Использование данных радиофизических и оптических инструментов для исследования и мониторинга верхней атмосферы

Взаимосвязанная система термосфера-ионосфера

Термосферные параметры:

T_n, $\boldsymbol{V}_n$

$n(O_2)$, $n(N_2)$, $n(O)$, $n(NO)$

(от 80 км до 526 км)

Ионосферные параметры:

n_e, T_i и T_e

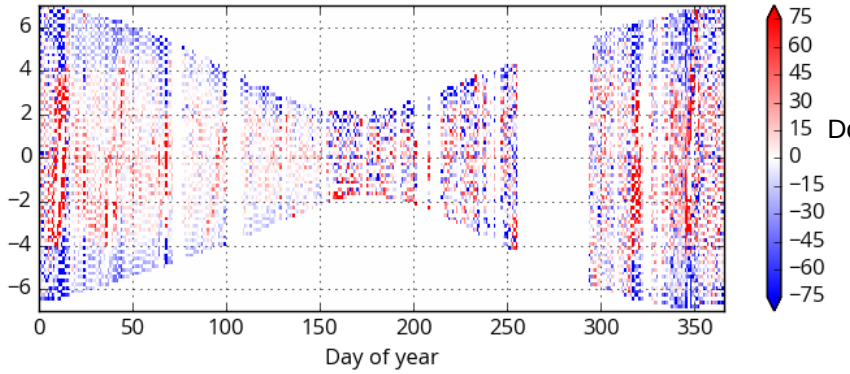
$n(O^+)$, $n(H^+)$, $n(O_2^+)$

вектора скоростей ионов

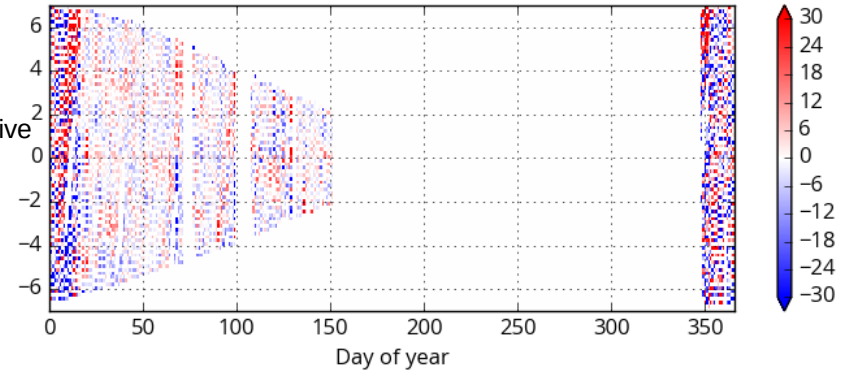
(от 180 км до 600 км???)

ExB дрейф плазмы

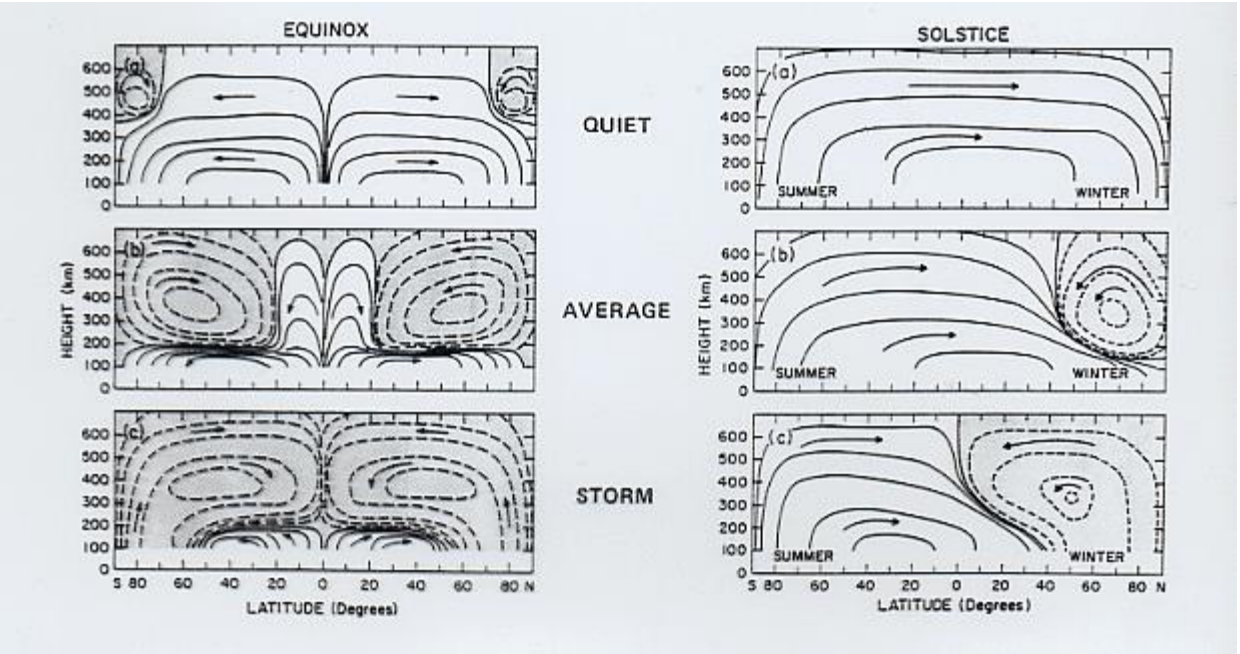
Измерения вертикального ветра интерферометром Фабри-Перро в Торах в 2016-2017 годах



