



New NASA's Propagation Experiment



Eight Ka Band Utilization Conference

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OUTLINE



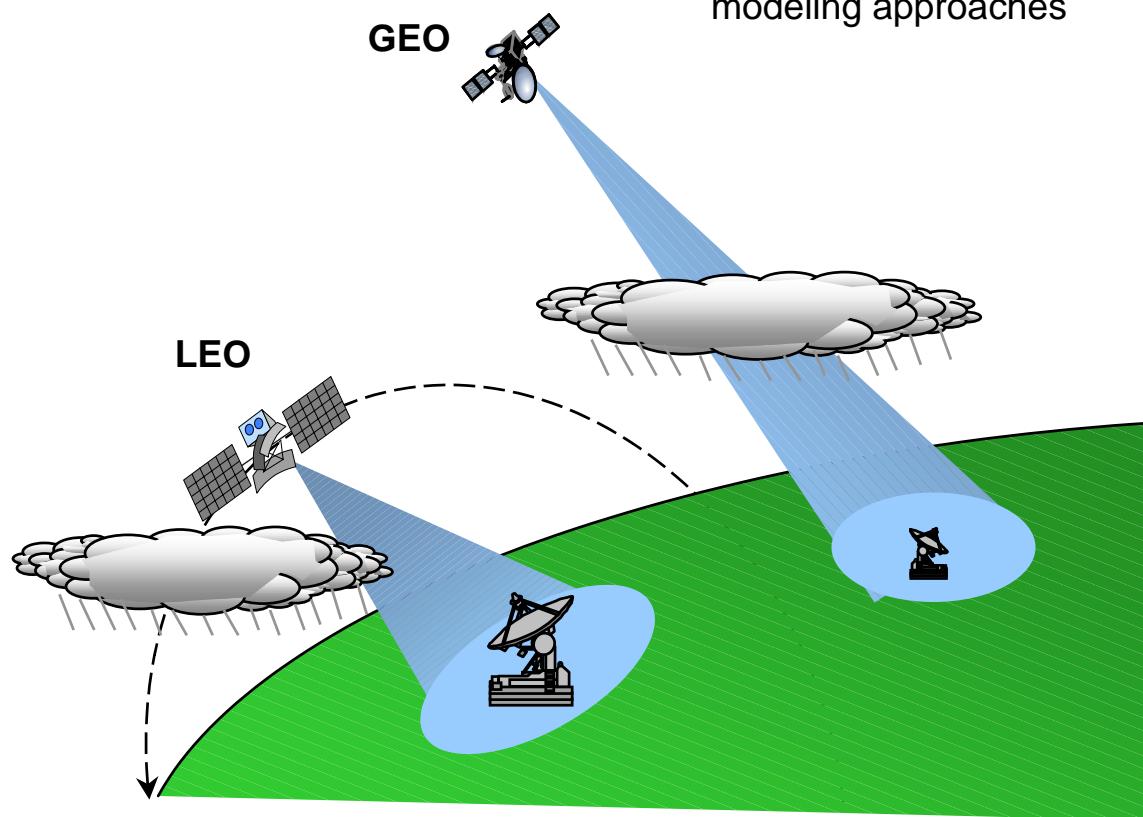
- NASA's New GEO PROGRAM OVERVIEW
- Site Description
- Rain Rate Measurements Results
- Data Collection Procedure
- Rain Event Measurements
- Conclusive Remarks



OVERVIEW

Overall Objectives

- Develop and evaluate GEO and LEO propagation models that will enable communication system designers to improve system availability predictions used by NASA, DOD and commercial mission planners without over-designing the communication network system link margins.



Goals & Products

- Enhanced fidelity of existing GEO Ka-Band model through inclusion of effects of tropical rain zone measurements
- Establish international agreements on LEO propagation measurements techniques and modeling approaches



OVERVIEW



Approach

- Continue to collect and characterize Ka-Band GEO propagation data at University of Puerto Rico (Tropical rain zone)
- Update existing models for Ka-band propagation
- Disseminate information through technical reports, conferences and data submission to the ITU-R

Co-I's/Partners

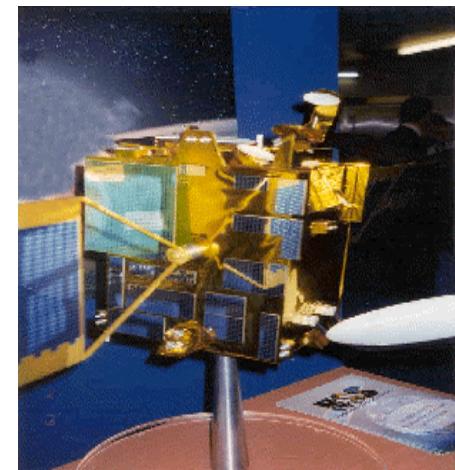
- Dr. Roberto J. Acosta/GRC
- Sandra K. Johnson/GRC
- Walber Feliciano/GRC
- Professor Luis Gonzalez/University of Puerto Rico
- Professor Henry Helmkin/Florida Atlantic University

Products

- Ka-Band GEO propagation terminal, measurement techniques and experiment plan



ACTS GEO Propagation Terminal



STENTOR Ka-Band GEO propagation data and models



OVERVIEW



Approach

- Develop a LEO propagation terminal to enable future characterization and modeling of the effect of rapidly varying atmospheric conditions on Ka-Band signal transmission from LEO spacecraft to ground
- Develop first-ever, world-class LEO propagation measurement techniques and experiment plan in collaboration with international partners

Co-I's/Partners

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- Sandra K. Johnson/GRC
- Walber Feliciano/GRC

