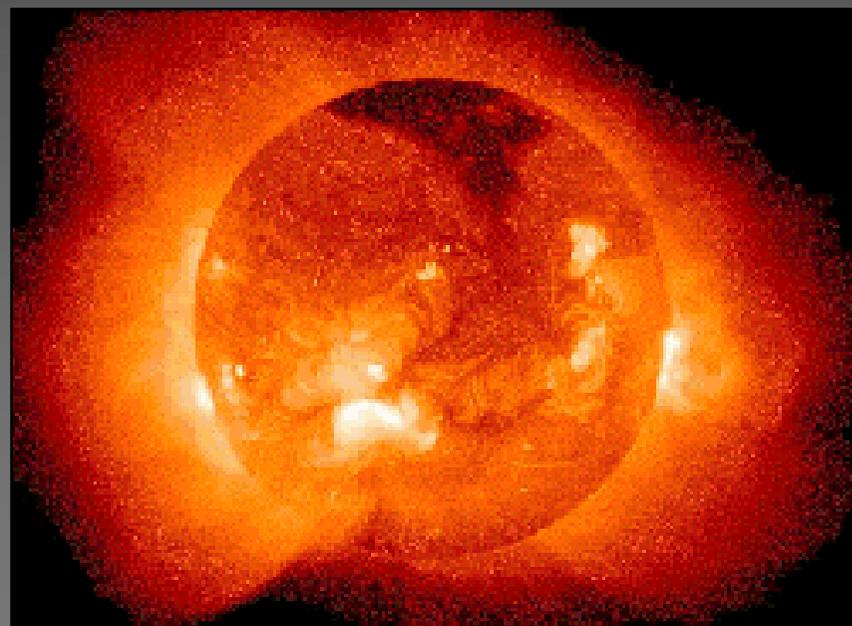
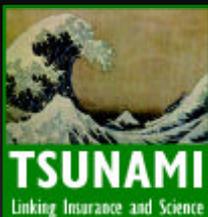


Satellite Risks

Two Research Proposals

- Developed with Mullard Space Science Laboratory
- and British Antarctic Survey
- **Prototype Instrumentation Project**
- **Space Weather Analysis and Prediction Project**

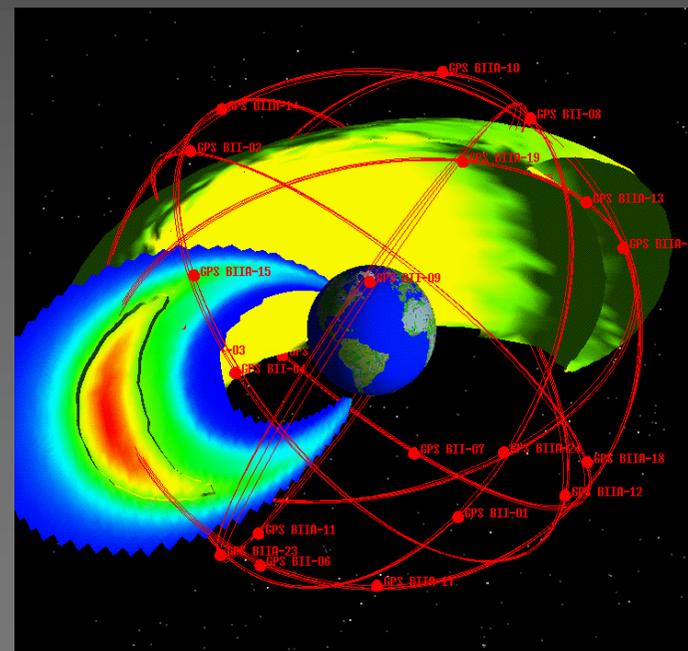
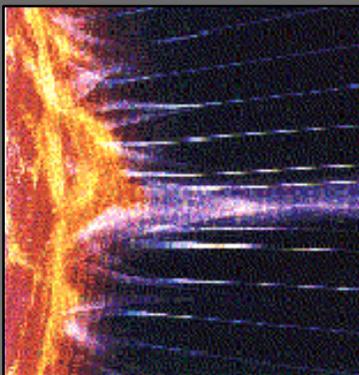


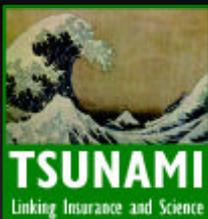


Satellite Risks

Hazard to Operational Commercial Satellites

- **Increasing numbers**
 - often in constellation in equatorial orbits
 - Often closer to Earth than geosynchronous orbit
- **Danger from charged particles in**
 - magnetosphere
 - radiation belts

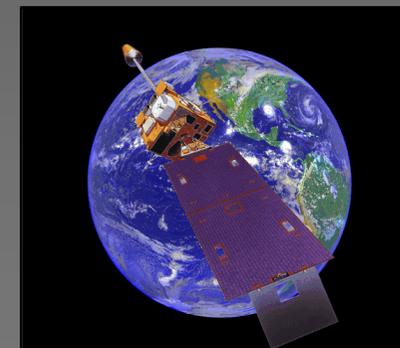


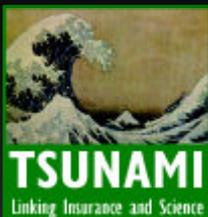


Satellite Risks

High Energy Particles

- **“Relativistic Electrons”**
 - inducing deep dielectric charging
 - Resultant arcing damages internal circuitry
- **Proton (cold ions)**
 - cause single event failures in electronic memory
 - Particular concern to defense satellite operators

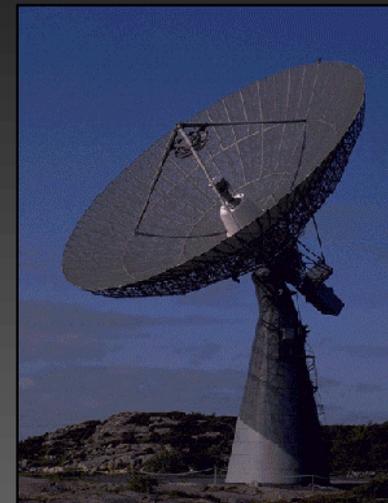


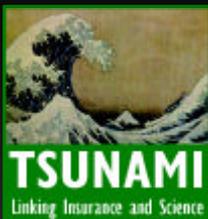


Satellite Risks

Compact Energetic Electron Detector

- Current sensors 6kg and 6litres
- Miniaturisation possible to 0.6kg and 0.6litres
- **Cost £39,000**
 - land prototype for ground testing and production development
- **Flying version ~£100k+ possible on DERA satellites**
 - Geostationary transfer orbits, from 6.6 Earth radii to ~200km
 - Surveys all radiation belts
- **Ultimately, sensor could fly on commercial satellites**





Satellite Risks

Space Weather Prediction Project

- **DERA's STRV1a's cold ion detector provided valuable data**
 - Currently being analysed to understand processes
- **Predictive engineering tool possible**
 - Using past anomalies from NOAA data
 - Theoretical input from British Antarctic Survey
- **Cost**
 - approximately £50,000