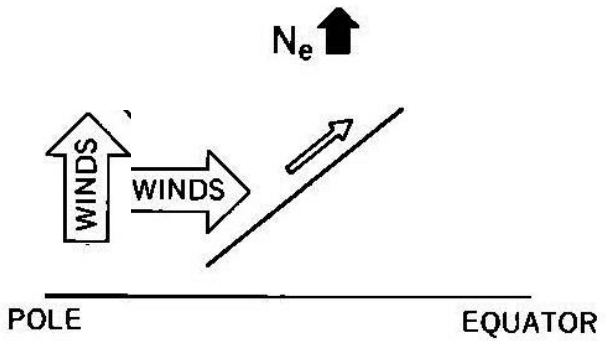
Z
vertical
Downward positive



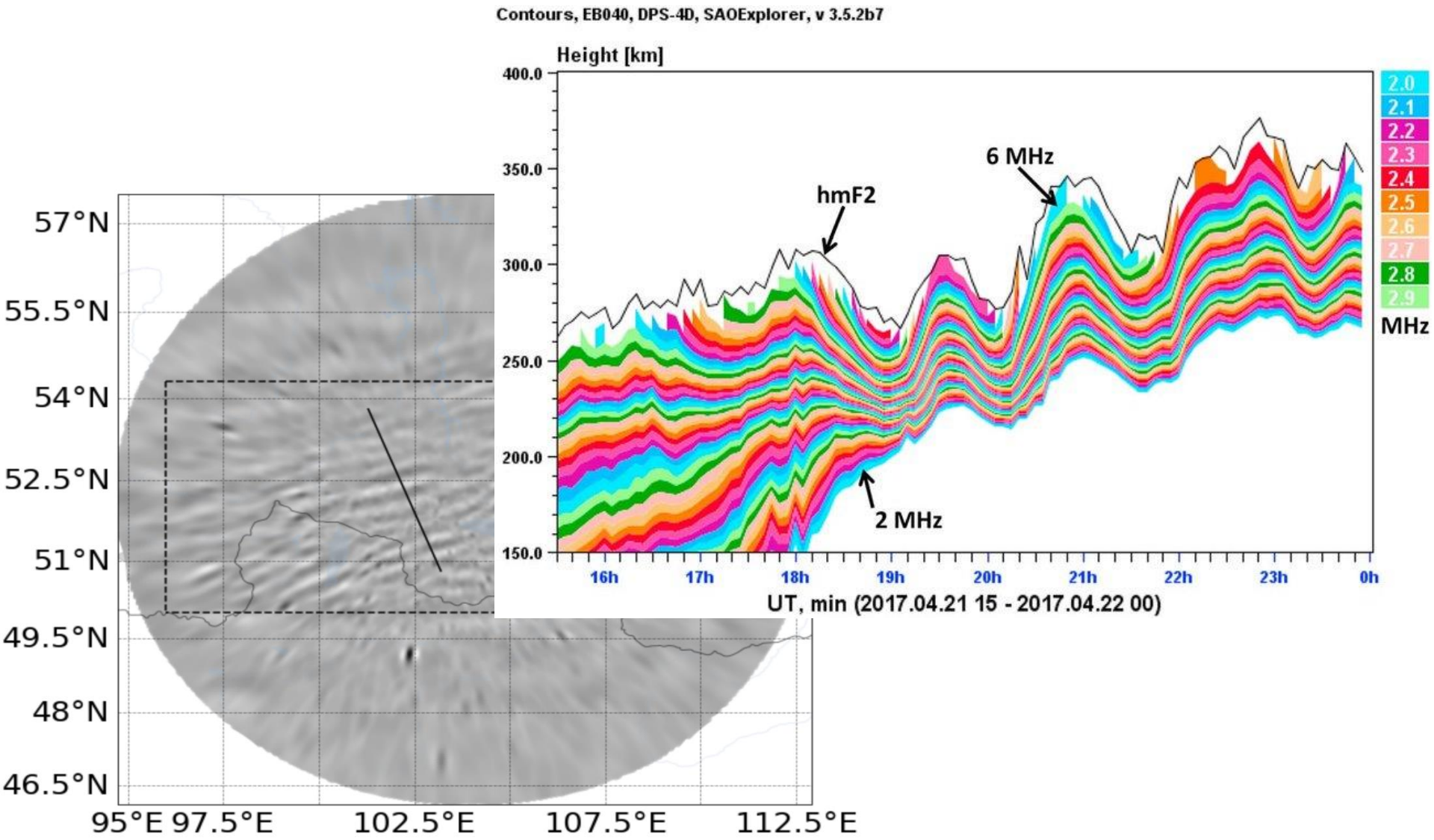
Проверка теории Ришбета



Вклад в вертикальный перенос плазмы

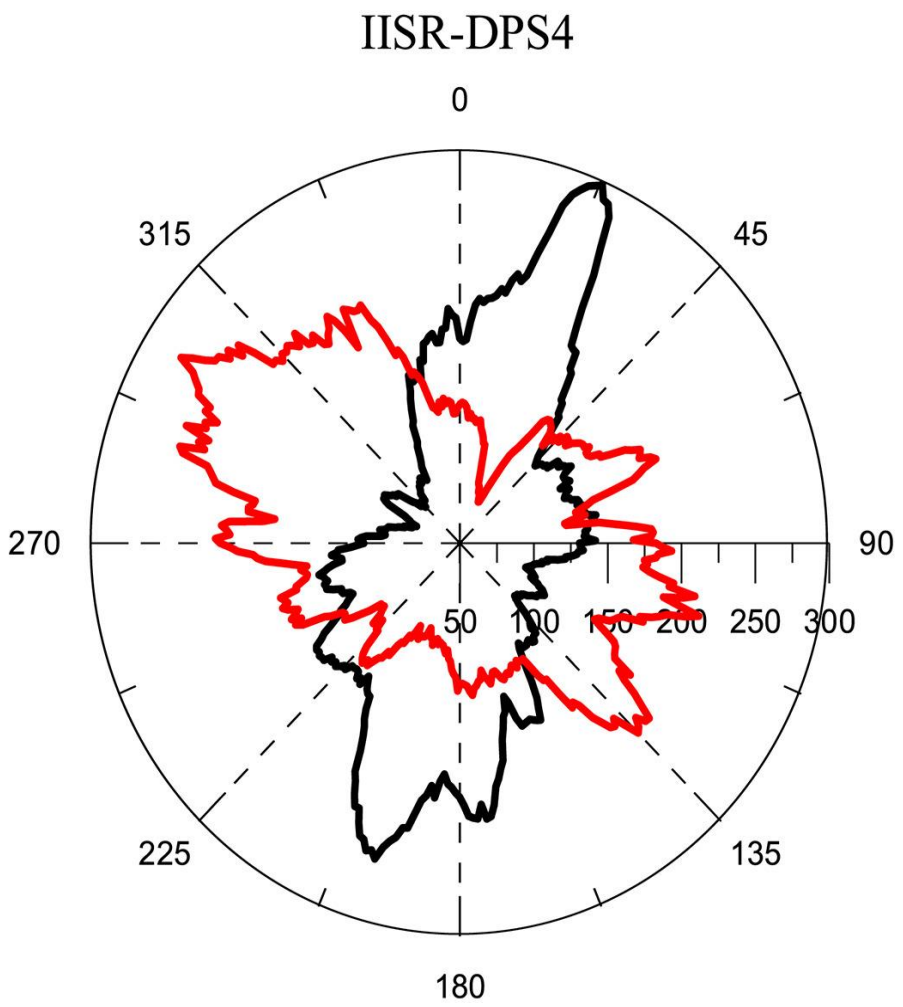


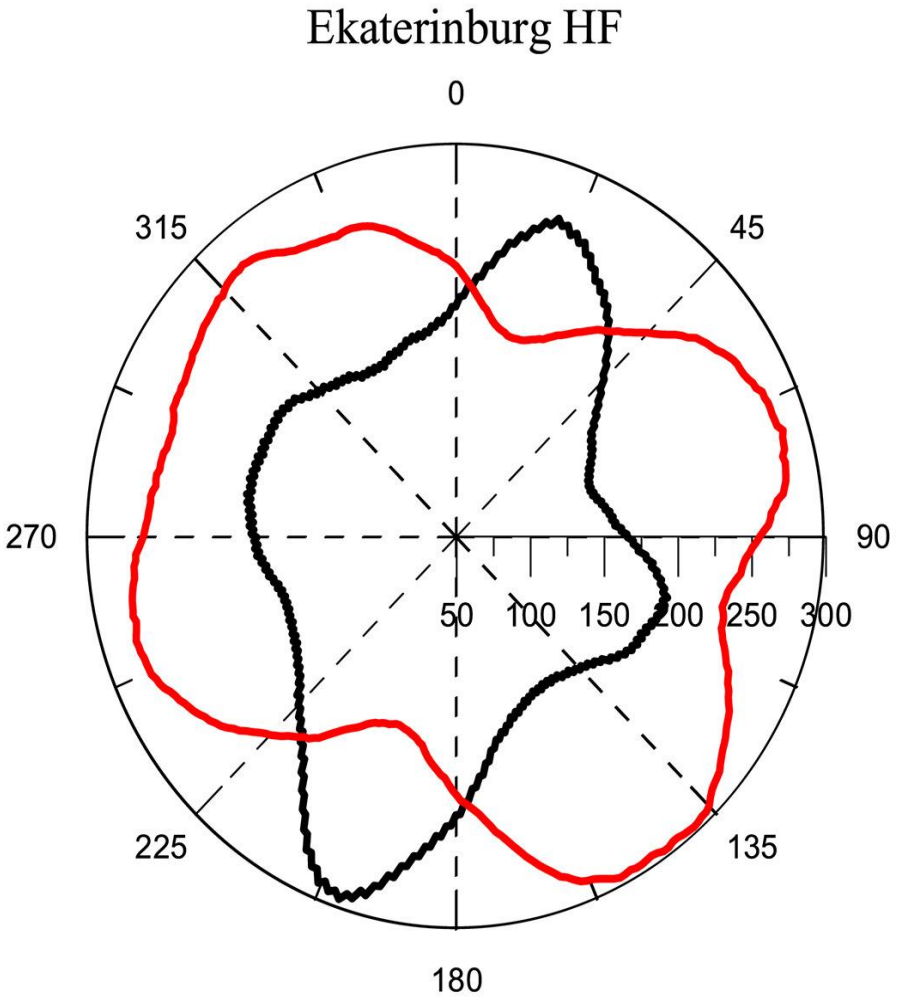
ВГВ и ПИВы



Syrenova et al., 2022

Определение ветра

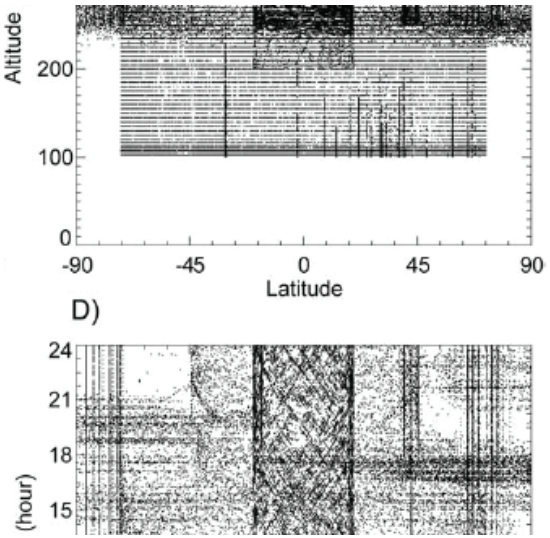




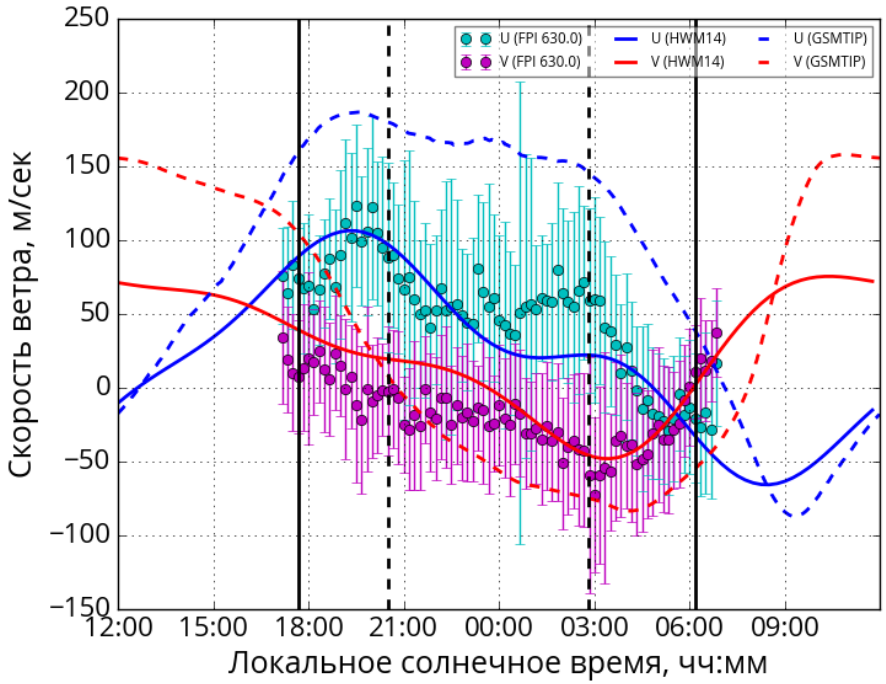
Medvedev et al., 2017

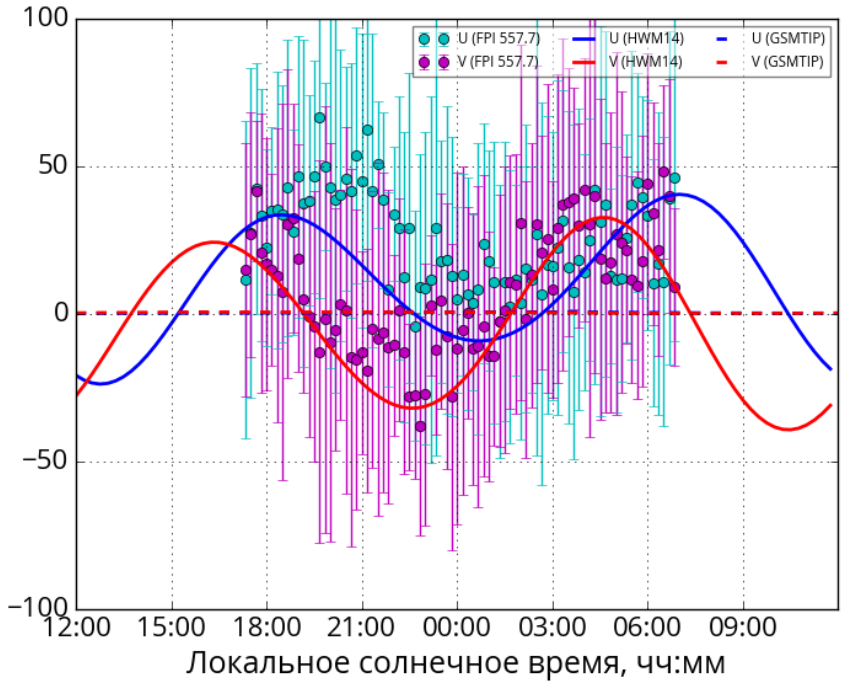
Данные для построения моделей

Fabry-Perot Interferometer							
Arecibo	18.4°N, 66.8°W	250	1980–1999	night	473	14,198	*Burnside and Tepley* [1989]
Arequipa	16.2°S, 71.4°W	250	1983–2001	night	1048	32,238	*Meriwether et al.* [1986]
Arrival Heights	77.8°S, 116.7°E	250	2002–2005	night	535	54,214	*Hernandez et al.* [1991]
Halley Bay	75.5°S, 26.6°W	250	1988–1998	night	799	82,614	*Crickmore et al.* [1991]
Millstone Hill	42.6°N, 71.5°W	250	1989–2002	night	1,770	68,333	*Sipler et al.* [1982]
Mount John	44.0°S, 170.4°E	89, 96, 250	1991–1996	night	560	2,660	*Hernandez et al.* [1991]
