No	Mission	Year	Orbit	Payload
1	Atmosphere Explorer – A	1963	255 – 916 km, i=57°	Sensors for neutral and ionized species of atmospheric gazes
2	Atmosphere Explorer – B	1966	276 – 2725 km, i=64°	Sensors for neutral and ionized species of atmospheric gazes
3	Atmosphere Explorer – C	1973	149 – 4294 km, i=68°	Sensors for neutral and ionized species of atmospheric gazes, optical and UV spectrometers
4	Atmosphere Explorer – D	1975	154 – 3816 km, i=90°	Sensors for neutral and ionized species of atmospheric gazes
5	Atmosphere Explorer – E	1975	156 – 2983 km, i=20°	Sensors for neutral and ionized species of atmospheric gazes
6	Dynamics Explorer 2	1981	309 – 1012 km, i=90°	Sensors for neutral and ionized species of atmospheric gazes, sensors for quasi DC magnetic field, DC and AC electric field
7	San Marco D/L	1988	262 – 619 km, i=2°	Neutral wind probe, plasma probes, electric field probe
8	Active (Intercosmos – 24)	1989	500 – 2500 km, i=82°	Plasma probes, sensors for quasi DC electric and magnetic fields, wave probes, energetic particle probe, VLF-transmitter
9	APEX	1991	440 – 3000 km, i=82°	Sensors for neutral and ionized species of atmospheric gazes, electric beam and plasma injectors
10	FREJA	1992	650 – 1800 km, i=65°	Plasma probes, high data rate electromagnetic wave probes, energetic particle probes, UV imager
11	GPS system	1994	20200 km, i different, ≥ 24 satellite	For ionosphere research: total electron content (TEC)
12	ROCSat – 1	1999	600 km, i=35°	Plasma probes
13	CHAMP	2000	454 km, i=87°	Magnetic field probes, precise accelerometer
14	Variant (on Sich – 1M S/C)	2004	280 – 650 km, i=83°	Electric probes, electromagnetic wave probes, electric current probes, fluxgate magnetometer
15	DEMETER	2004	~ 710 km, changed to 660 km, i=98°	Plasma probes, electric field and AC magnetic field probes
16	Compass – 2	2006	~ 400 km, i=79°	Electromagnetic wave probes in ULF-VLF bands

