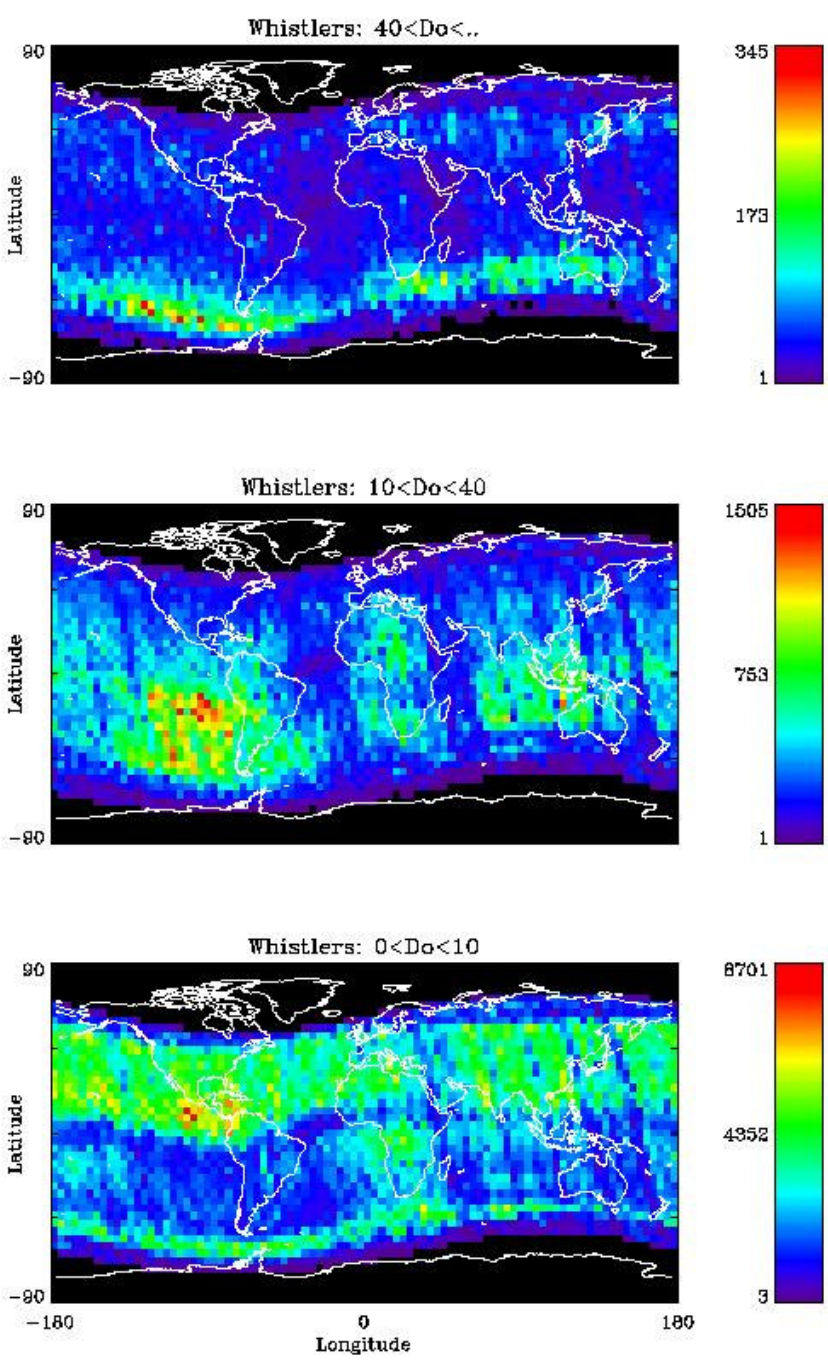
TARANIS
Main ouput of the ISSI meeting

Janary 2006

1. Evolution in the scientific objectives

EVOLUTIONS IN THE SCIENTIFIC OBJECTIVES ARE DUE TO:

