

List of Events in Solar Cycle 23

Events	Data currently/ to be available/Providers	Previous/ on-going / planned Studies	Notes
E.2001.090 (03/31): 2001/03/29 - 04/03			<ul style="list-style-type: none"> • Kp_max = 8.7 • F10.7 = 245 (273) • Dst_min= -387 nT • E. Henley's choice
E.2001.243 (08/31): 2001/08/31 - 09/01	<ul style="list-style-type: none"> • B fields at GOES • Ground based magnetometers data • DST index (Kyoto WDC, USGS) • DMSP Poynting flux/D. Knipp • CHAMP electron density • CHAMP neutral density/E. Sutton (AFRL) • Jicamarca vertical drift/J. L. Chau(IAP Rostock) and D. Anderson (UCB) 	<ul style="list-style-type: none"> • Magnetic field at geosynchronous orbit • Ground magnetic perturbations • DST index • Poynting Flux • Electron density at CHAMP orbit • Neutral density at CHAMP orbit (point by point comparison) • Vertical drifts at Jicamarca 	<ul style="list-style-type: none"> • GEM/GEM-CEDAR event • Kp_max = 4 • F10.7 = 192 (203) • Dst_min= -40 nT
E.2002.143 (05/23): 2002/05/22 – 05/25			<ul style="list-style-type: none"> • Kp_max = 8.3 • F10.7 = 185 (190) • Dst_min= -109 nT • E. Henley's choice
E.2003.302 (10/29): 2003/10/29 - 10/30	<ul style="list-style-type: none"> • B fields at GOES • Ground based magnetometers data • DST index (Kyoto WDC, USGS) • DMSP Poynting flux/D. Knipp • HADSM orbit averaged neutral density along CHAMP and GRACE orbits/B. Bowman • CHAMP and GRACE orbit averaged neutral density/B. Bowman 	<ul style="list-style-type: none"> • Magnetic field at geosynchronous orbit • Ground magnetic perturbations • Dst Index • Poynting Flux 	<ul style="list-style-type: none"> • GEM event • Kp_max = 9 • F10.7 = 275 (275) • Dst_min= -353 nT
E.2003.324 (11/20): 2003/11/19 – 11/24	<ul style="list-style-type: none"> • HADSM orbit averaged neutral density along CHAMP and GRACE orbits/B. Bowman • CHAMP and GRACE orbit averaged neutral density/B. Bowman 	<ul style="list-style-type: none"> • Orbit averaged neutral density at CHAMP and GRACE orbits 	<ul style="list-style-type: none"> • Two storm period; • Kp_max = 8.7, 6.0 • F10.7 =171 • Dst_min= -422 nT, -87 nT • E. Henley's choice

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2004/07/18 – 07/31 2004/11/05 – 11/14	<ul style="list-style-type: none"> • HADSM orbit averaged neutral density along CHAMP and GRACE orbits/B. Bowman • CHAMP and GRACE orbit averaged neutral density/B. Bowman 	<ul style="list-style-type: none"> • Orbit averaged neutral density at CHAMP and GRACE orbits 	<ul style="list-style-type: none"> • GEM event
E.2005.135: 2005/05/15 - 05/16 E.2005.190: 2005/07/09 - 07/12	<ul style="list-style-type: none"> • DMSP Poynting flux/D. Knipp • CHAMP electron density • CHAMP neutral density/E. Sutton (AFRL) • CHAMP RO NmF2 and hmF2 • TIMED/GUVI and DMSP/SSUSI auroral data/Y. Zhang (APL) 	<ul style="list-style-type: none"> • Poynting Flux • Auroral region • Orbit averaged neutral density at CHAMP orbit 	<ul style="list-style-type: none"> • GEM/GEM-CEDAR event
E.2005.243: 2005/08/31 - 09/01	<ul style="list-style-type: none"> • B fields at GOES • Ground based magnetometers data • DST index (Kyoto WDC, USGS) • DMSP Poynting flux/D. Knipp • CHAMP electron density • CHAMP neutral density/E. Sutton (AFRL) • NmF2 and hmF2 from CHAMP • NmF2 and hmF2 from ISRs/J. Sojka (USU) and B. Rideout (MIT) • Jicamarca vertical drift/J. L. Chau(IAP Rostock) and D. Anderson (UCB) • World Day Observations (WDO) (for 2005/09/01 from JRO, MLH, and SON ISR stations) • TIMED/GUVI and DMSP/SSUSI auroral data/Y. Zhang (APL) 	<ul style="list-style-type: none"> • Magnetic field at geosynchronous orbit • Ground magnetic perturbations • DST index • Poynting Flux • Auroral region • Electron density at CHAMP orbit • Neutral density at CHAMP orbit (point by point comparison and orbit averaged value comparison) • NmF2 and hmF2 • Vertical drifts at Jicamarca • Ne, Te, and etc. using WDO 	<ul style="list-style-type: none"> • GEM/GEM-CEDAR event