Products

- Ka-Band LEO propagation terminal, measurement techniques and experiment plan



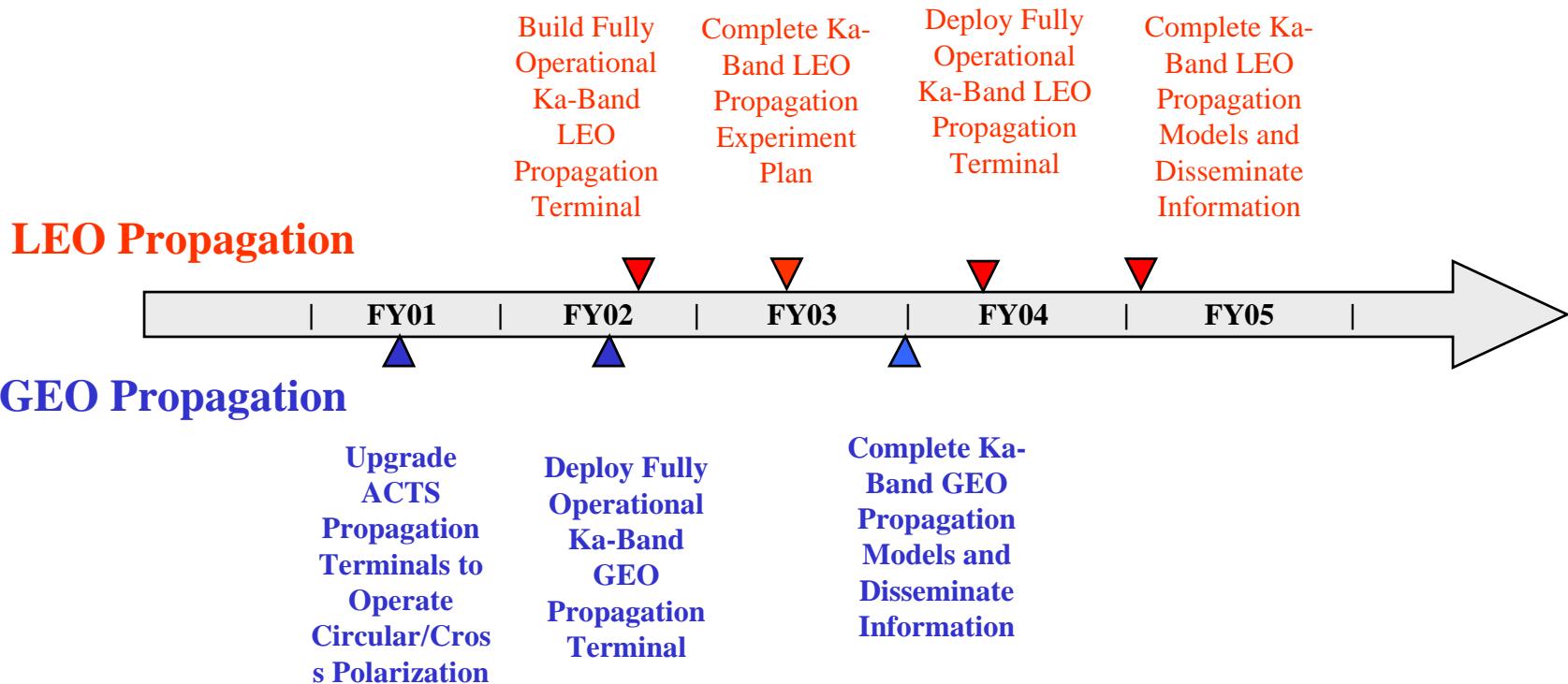
NASA's LEO Propagation Terminal



OVERVIEW



Schedule





GEO Propagation

Site Description



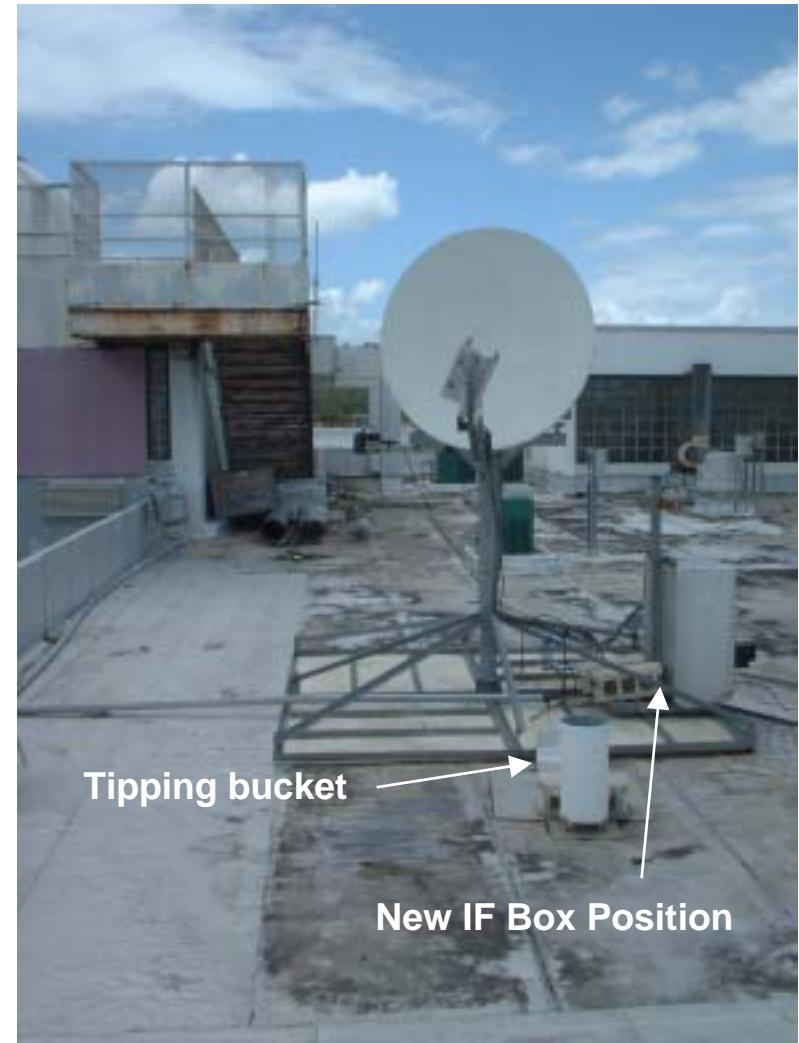
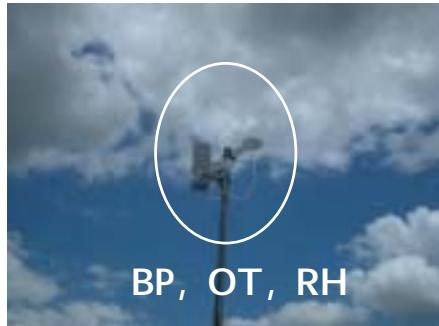
NASA GEO Propagation Terminal in Humacao, Puerto Rico:
University of Puerto Rico, Humacao Campus