- more accurate definitions of the scientific objectives, with sub-objectives common to thematics previously defined
- priority to measurements which are known to be possible (identification of Lighting induced Electron Precipitations) as regards to measurements the feasibility of which has not been demonstrated (detection of runaway electrons)
- Interest for the study of the atmosphere – ionosphere –magnetosphere coupling to track the variability of the radiation belts and to point out the role of low altitude sources on the radiation belt (+ opportunity of the presence of equatorial satellites in the same time period)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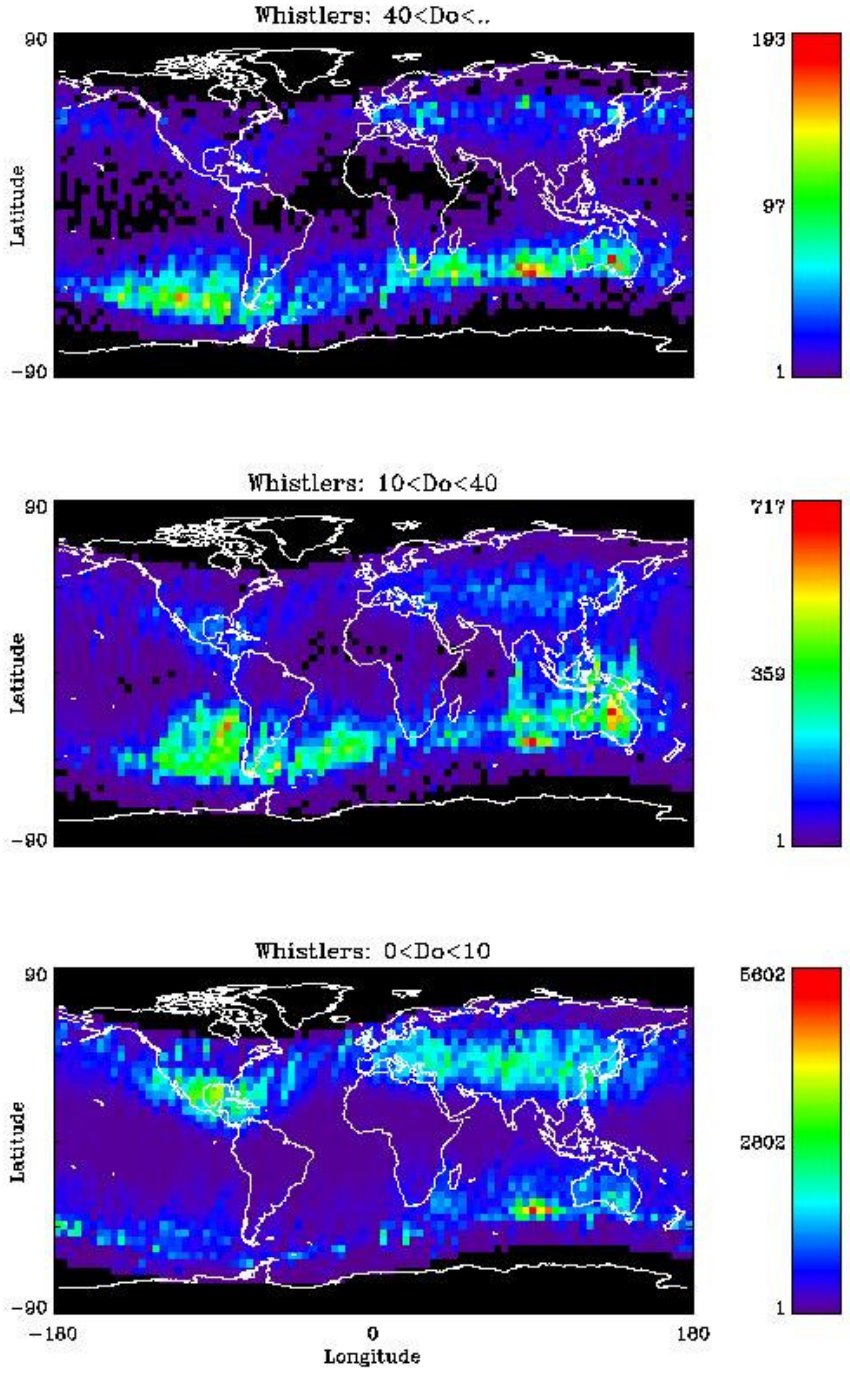
Longitude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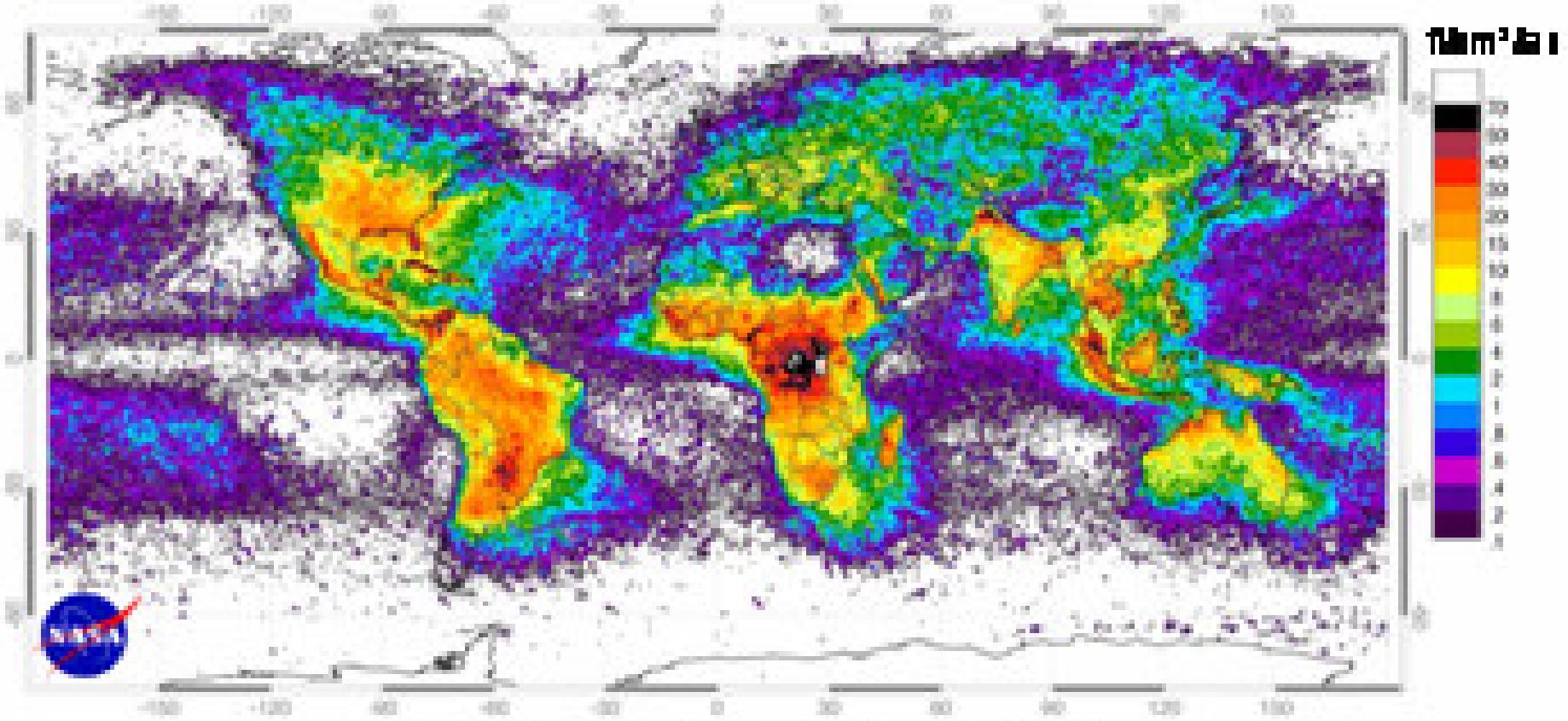
Longitude