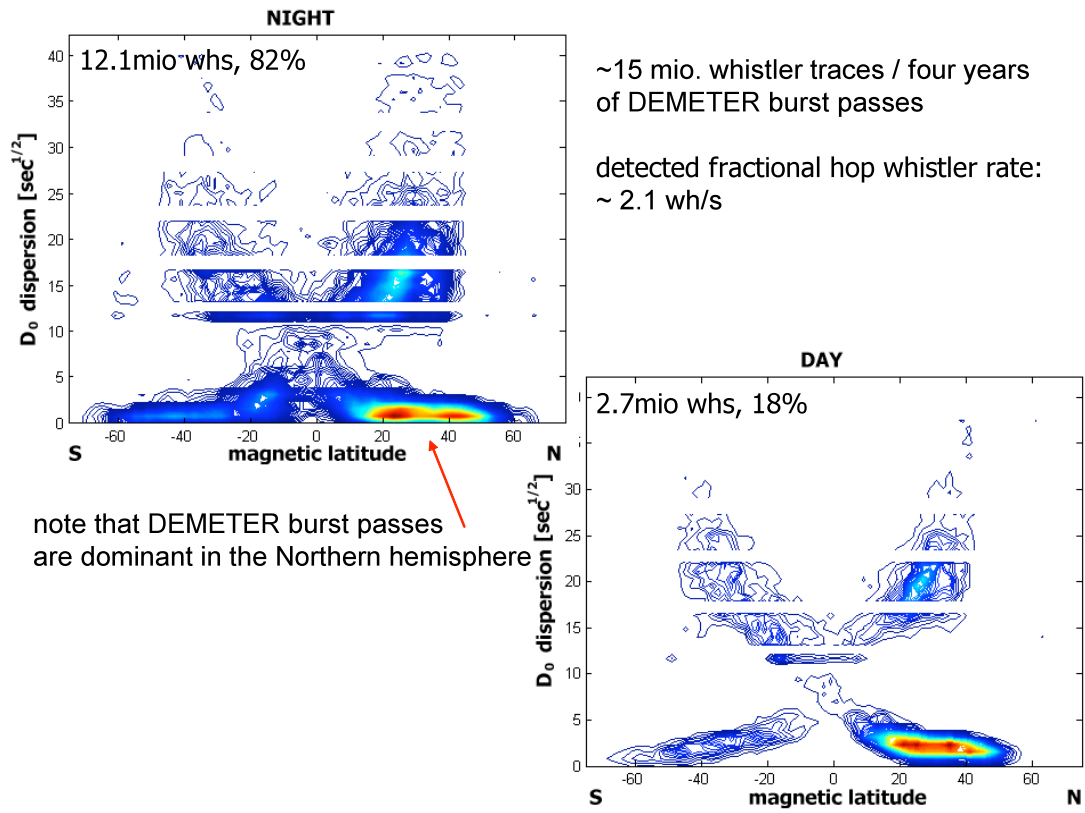**Table 1.** *Main ionosphere satellite missions important in the creation of the IWS*
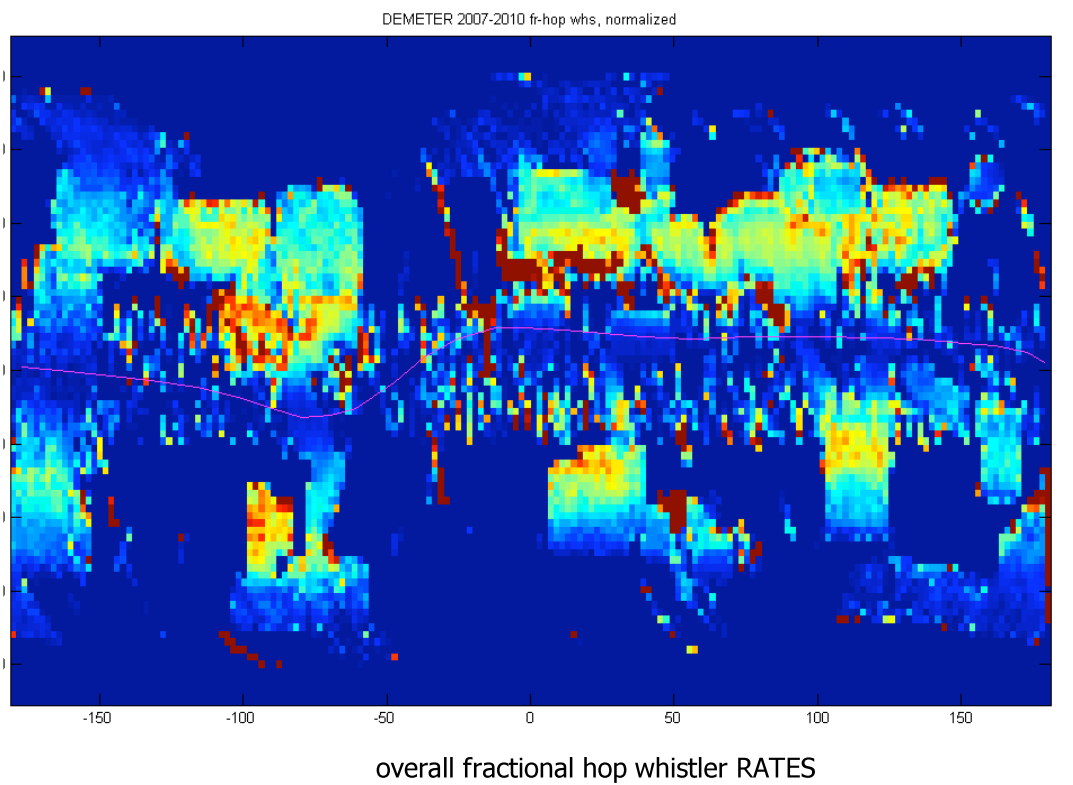
Figure 1.

NIGHT

12.1mio whs, 82%

~15 mio. whistler traces / four years
of DEMETER burst passes

detected fractional hop whistler rate:
~ 2.1 wh/s

DAY

2.7mio whs, 18%

note that DEMETER burst passes
are dominant in the Northern hemisphere

Figure 2.

