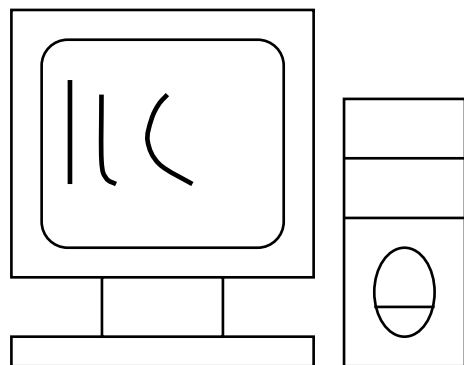
# WWLLN

## World-Wide Lightning Location Network

(<http://webflash.ess.washington.edu/>)

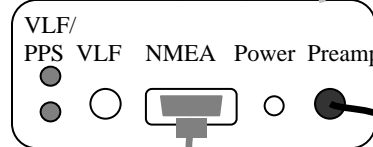


### Microcomputer

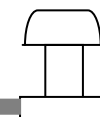


VLF / PPS  
outputs to the  
two sound  
cards in the PC

### Service Unit (SU)

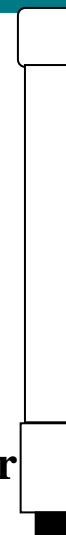


### GPS Antenna



### VLF Antenna encased in a PVC pipe

### Preamplifier



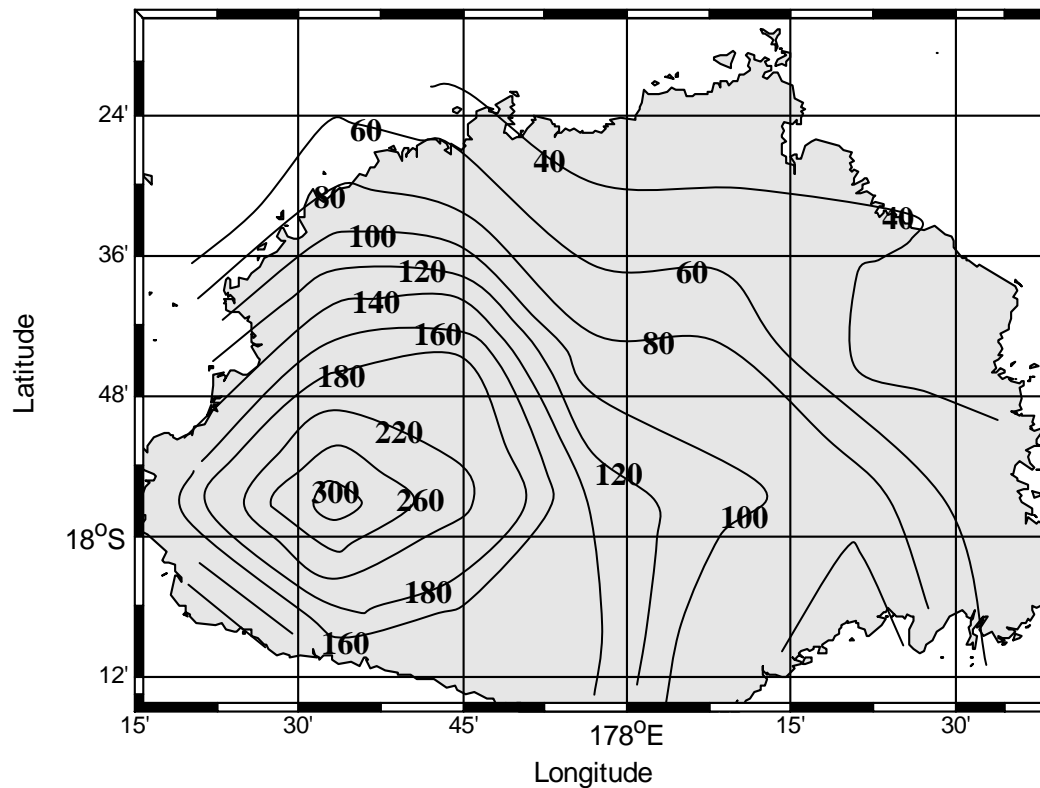
System used by “World Wide Lightning  
Location Network (WWLLN). 2003: 11 stations

Fiji: Viti Levu and Vanua Levu - 10,388 km<sup>2</sup> and 5,536 km<sup>2</sup>.