Søndrestrøm	67.0°N, 51.0°W	250	1984–2004	night	1,223	69,734	*Killeen et al.* [1995]
South Pole[d]	90.0°S	86, 250	1989–1999	night	1,091	163,044	*Hernandez et al.* [1991]
Svalbard[e]	78.2°N, 15.6°E	250	1980–1983	night	44	7,472	*Smith and Sweeny* [1980]
Thule	76.5°N, 68.4°W	250	1987–1989	night	172	21,500	*Killeen et al.* [1995]
Resolute Bay	74.7°N, 94.9°E	250	2003–2005	night	166	5,299	*Wu et al.* [2004]
Watson Lake	60.1°N, 128.6°W	250	1991–1992	night	135	28,000	*Niciejewski et al.* [1996]
Incoherent Scatter Radar[e]							
Arecibo	18.3°N, 66.8°W	100–170	1974–1987	day	149	30,600	*Harper* [1977]
Chatanika	65.1°N, 147.4°W	90–130	1976–1982	day	97	38,721	*Johnson et al.* [1987]
European Incoherent Scatter	69.6°N, 19.2°E	100–120	1985–1987	day	29	2,900	*Williams and Virdi* [1989]
Millstone Hill	42.6°N, 71.5°W	120–400	1983–1987	both	142	23,536	*Salah and Holt* [1974]
Søndrestrøm	67.0°N, 50.9°W	150–400	1983–1987	both	146	19,600	*Wickwar et al.* [1984]
St. Santin[f]	44.6°N, 2.2°E	90–165	1973–1985	day	256	18,382	*Amayenc* [1974]