Variabilité spatiale

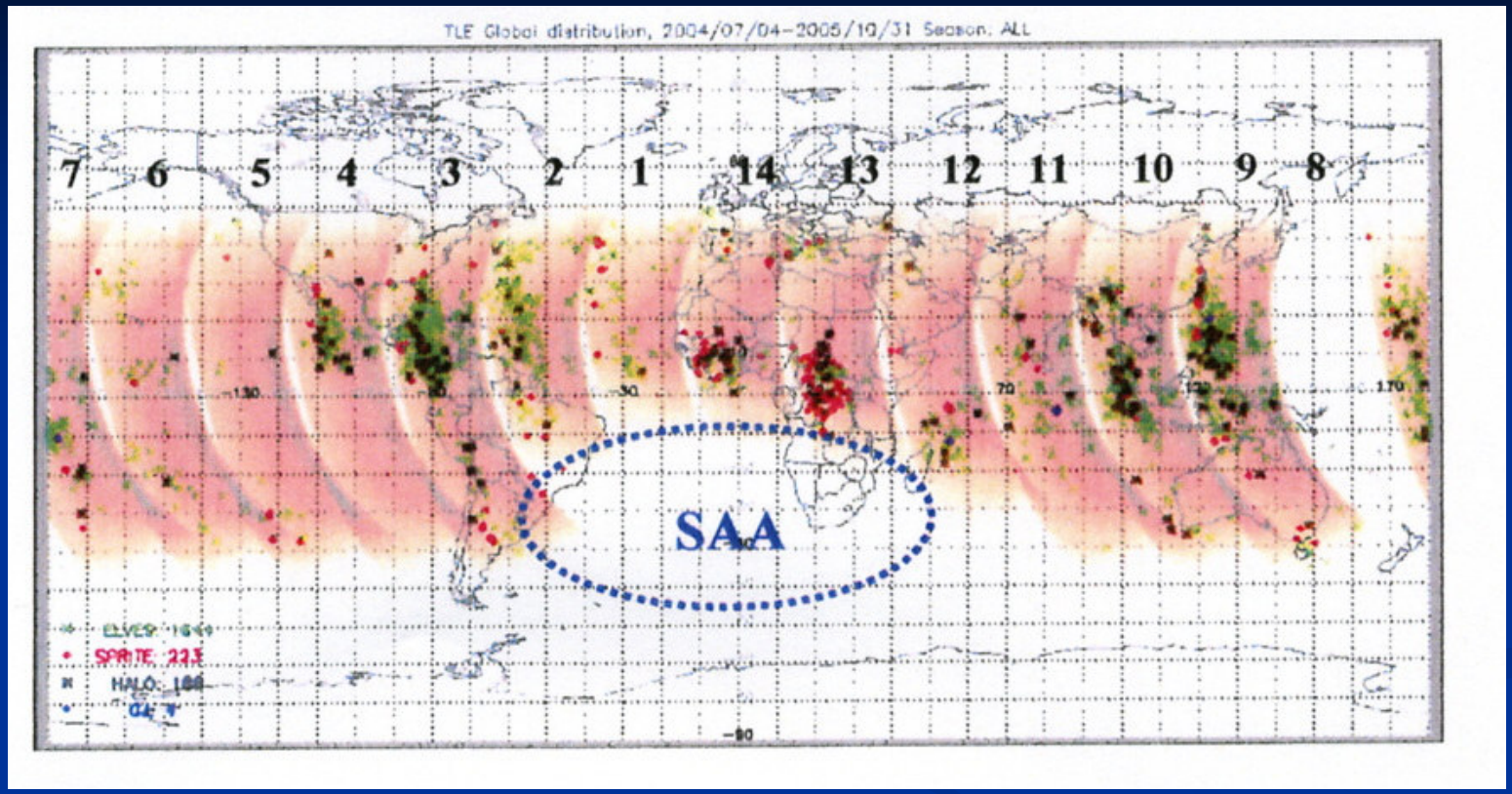


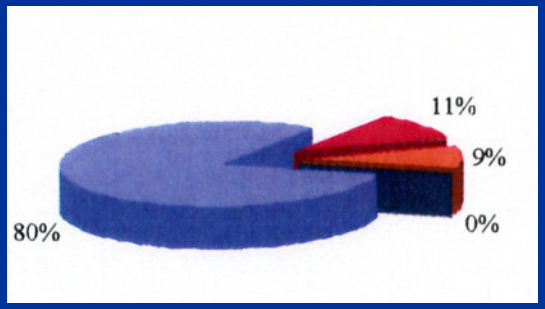
High Resolution Full Climatology Annual Flash Rate