GEO Propagation

Site Description





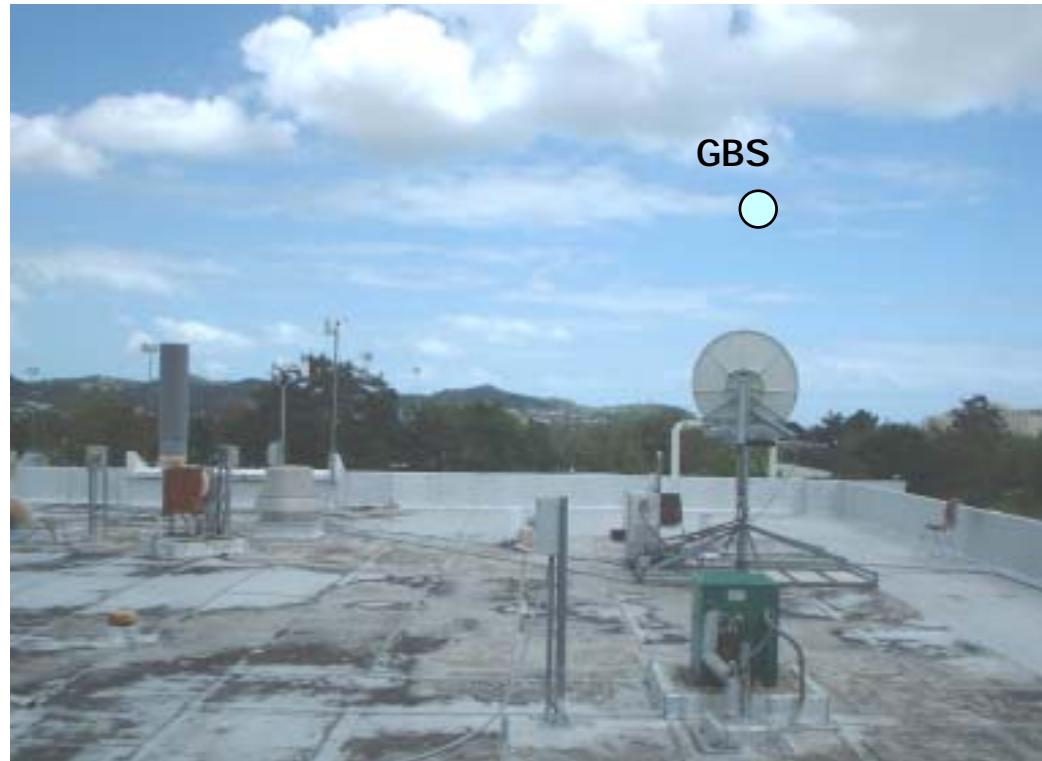
GEO Propagation

Site Description



Current Data Collection in on
Global Broadcast Service GBS

- Longitude : 23.4 Degrees W
- Inclined orbit: +/- 3.8 Degrees
- Elevation : 37.20 Degrees N
- Azimuth : 108.5 Degrees W