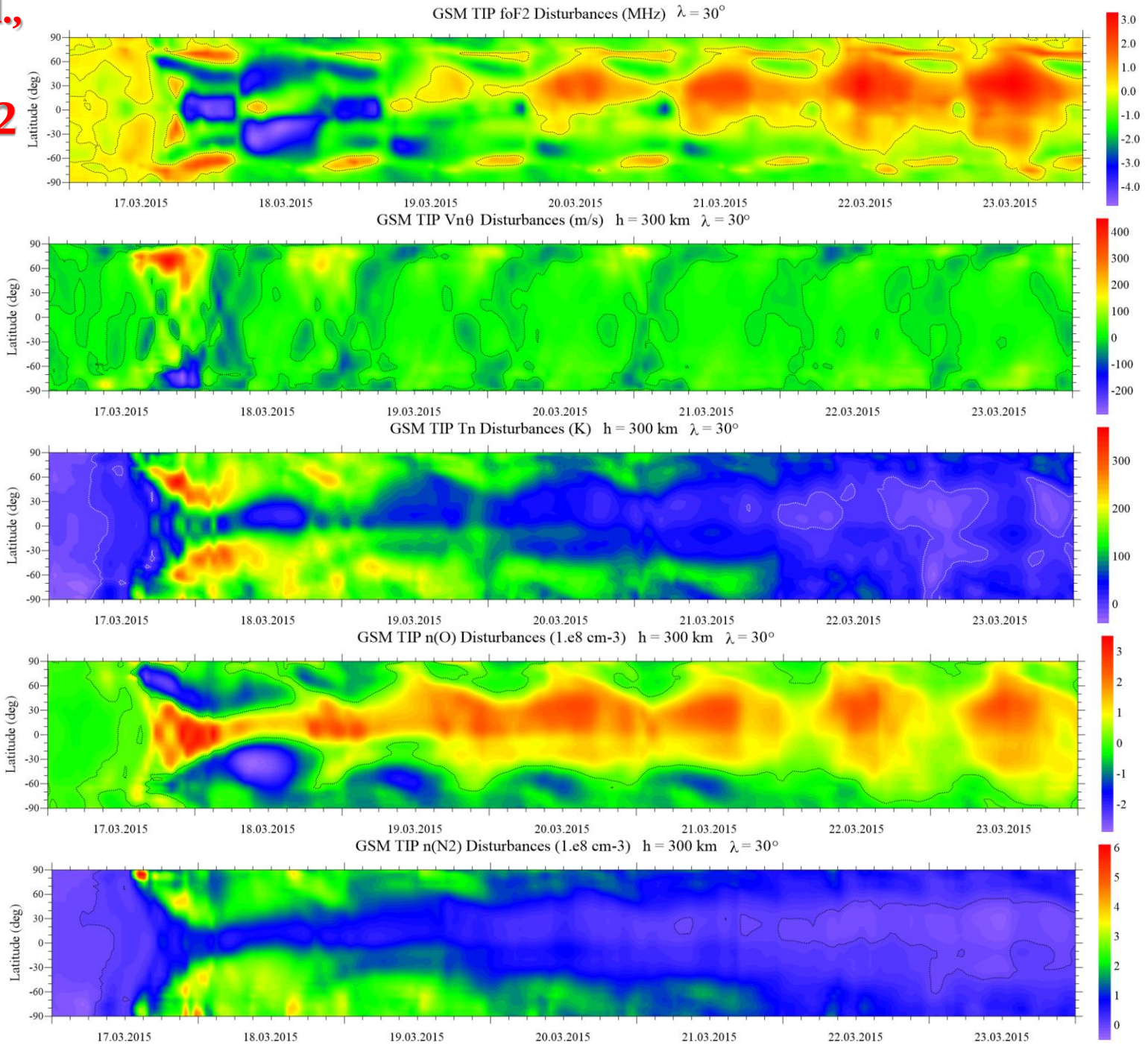


630.0 nm **Валидация моделей** 557.7 nm





Klimenko et al., 2018 JASTP model Δ*foF2*



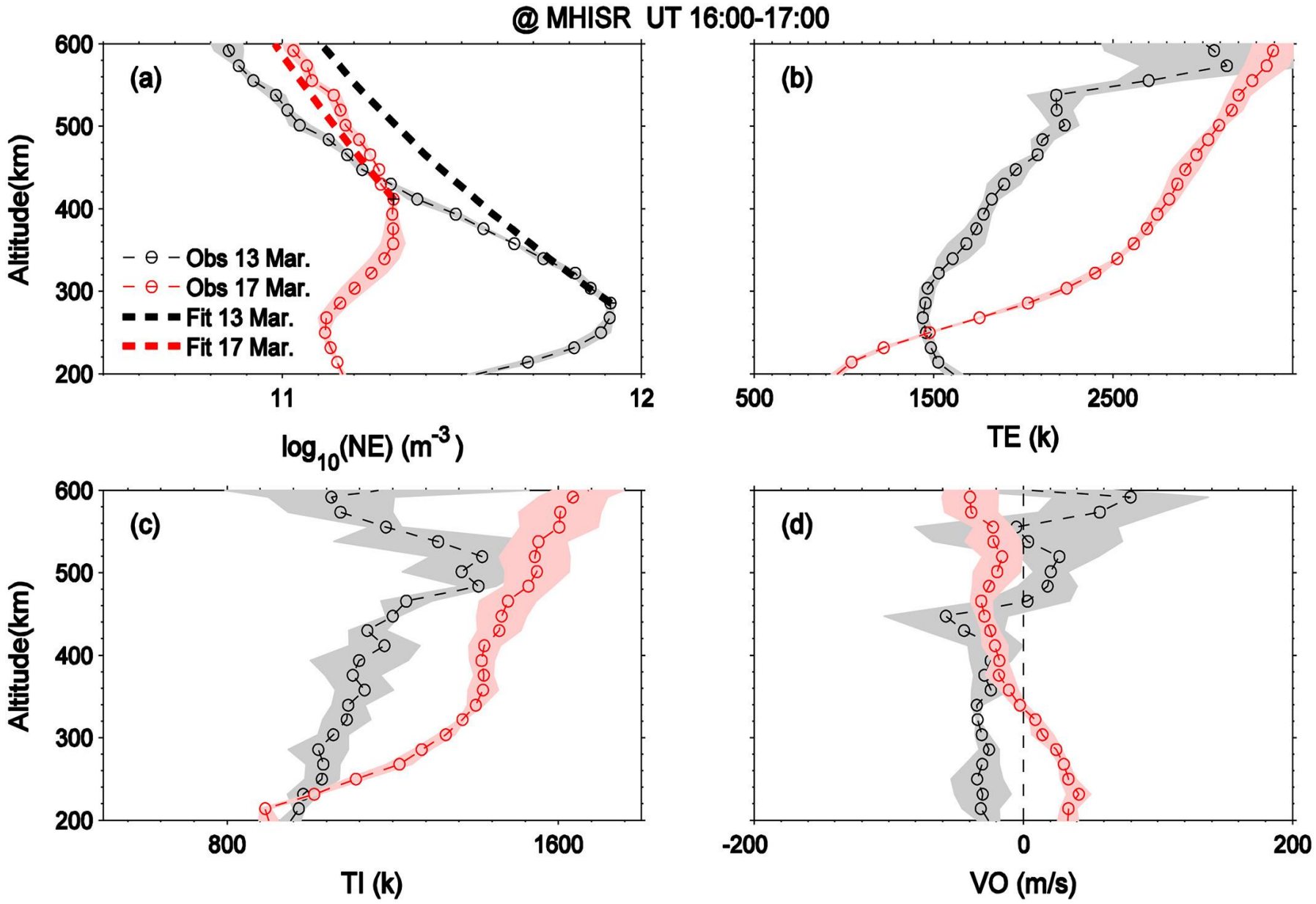
$\Delta V_{n\Theta}$

ΔTn