Global distribution of lightning April 1995-February 2003 from the combined observations of the NASA OTD (4/95-3/00) and LIS (1/98-2/03) instruments

http://thunder.nsstc.nasa.gov/images/HRFC_AnnualFlashRate_zoom.jpg

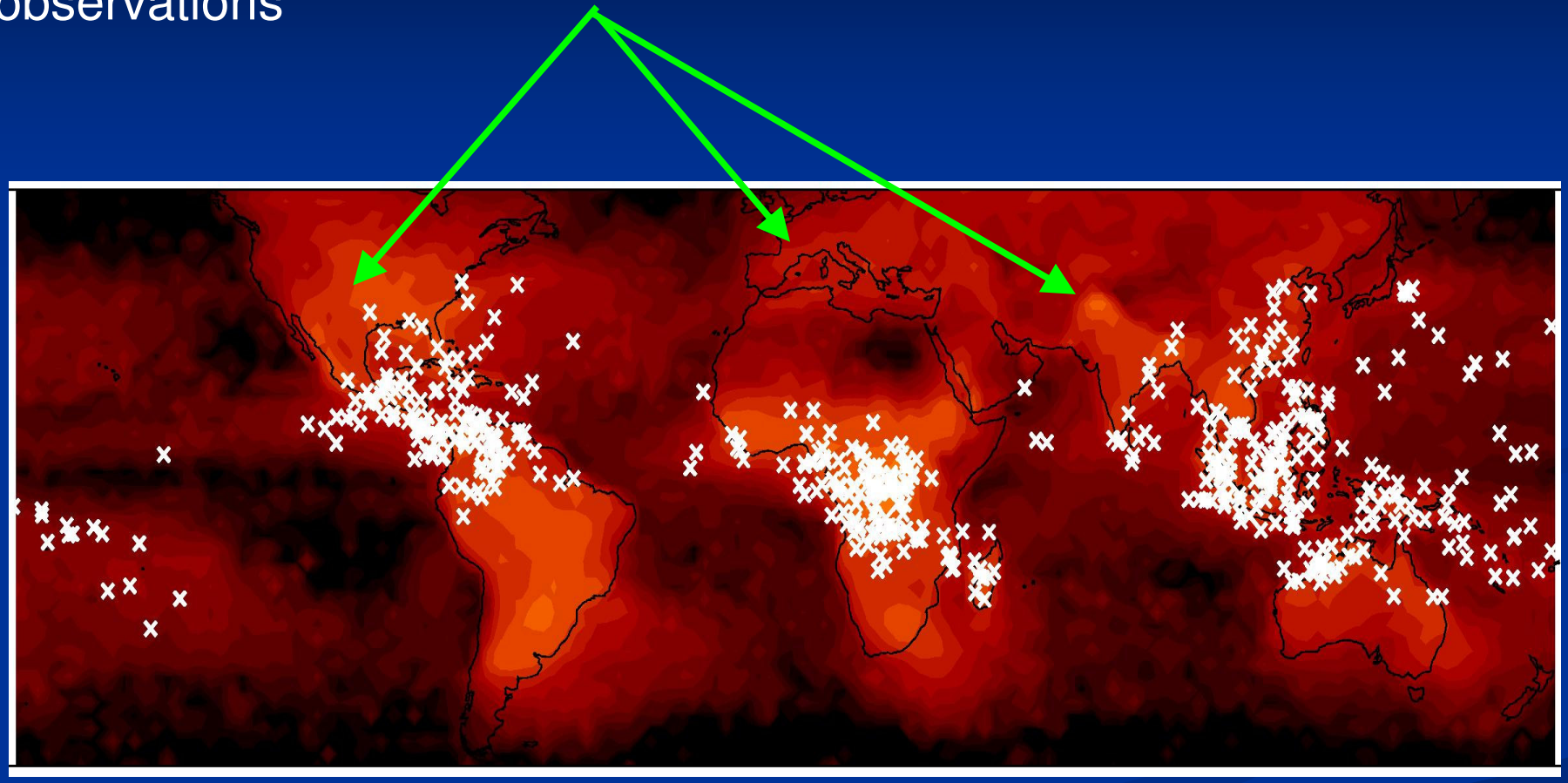
Distribution of sprites, halos and elves