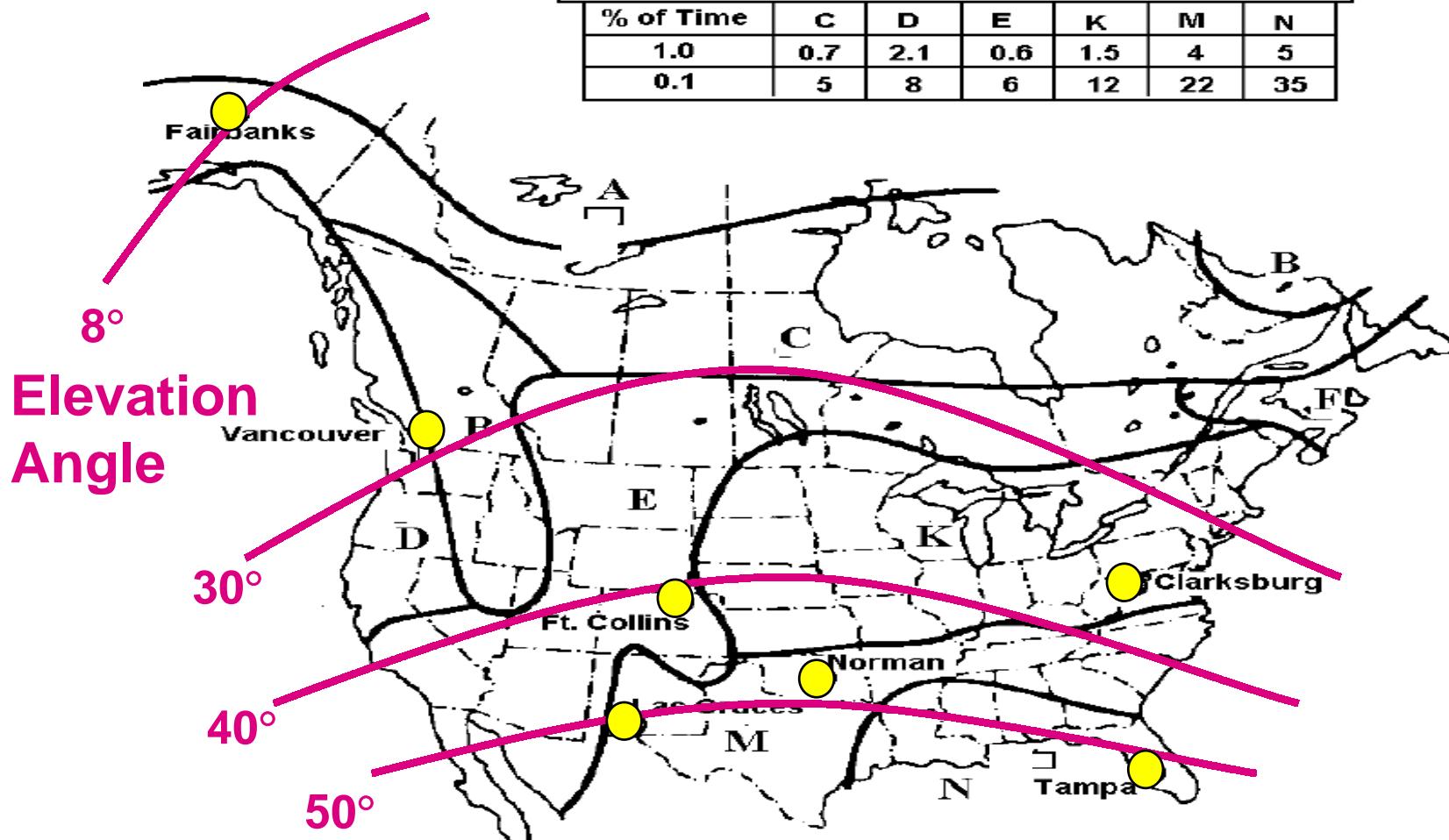


GEO Propagation Results

OLD ITU-R Rain Zones



ITU-R Rain Zones & Rainfall Rate Exceeded (mm/h)						
% of Time	C	D	E	K	M	N
1.0	0.7	2.1	0.6	1.5	4	5
0.1	5	8	6	12	22	35