$\Delta n(O)$

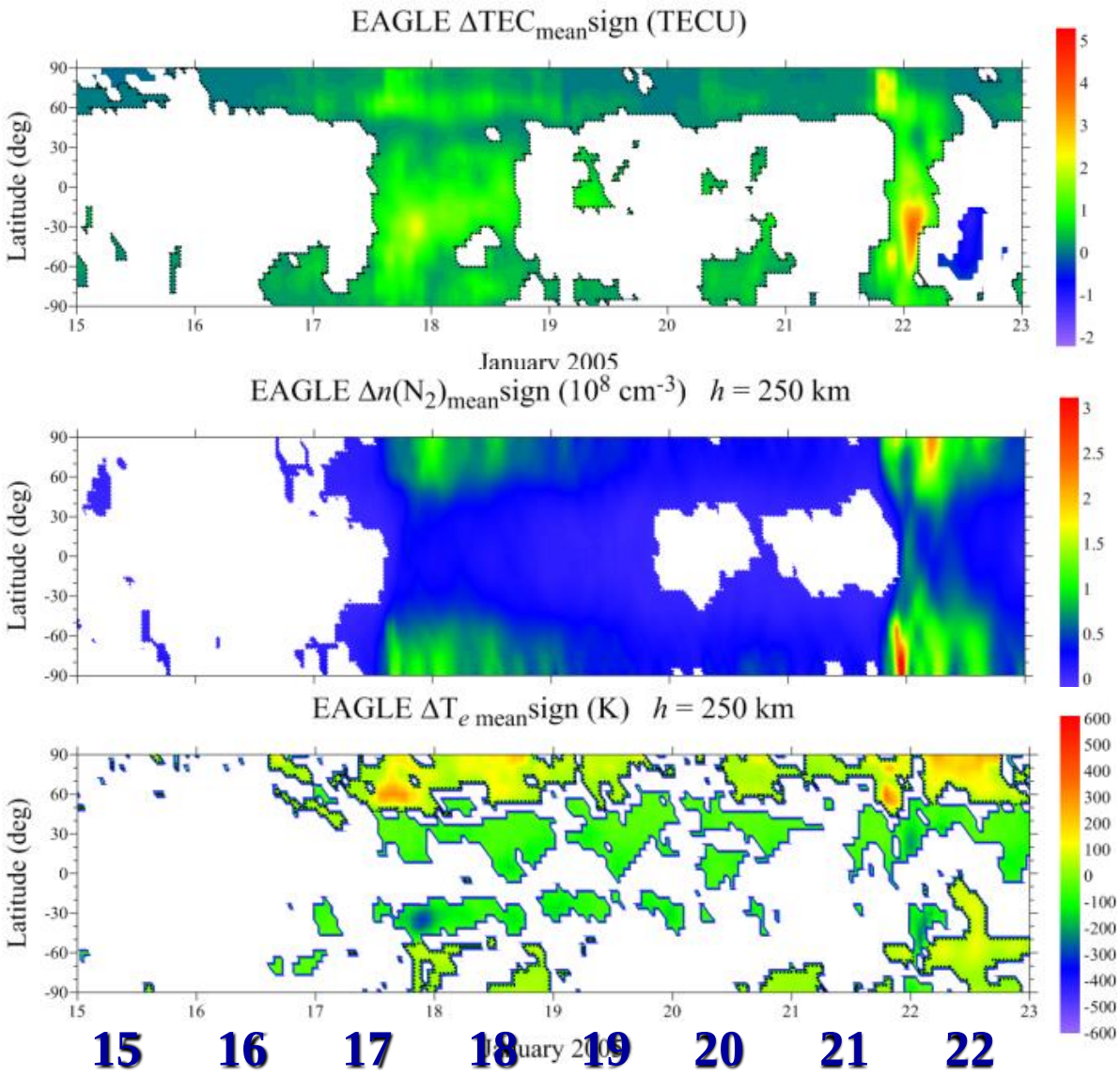
$\Delta n(N_2)$

Влияние Te на ne во внешней ионосфере



Profiles of ionospheric storm-enhanced density during the 17 March 2015 great storm