Spatial distribution of average annual CG flash (Viti Levu)

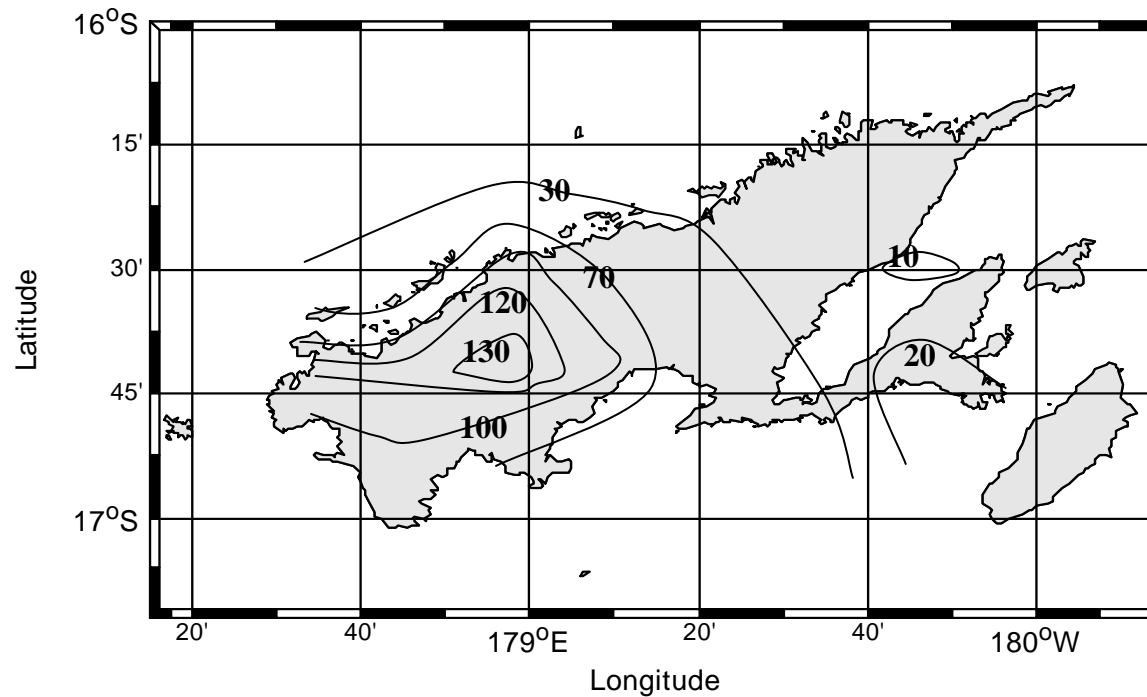
V. Ramachandran, Sushil Kumar, A. Kishore,