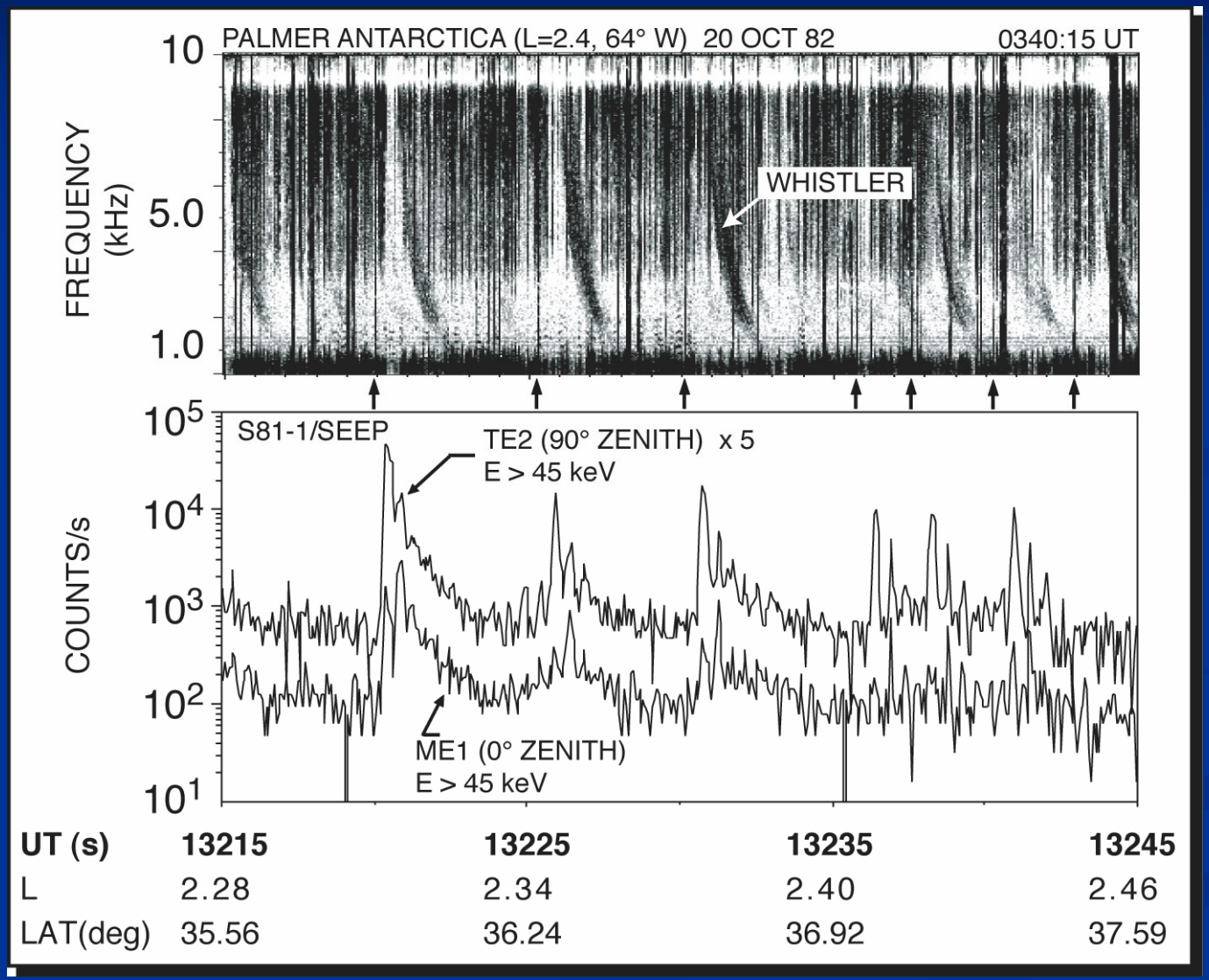
	continents	coasts	oceans
halos	25%	42%	42%
sprites	57%	24%	19%
elves	10%	33%	57%