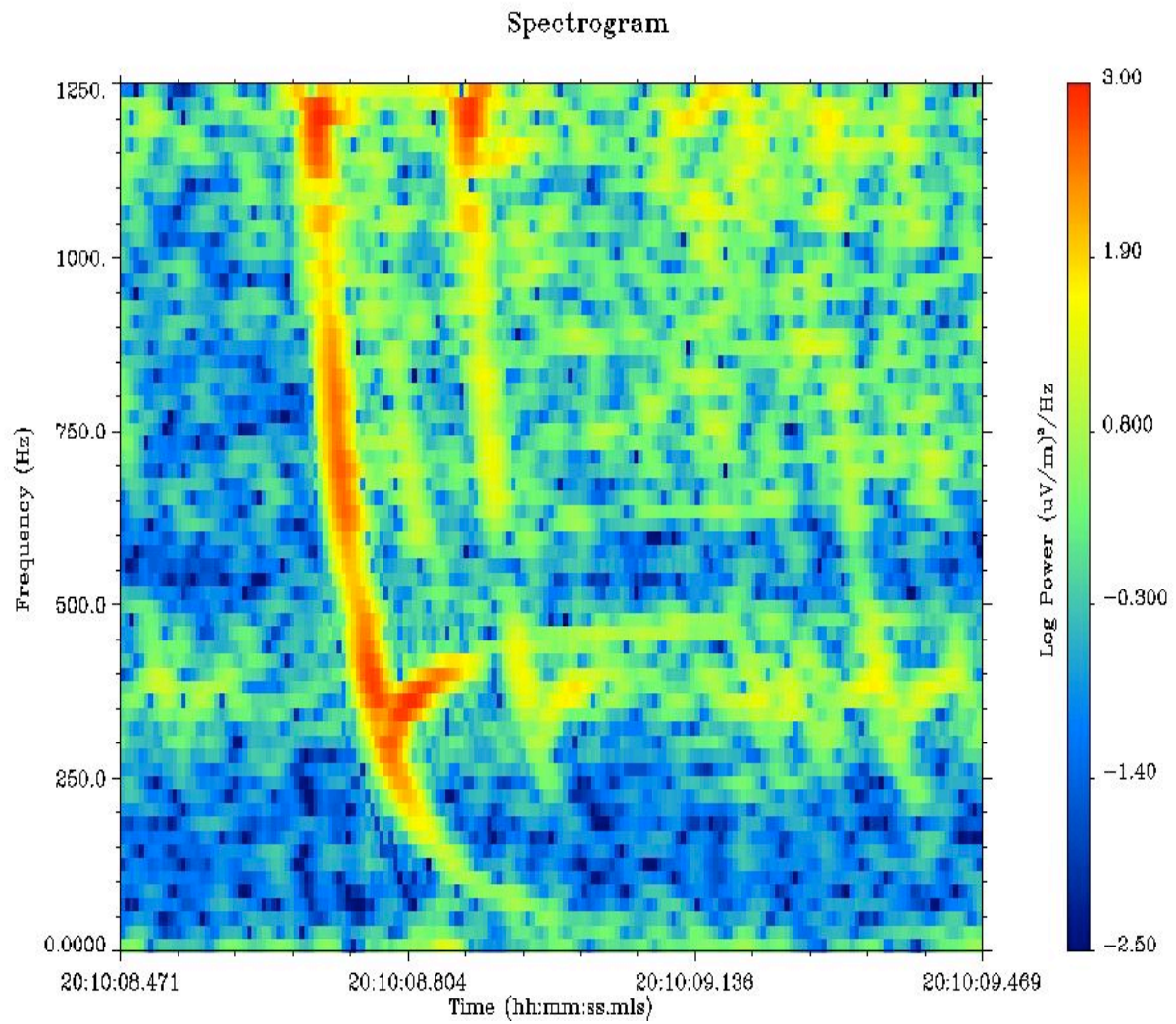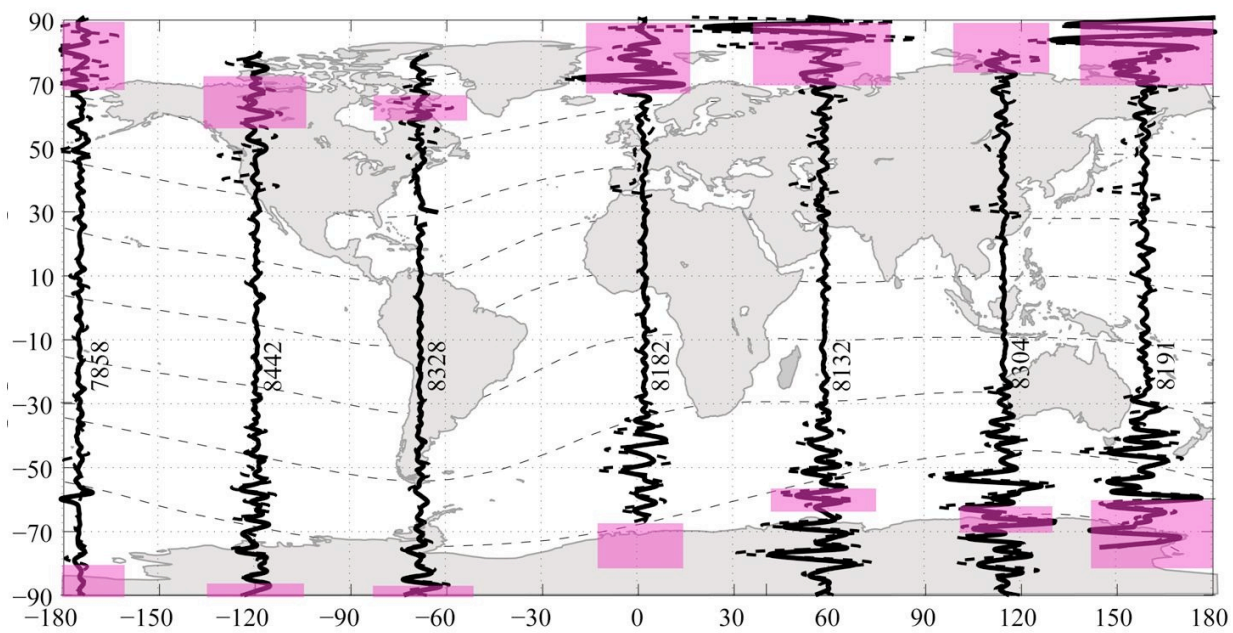DEMETER 2007-2010 fr-hop whs, normalized