*Atmos. Res. Lett.*, 6, 128-132, 2005

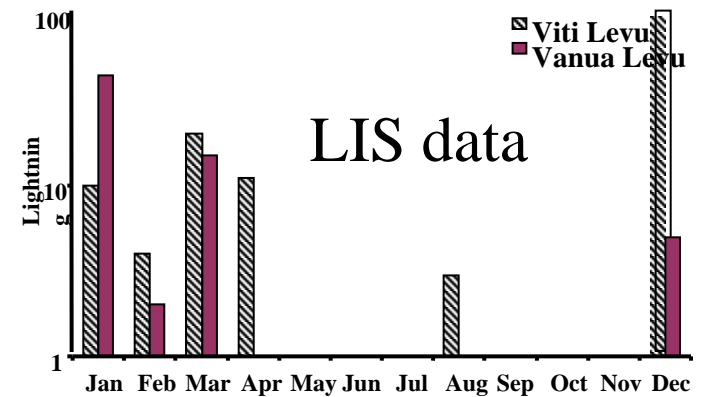
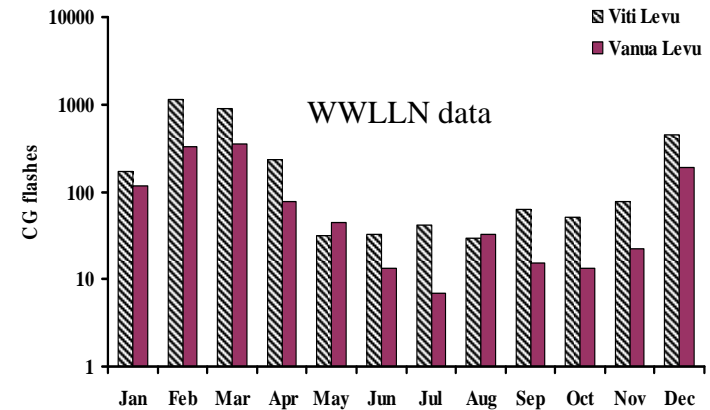
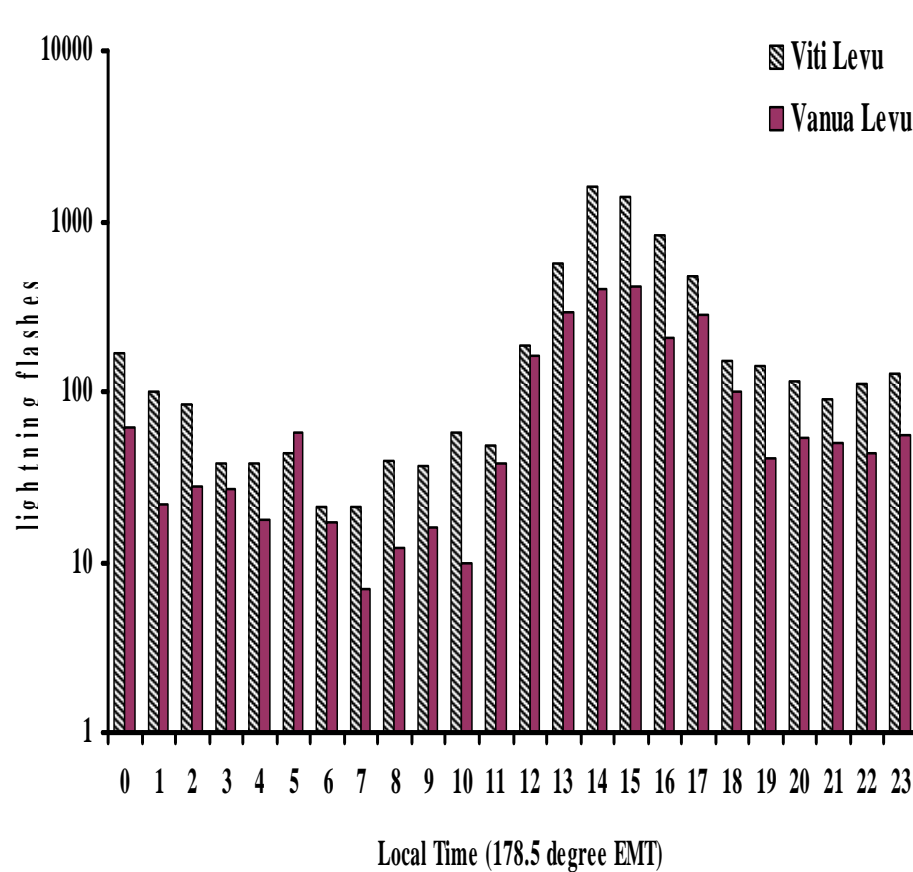