Влияние Te на ne во внешней ионосфере

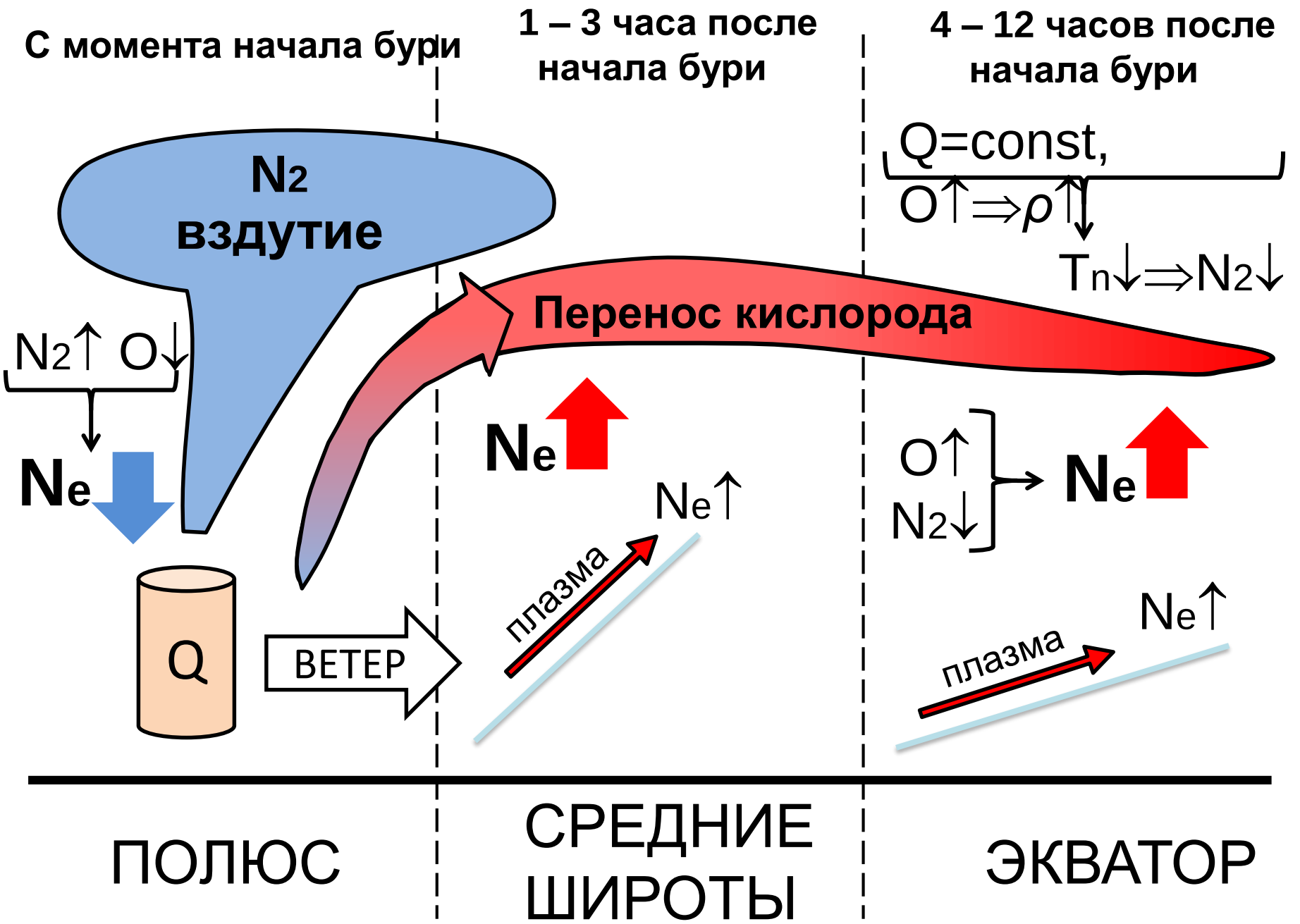


возмущения TEC

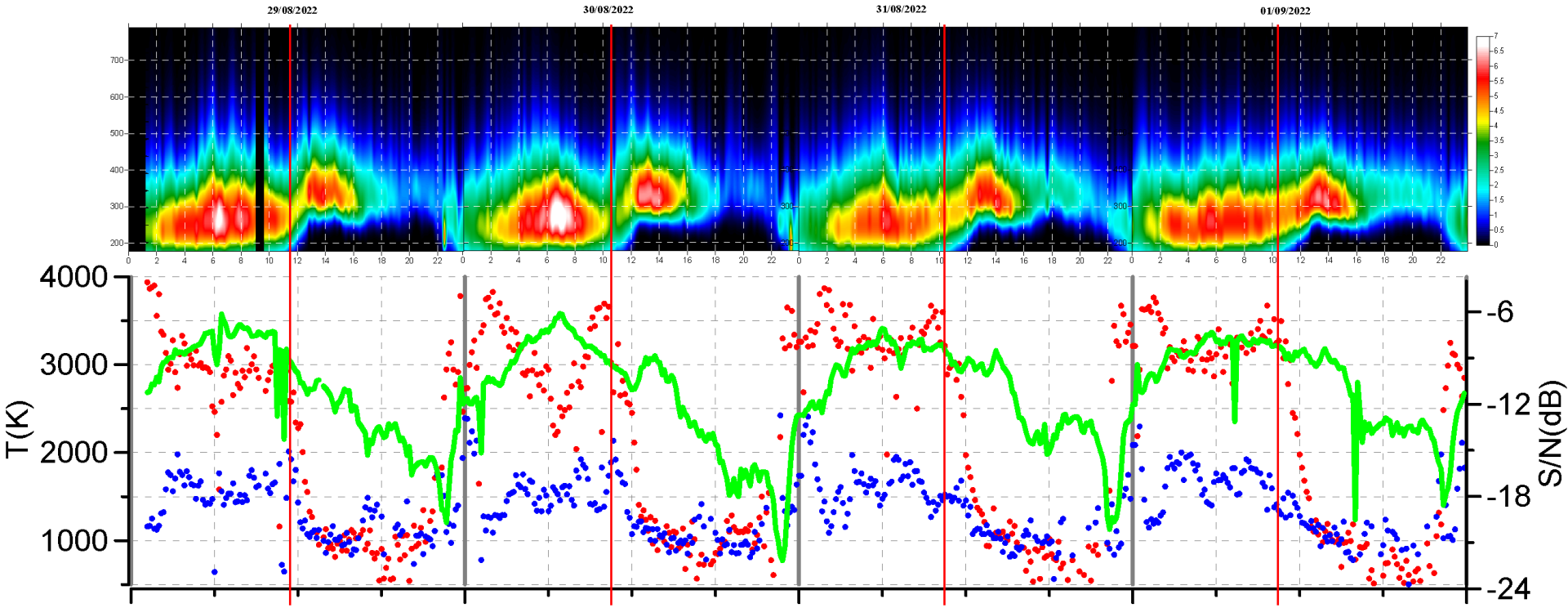
возмущения n(N2)