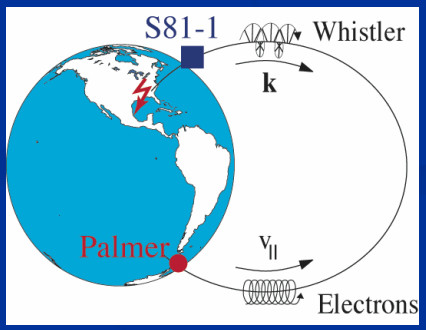
No TGFs in the mid latitude regions characterized by a strong lightning activity, a good coverage of the satellite and many sprite observations



* Lightning map : NASA LIS/OTD science team

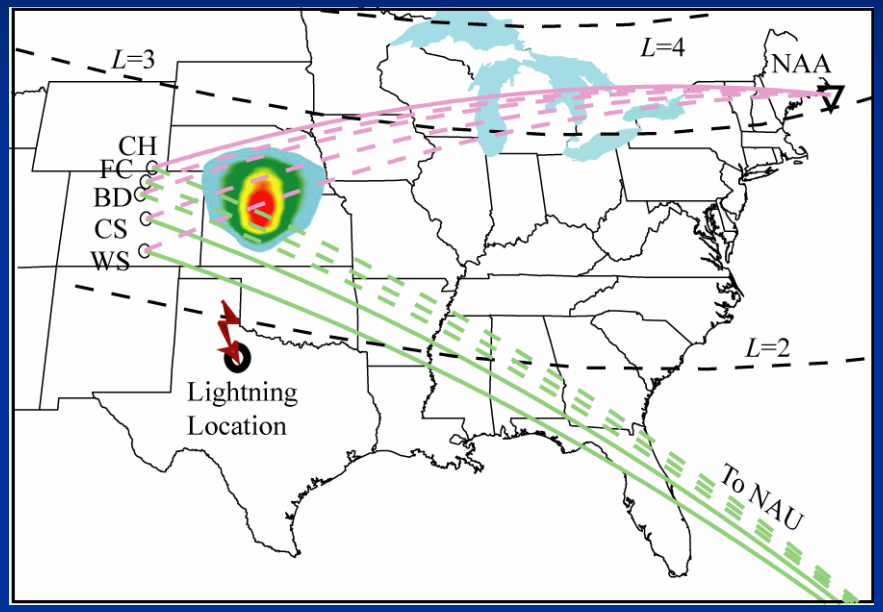
Lightning-induced Electron Precipitation (LEP) Bursts





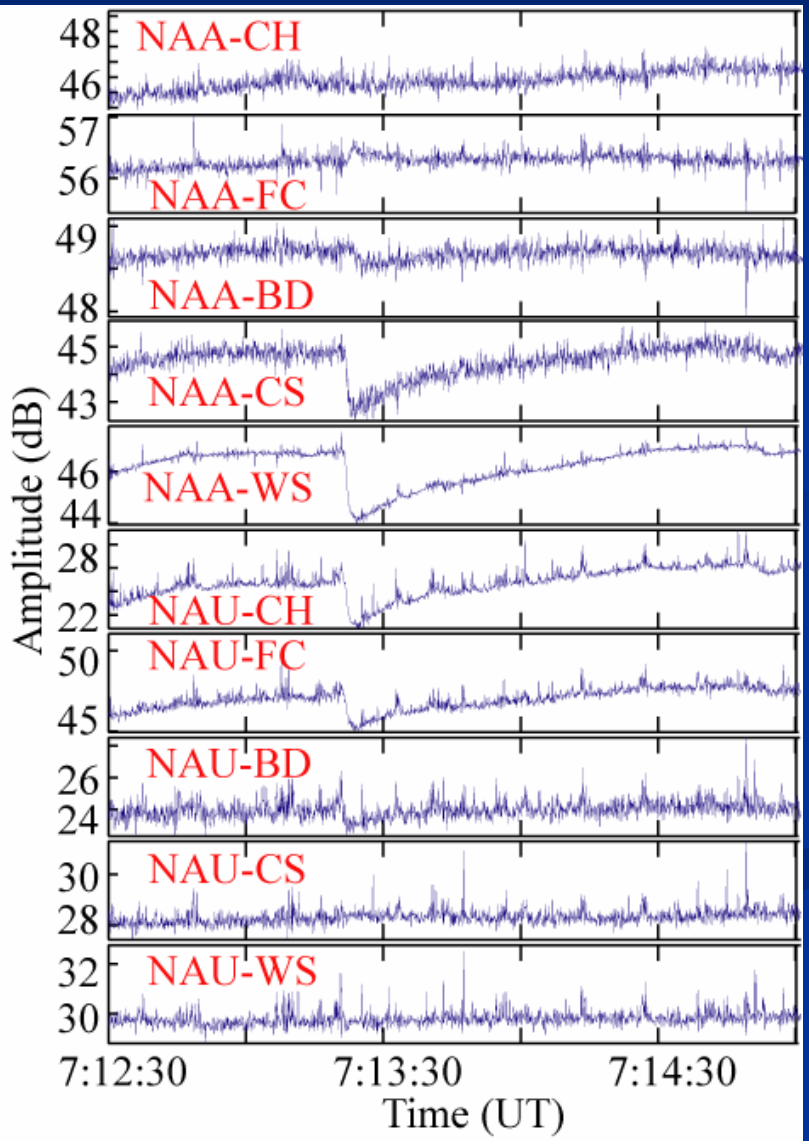
Subionospheric VLF Signatures of LEP Events