overall fractional hop whistler RATES

Figure 3.

Figure 4.

Figure 5.

Figure 6.

DE-2
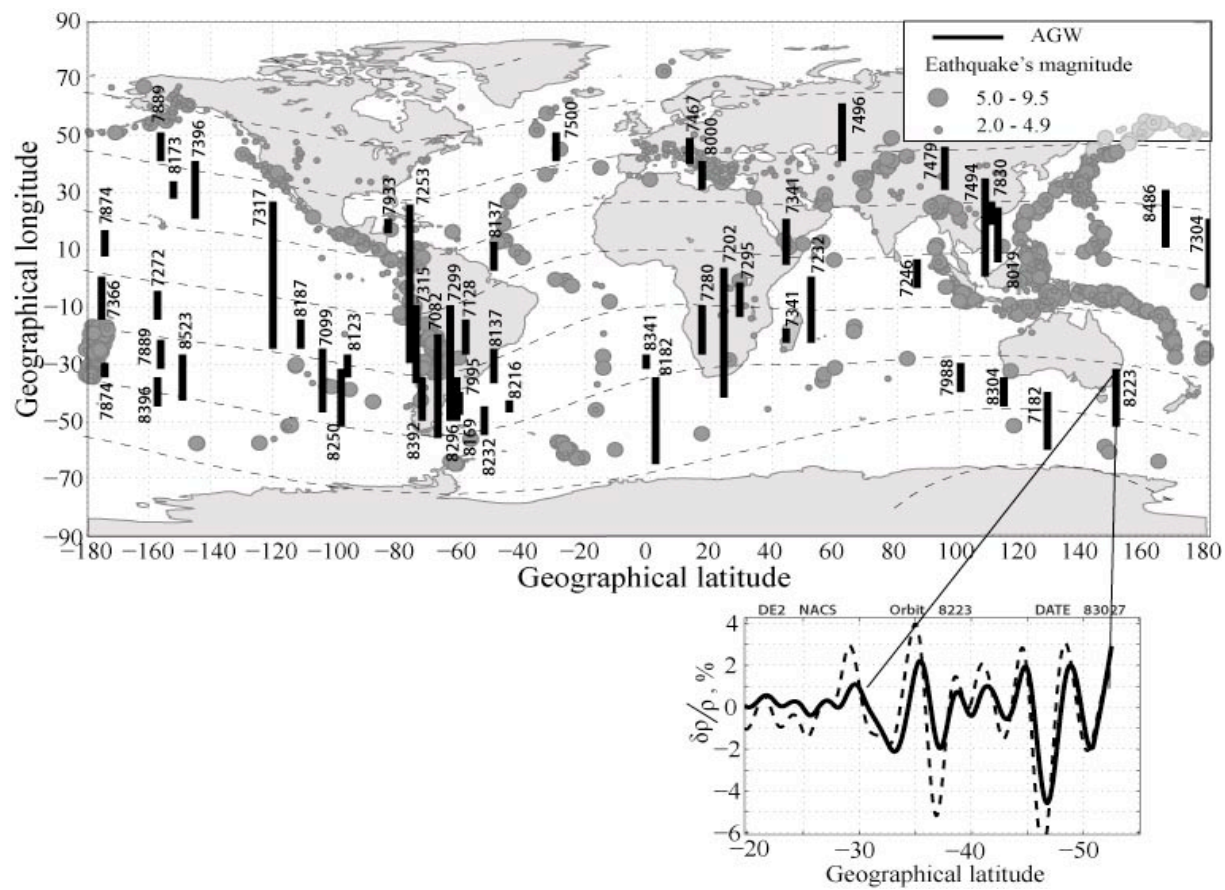
Occurrences of wavelength_spectral_max

DEMETER

Occurrences of wavelength_spectral_max

Figure 7.

Figure 8.