возмущения Te

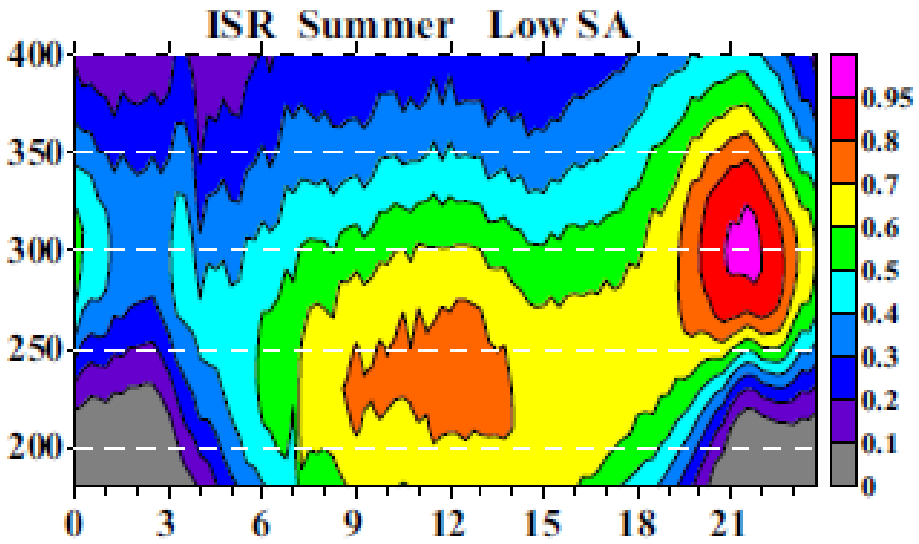
А) Главная фаза геомагнитной бури

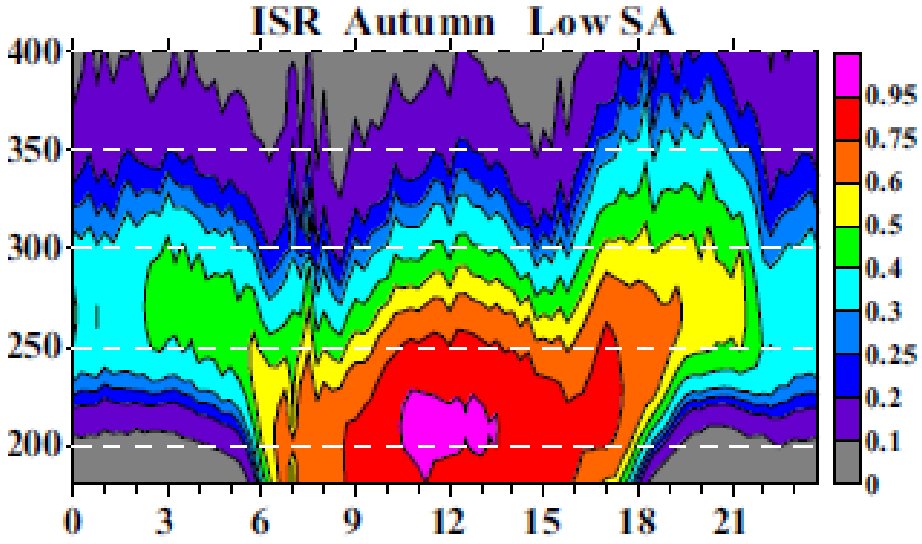


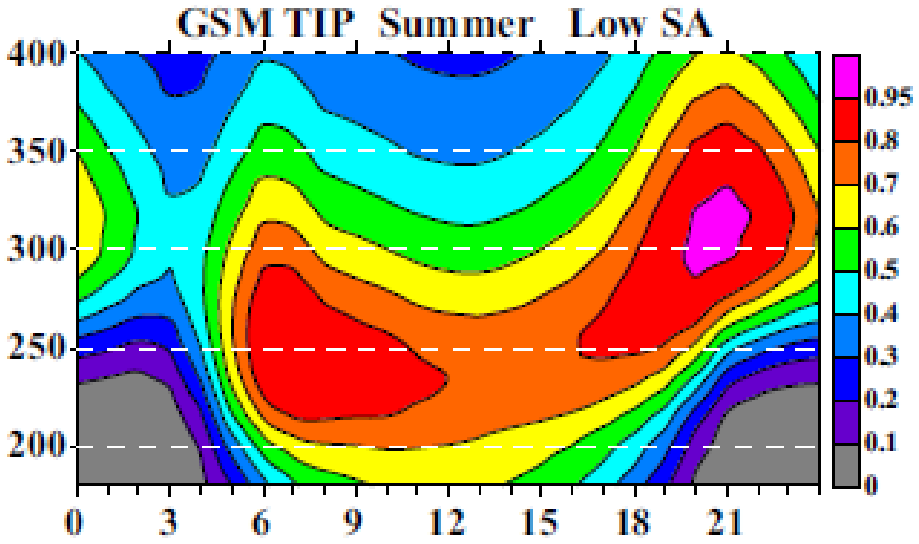
Данные интенсива 29.08-01.09

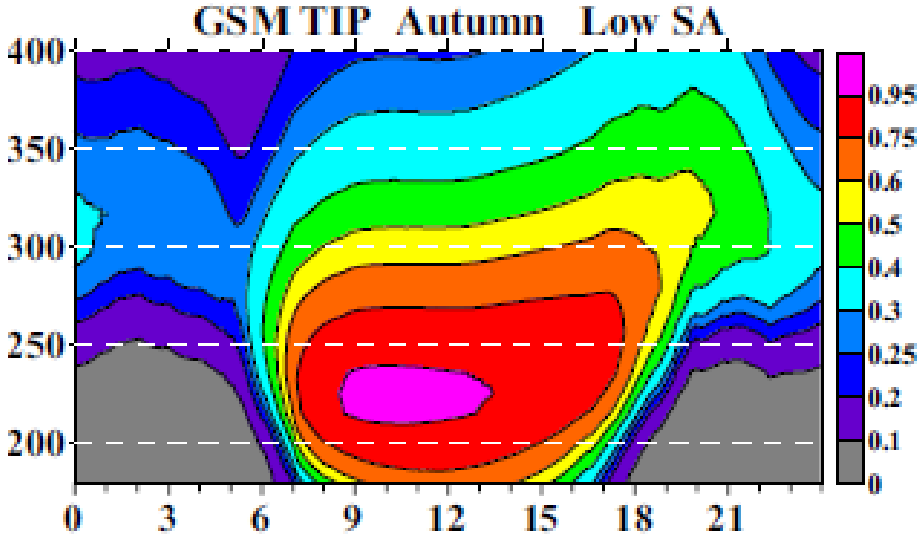


Вечерний среднеширотный максимум в NmF2



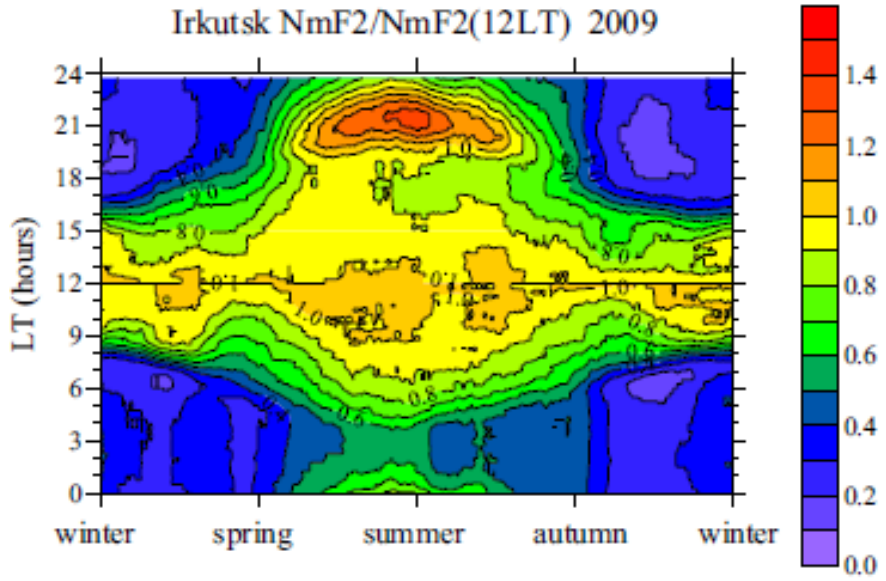


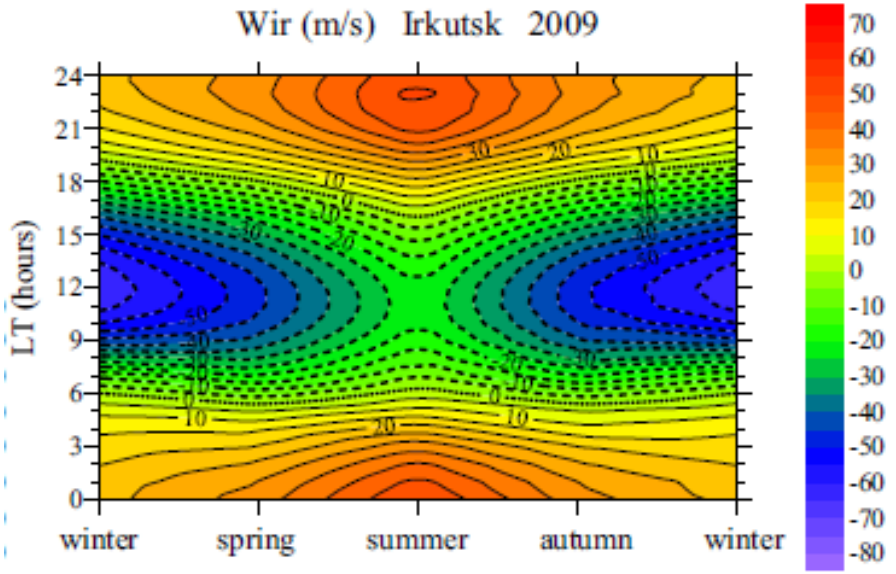