Theoretical Precipitation Region



The HAIL array captures the full latitudinal extent of the LEP events.

VLF Amplitude Data for 24 March 2001



Scientific Objectives - December 2005	Scientific Objectives – January 2006
Characterization of TLEs and TGFs, occurrence rate and triggering factors (QE, Cosmic rays)	Global mapping of TLEs and TGFs Characterization of TLEs and TGFs, occurrence rate and triggering factors (QE, Cosmic rays) Characterization of the parent lightning, that cause TLEs and TGFs and precipitate electrons, from optical and VLF and HF wave measurents
Effects of TLEs on ionosphere – atmosphere coupling	Control of thermospheric parameters (ionization rate, NOx, O3) from TLEs, TGFs and precipitated electrons
« Runaway electrons » and associated phenomena	Investigation of WPI leading to precipitated (LEP) electrons and accelerated (runaway) electrons Global mapping of the inner magnetosphere from wave and particle measurements
Direct coupling between the radiation belts and the atmosphere	Effects on the radiation belts of low altitude sources Track the variability of the radiation belt from electron and wave measurements at low altitudes and correlation with ground-based and high altitude measurements

2. Summary of the actions

- Write a common ASIM/TARANIS document showing complementarities and road maps
- Adjust the latitude coverage to allow (non-systematic observations) up to 67° Invariant Latitude
- Accommodate the LF electric antenna in such a way that EM signatures of bursts (10 – 100 ms) of Quasi Electrostatic (QE) be visible
- Base the Event mode on the capture of bursts of TLEs, TGFs and LEPs (taking into account of the shift of EM emissions towards higher L values for L <4)
- For each experiment define : (a) what is « an event », (b) what is the require resolution time to identify it, (c) what is the time interval needed to collect it
- Develop on-board processing to increase resolution times and collecting times without increasing the data rate (examples : MCM transmitted images, k vectors in the VLF band, ..)
- Examine complementarities between X ray and electron measurements for the detection of precipitated electrons
- Adjust each experiment to the Event and Survey Modes format proposed by LPCE
- Investigate the possibility of implementing a neural network for mapping the inner magnetosphere

- Use Nançay radiotelescope (Decameter) plus VLF antenna to point out potential signatures of EM waves associated with cosmic rays, compare with models (R. Roussel Dupré, M. Fullekrug)
- Use DEMETER data to test :

  - the detection of the parent lightning of TLEs and TGFs and potential other signatures in the ELF and VLF bands

  - the detection of LEPs and the identification of the parent lightning

  - the detection of bursts of QE field and the estimation of charge moment

  - the derivation of Ne from LHR and/or UHR (at least around the trough region)
- Investigate the possibility of a TM reception at Stanford