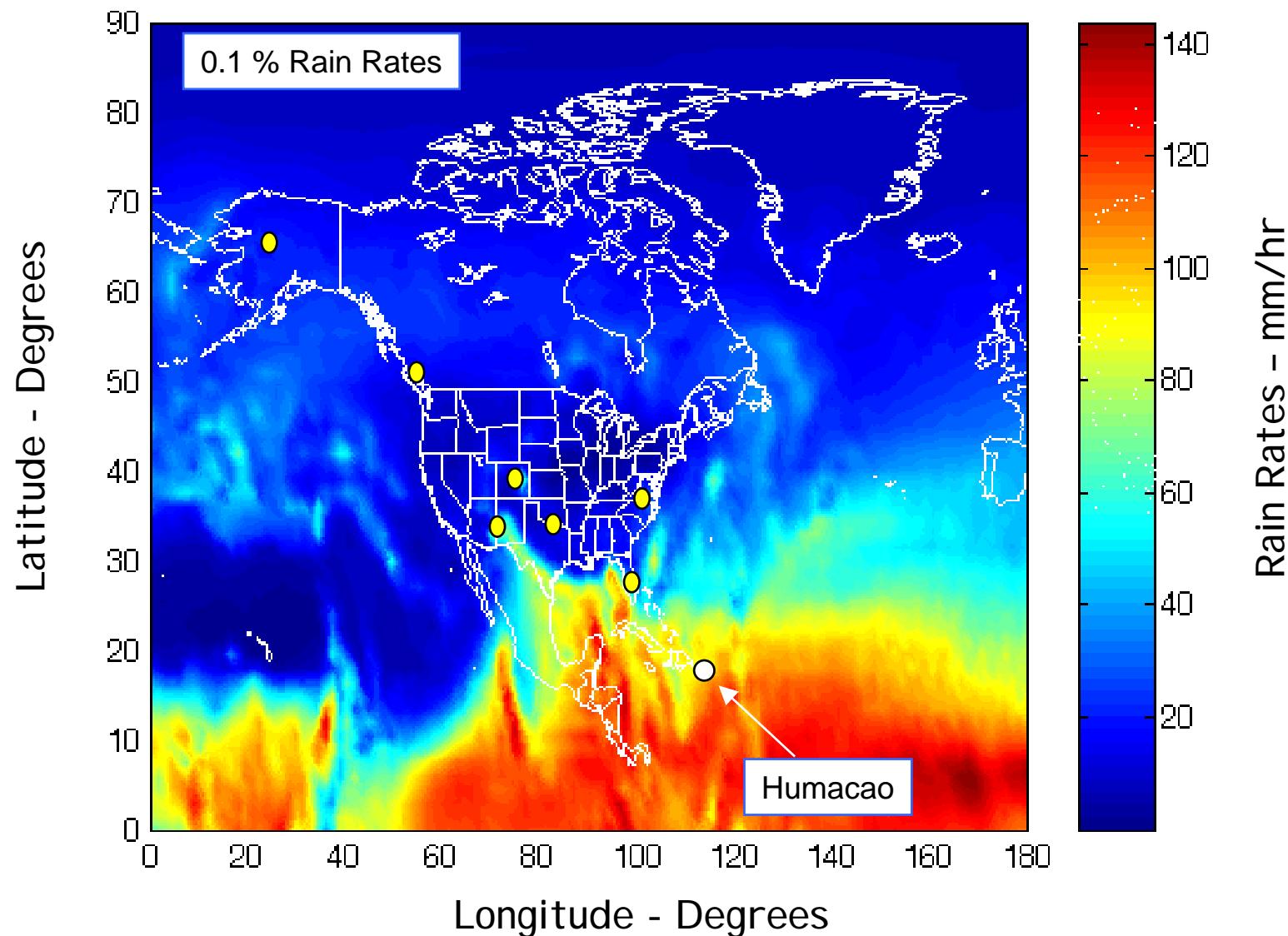


ACTS Propagation Campaign Sites



GEO Propagation Results

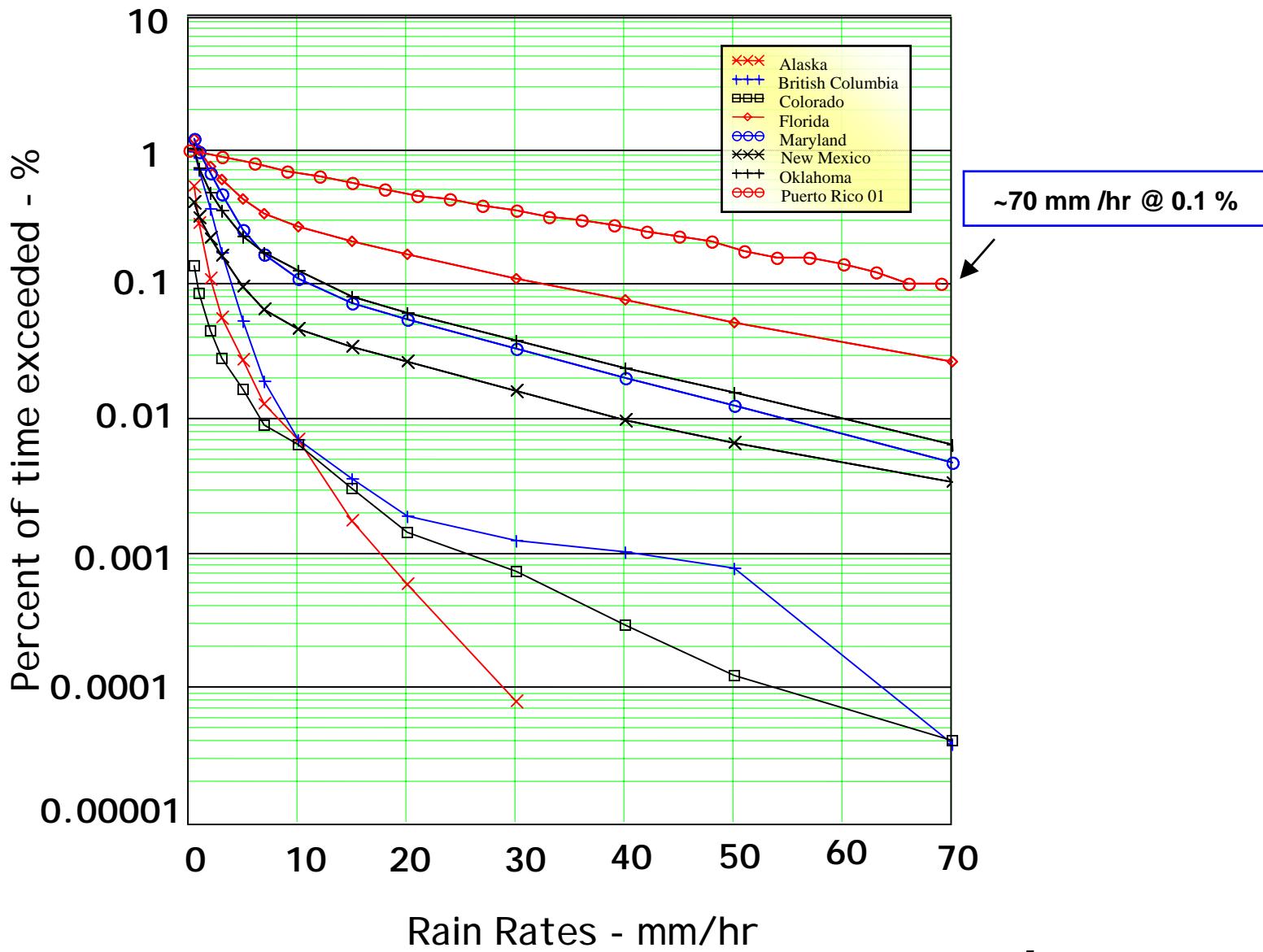
New ITU-R Rain Zone





GEO Propagation Results

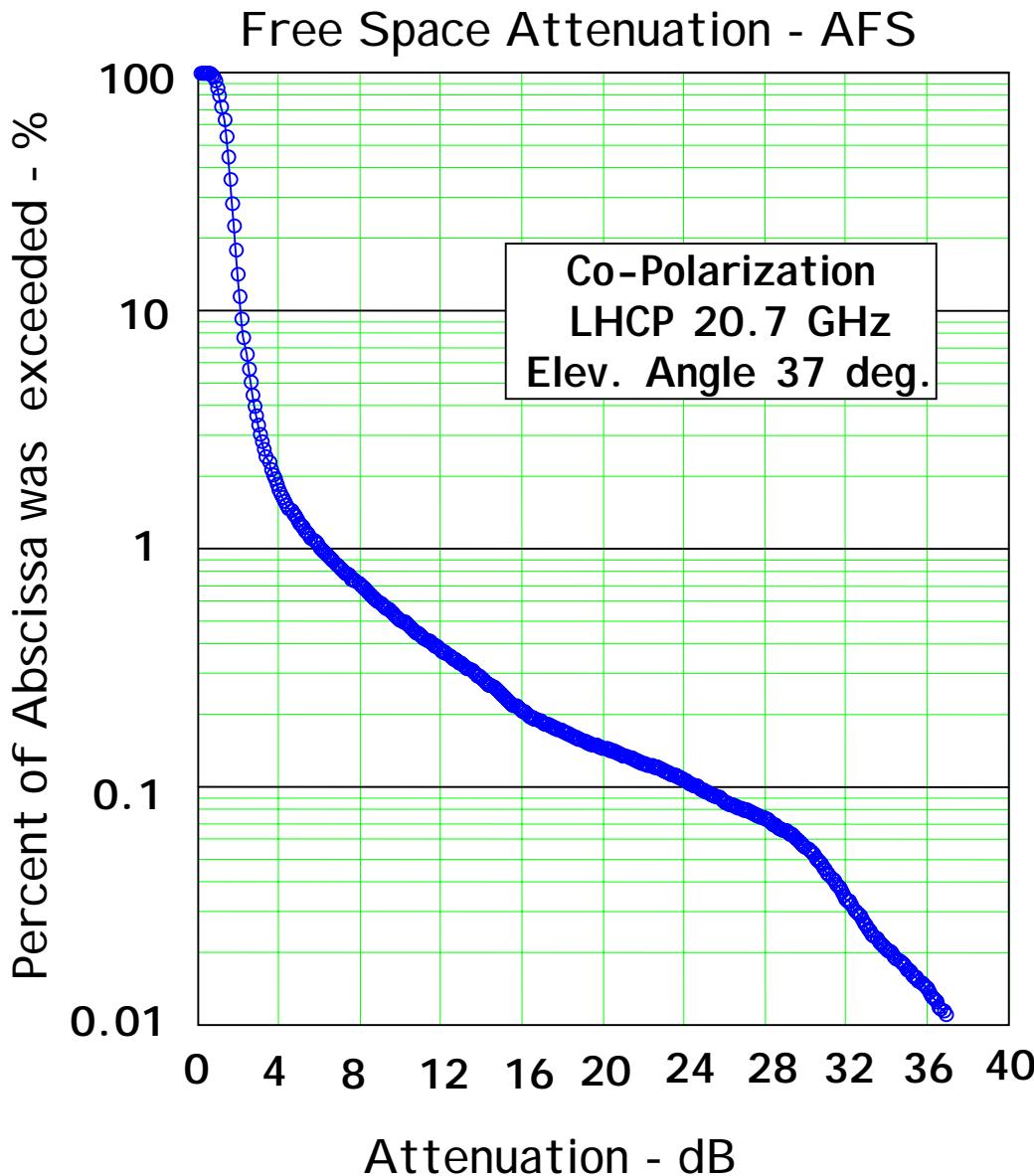
Rain Gage Data





GEO Propagation Results

Co Pol. Distribution - May 2002



AFS Include the following Propagations effects

- Atmospheric Absorption
- Rain
- Clouds
- Scintillation
- Wet Antenna

Radiometer derived attenuation (ARD) is used to correct for beacon diurnal and DC bias effects (systems variations)