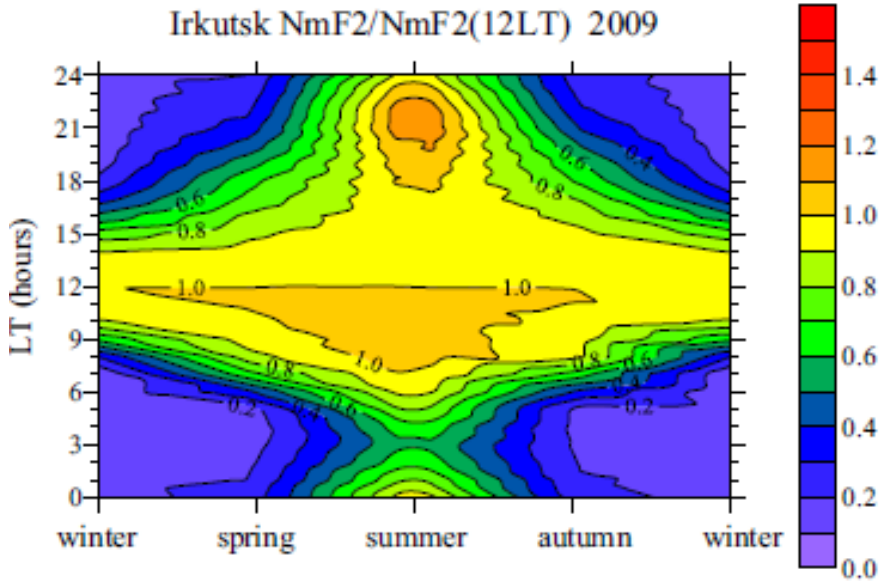


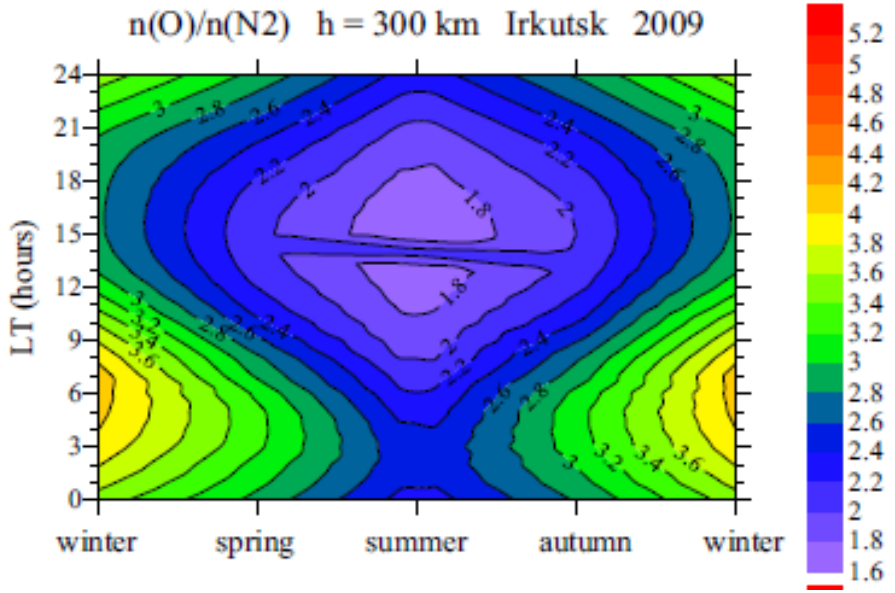
Zherebtsov et al., 2017

Вечерний среднеширотный максимум в NmF2









Klimenko et al., 2015

SAMI-2

18 LT | 20 LT | 22 LT | 24 LT

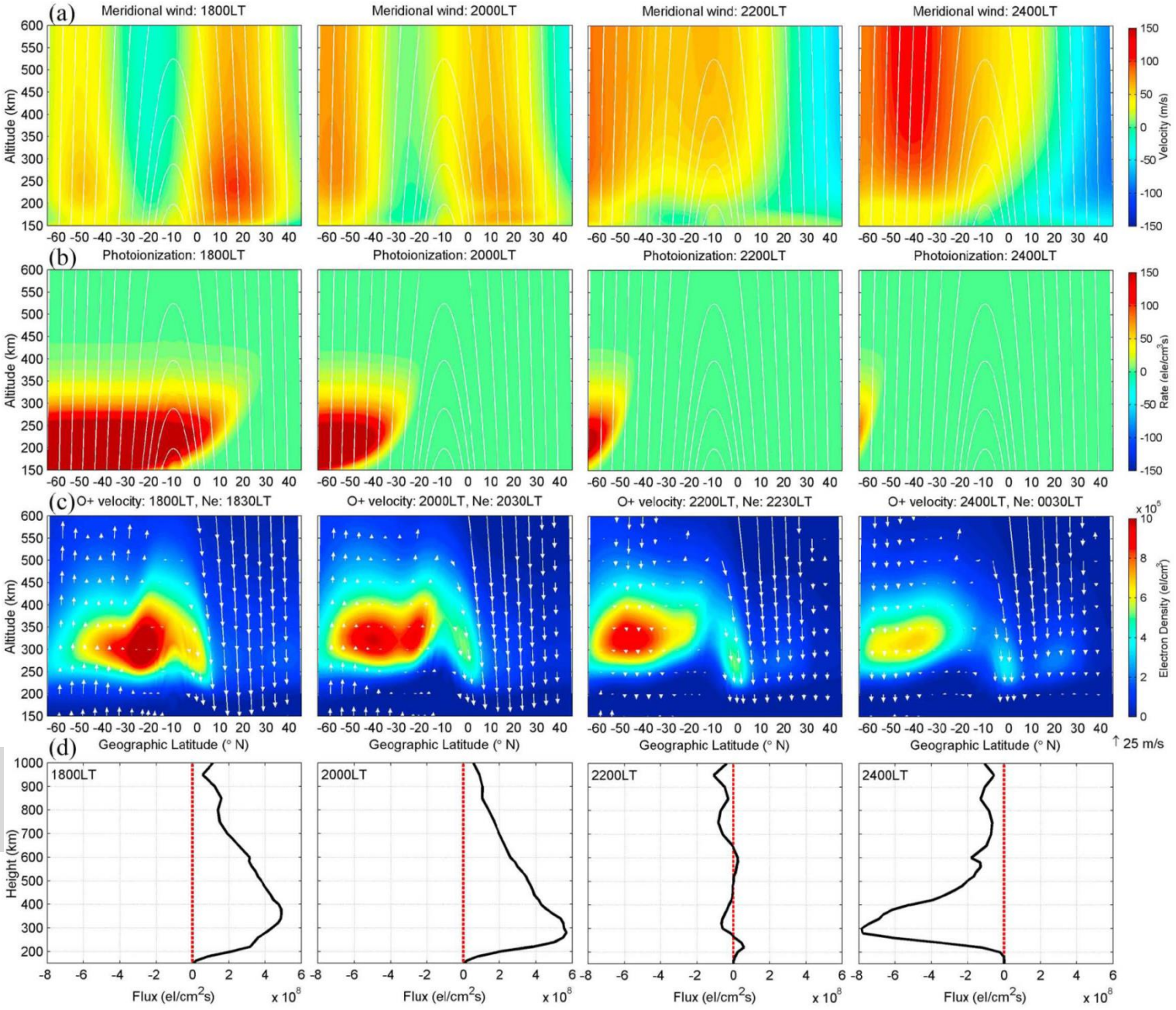
Meridional neutral wind

Photoioniztion displasement

Electron density

Very low latitudes of WSA

Plasmaspheric flux



Chen et al., 2011