2003-2004

# Spatial distribution of average annual lightning flashes (Vanua Levu) 2003-2004

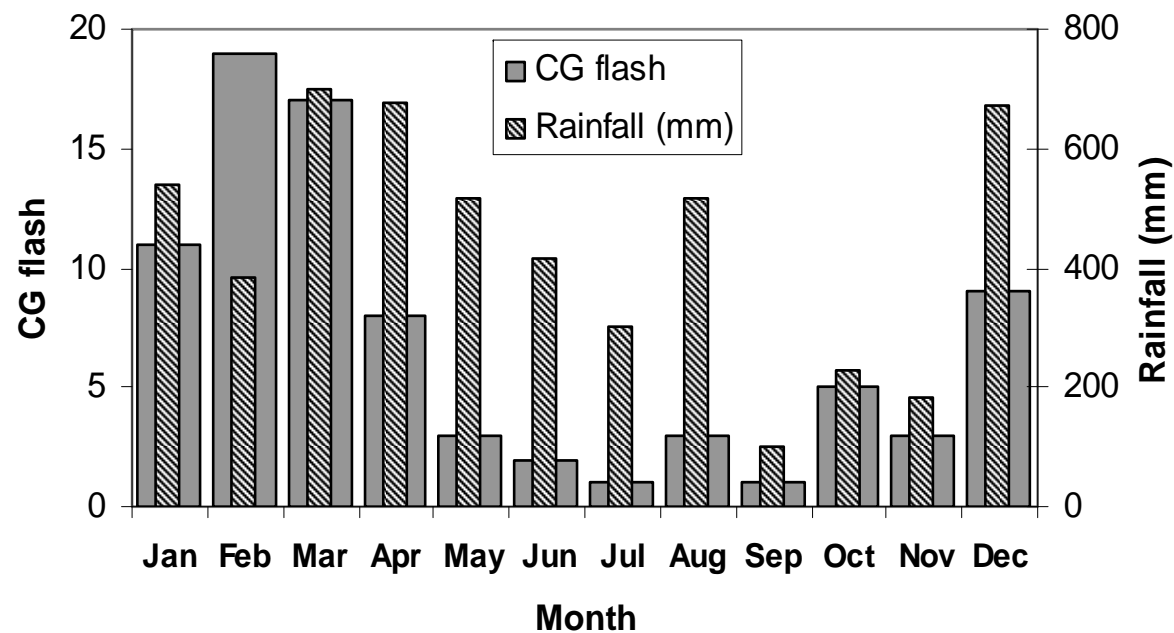


# Diurnal and seasonal variation



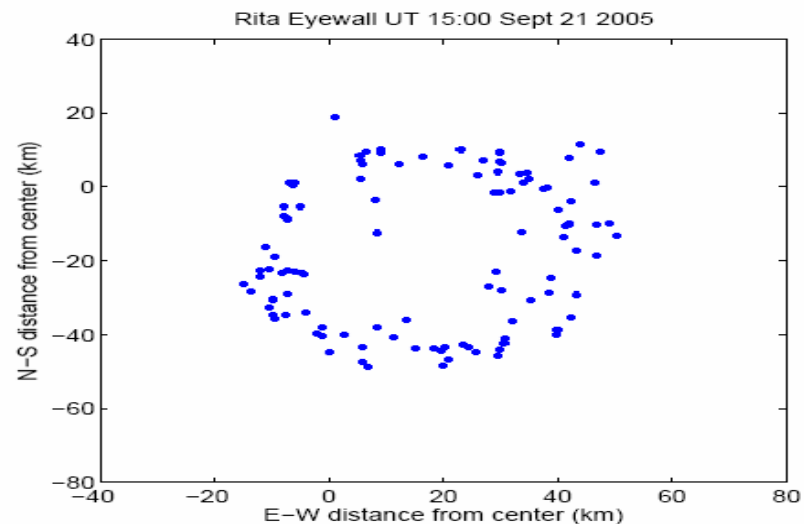
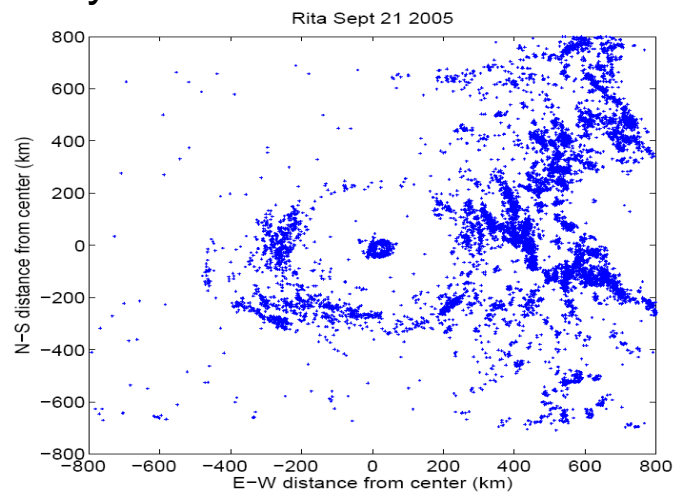
## Lightning and rainfall at Suva-2003-2004