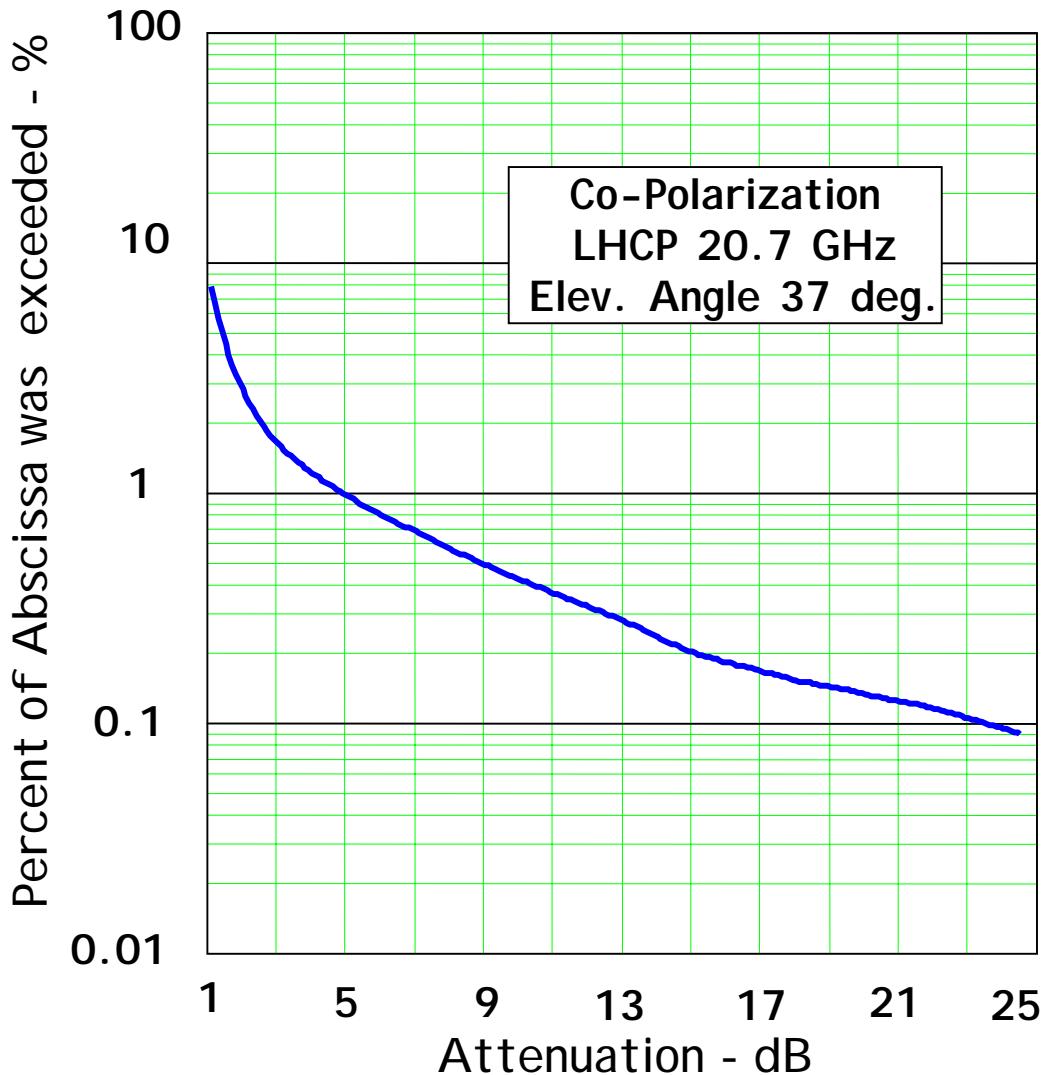


GEO Propagation Results

Co Pol. Distribution - May 2002



Clear Air Attenuation - ACA



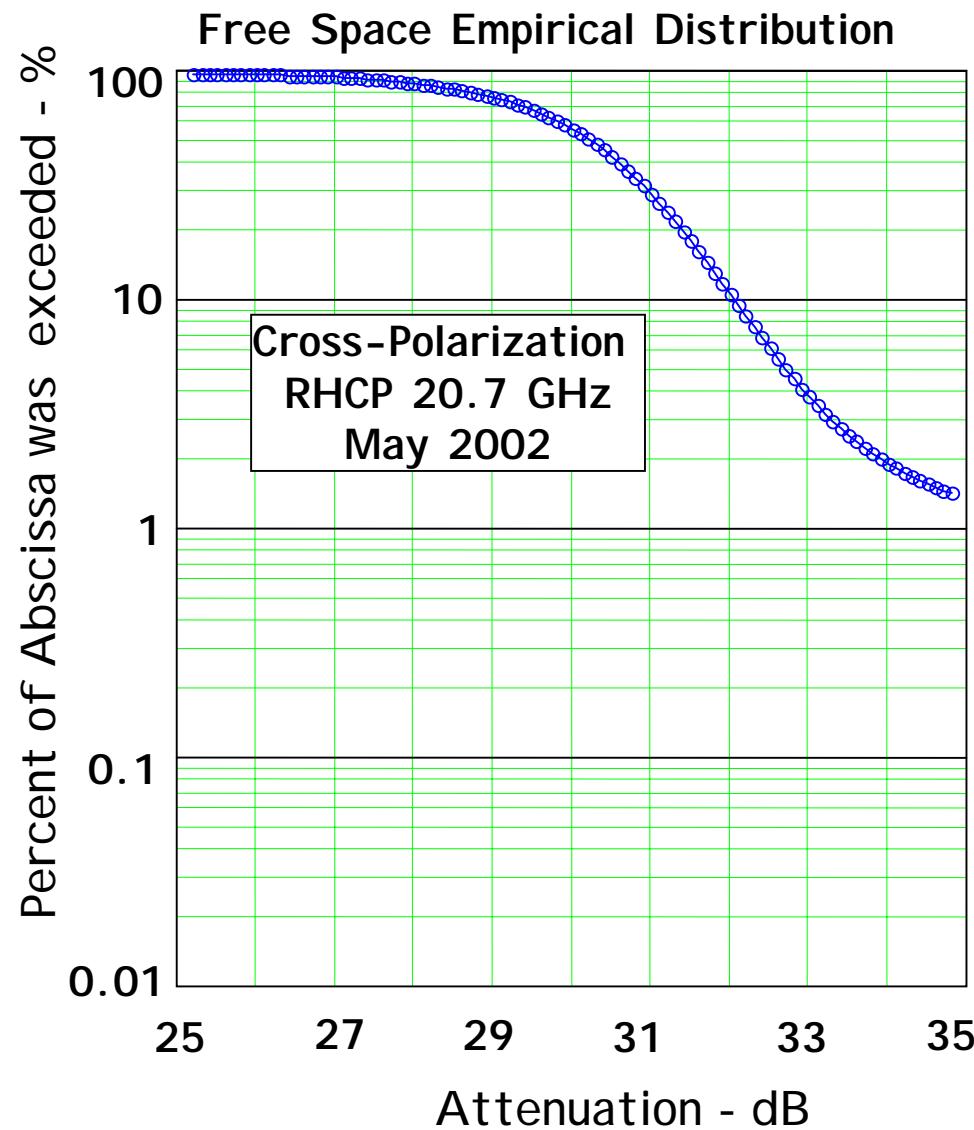
ACA Include the following Propagations effects

- Rain
- Clouds
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GEO Propagation Results

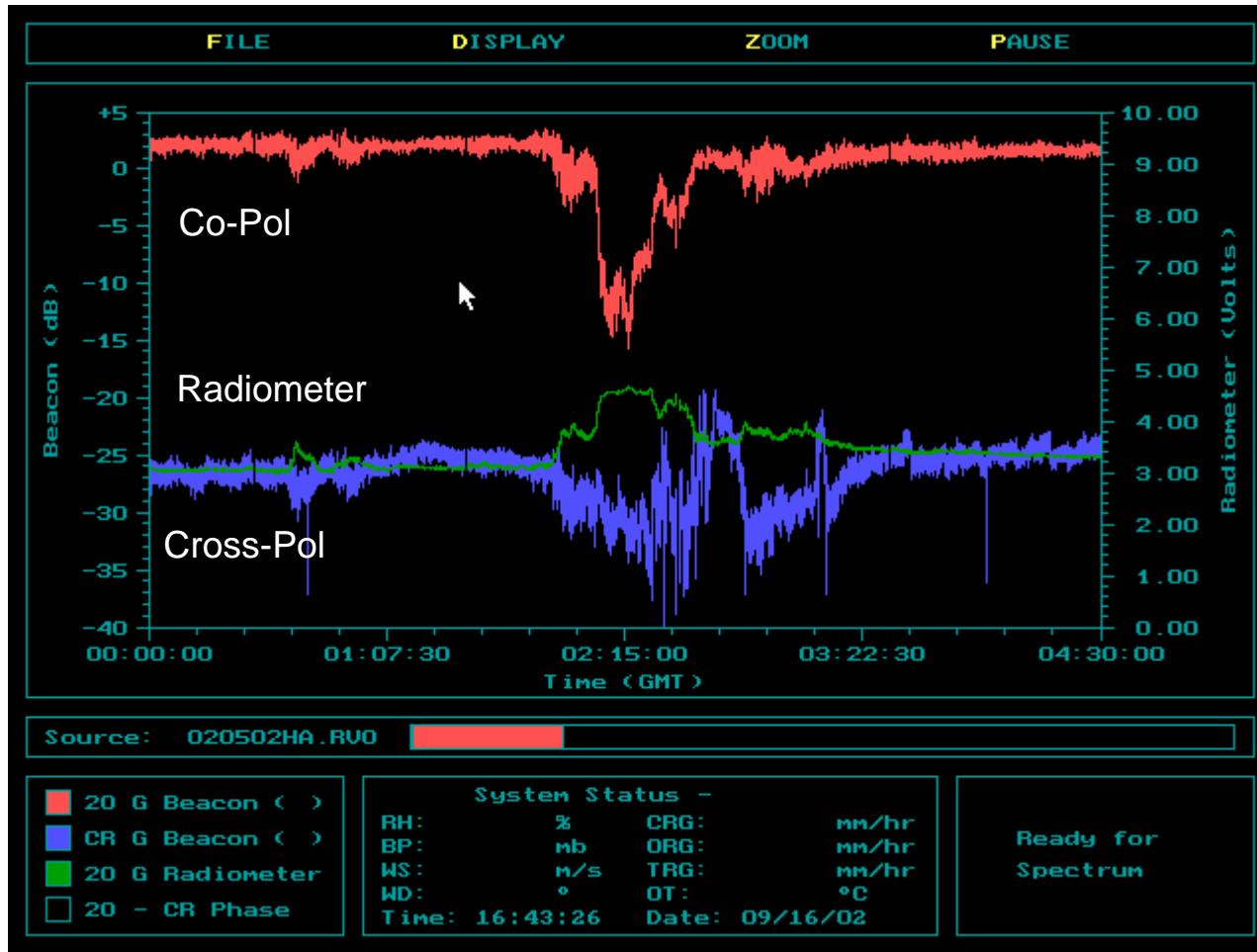
Cross Pol. Distribution - May 2002





GEO Propagation Results

Time Series Rain Events - May 2, 2002

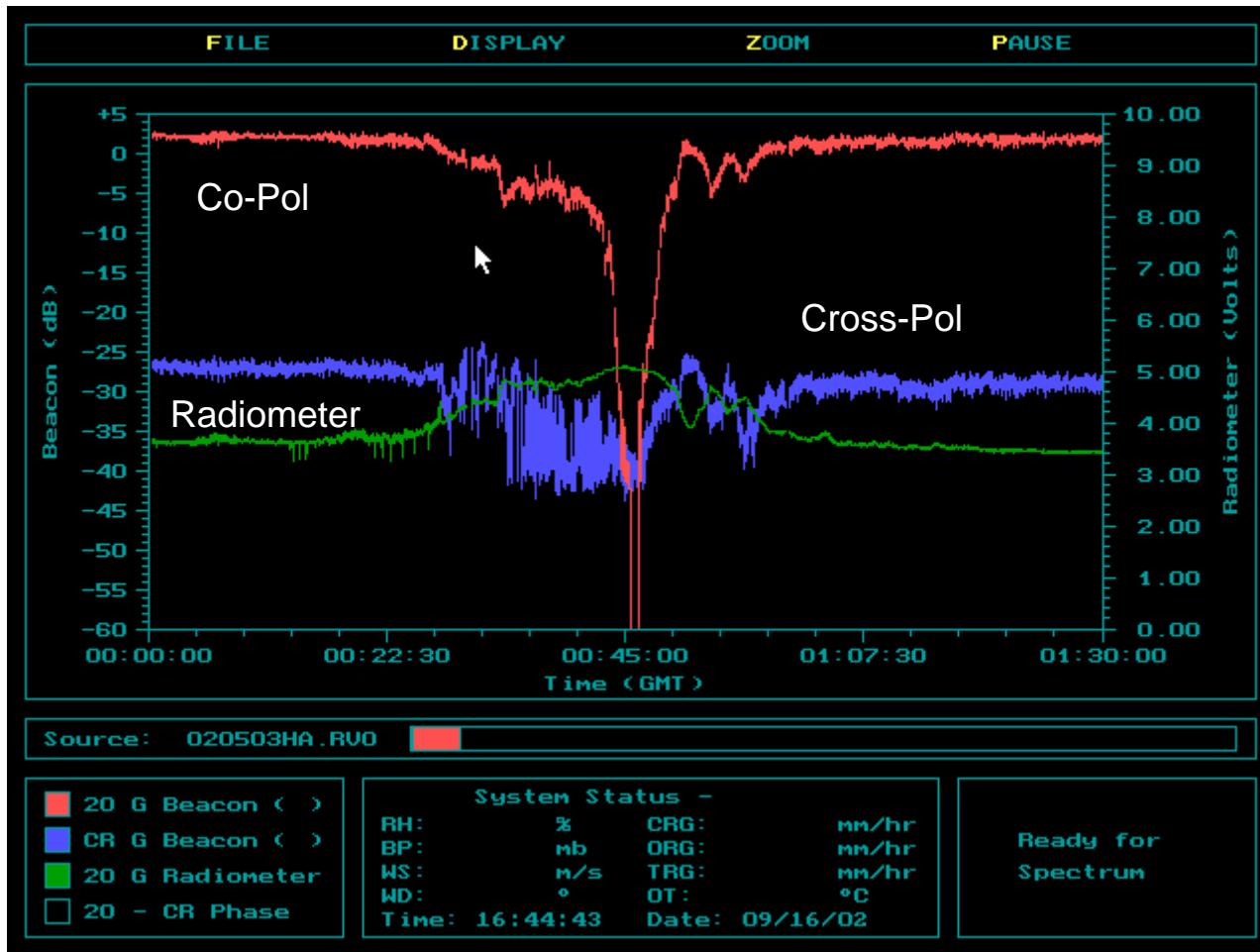


Medium Fade Event



GEO Propagation Results

Time Series Rain Events - May 3, 2002



Large Fade Event



GEO Propagation

Conclusive Remarks



- Five month data collection using GBS satellite at 20.7 GHz
- Hardware availability is above 90 %, LNB malfunction, loss 2 week of operations
- Rain rates data shows larger fades probabilities than any of ACTS sites
- The rain fall is not any different than Cleveland (non-tropical rain zone)



GEO Propagation

Future Work



- A Second NASA Ground Station (20 miles Site Diversity Station) to be deploy in Puerto Rico beginning December 2002 (Professor Henry Helkim, FAU)
- Switch to STENTOR 2002
- Continue data collection 5 Years