The grid for the spatial distribution for lightning was refined to (Lat.: 18.1°S – 18.2°S, Long.: 178.4°E – 178.5°E) to give a surface area ~ 10 km×10 km .



# WWLLN data for September 21, 2005 (Atlantic hurricane) when Rita rapidly intensified from a category 2 to 5 storm (Solorzano *et al.* 2008)

- Recent studies have used satellite-based lightning detection and an extended regional network to investigate lightning activity in tropical cyclones before landfall.



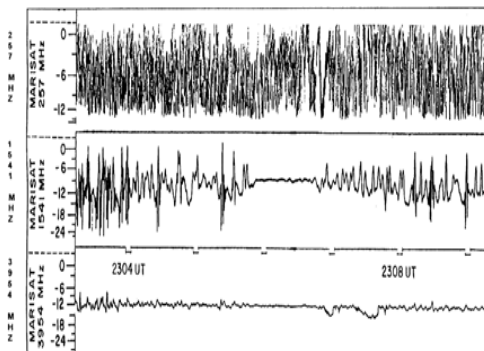
# GPS-signal fading

## Introduction:

- The GPS consists of 24 satellites in 12-hour orbits at an altitude of 20,000 kilometers above the Earth's surface. Their motion and position are controlled and corrected by 5 ground control stations located around the world. The signals from GPS are currently transmitted at 1575.42 MHz (L1-band) and 1227.60 MHz (L2-band).
- The performance of GPS receivers in the equatorial and low latitude belts is severely affected by the F-region ionospheric irregularities causing scintillations on GPS signals.

# Global picture of Scintillation (signal fading)

- Globally there are two zones of severe scintillation activity, one in equatorial zone which extends up to  $\pm 20^\circ$  in geomagnetic latitude around the magnetic equator and another at high latitudes in the vicinity of auroral oval.

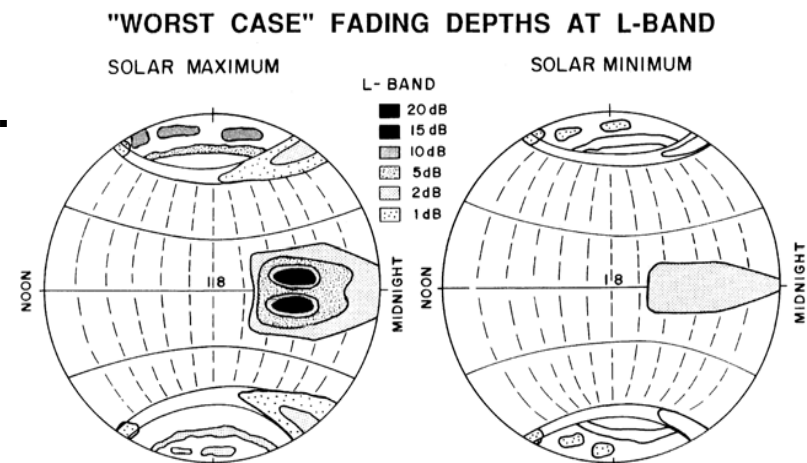


**>10 GHz- Rain att.**

**VHF, UHF, SHF**

**Space weather-**

**Magnetic storms**





Thank you