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E.2006.347: 2006/12/13 - 12/16	<ul style="list-style-type: none"> • GPS TEC for eight longitude sectors/A. Coster and L. Goncharenko (MIT) and X. Pi (JPL) and IGS TEC provided by S. McDonald (NRL) • COSMIC NmF2 and hmF2 for eight longitude sectors/ L. Lomidze and L. Scherliess (USU) • Regional GPS TEC (North and South America)/A. Coster and L. Goncharenko (MIT) • TIMED/GUVI and DMSP/SSUSI auroral data/Y. Zhang (APL) 	<ul style="list-style-type: none"> • TEC_ion (TEC for eight longitude sectors) • NmF2, hmF2 (eight longitude sectors) • Role of drivers • TEC_regional (TEC for North and South America, and Europe) • Auroral region 	GEM/ GEM- CEDAR event
E.2006.348: 2006/12/14 - 12/16	<ul style="list-style-type: none"> • GOES B fields • Ground based magnetometers data • DST index (Kyoto WDC, USGS) • DMSP Poynting flux/D. Knipp • CHAMP electron density • CHAMP neutral density/E. Sutton (AFRL) • NmF2 and hmF2 from COSMIC, CHAMP • NmF2 and hmF2 from ISRs/J. Sojka (USU) and B. Rideout (MIT) • Fabry-Perot Spectrometer neutral temperature and wind/ Q. Wu (NCAR) • Electron density and temperature from ISRs/J. Holt (MIT) • Jicamarca vertical drift/J. L. Chau(IAP Rostock) and D. Anderson (UCB) 	<ul style="list-style-type: none"> • Magnetic field at geosynchronous orbit • Ground magnetic perturbations • DST index • Poynting Flux • Auroral region • Electron density at CHAMP orbit • Neutral density at CHAMP orbit (point by point comparison and orbit averaged value comparison) • NmF2 and hmF2 (ISRs, CHAMP and COSMIC locations) • Vertical drifts at Jicamarca • Tn, neutral winds, and Te 	GEM/ GEM- CEDAR event

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E.2010.095: 2010/ 04/05 - 04/07	<ul style="list-style-type: none"> • CHAMP neutral density/E. Sutton (AFRL) • ISS/FPMU electron density and Te/J. Minow (NASA) • Ground based magnetometers data • DMSP/SSUSI auroral data/Y. Zhang (APL) 	<ul style="list-style-type: none"> • Electron density and temperature • Neutral density at CHAMP orbit (orbit averaged) • Ground magnetic perturbations • Auroral region 	<ul style="list-style-type: none"> • Single CME • Dst_min= -81 nT • ISS auroral charging observed • GEM/GEM-CEDAR event
2011/04/27 – 05/04	<ul style="list-style-type: none"> • SuperDARN ion drift velocity • GPS TEC, COSMIC TEC • Neutral wind from FPI, CHAMP and GOCE • Neutral density from GRACE, GOCE • O/N2 from GUVI • Ground based magnetometers data 	<ul style="list-style-type: none"> • Vertical drift • TEC • Neutral wind • Neutral density • O/N2 • Ground magnetic perturbations 	<ul style="list-style-type: none"> • CEDAR Grand Challenge (SSWB) event • High speed stream storm
E.2011.217: 2011/08/05 - 08/07	<ul style="list-style-type: none"> • CHAMP neutral density/E. Sutton (AFRL) • DMSP Poynting flux/C. Huang (AFRL) • ISS/FPMU electron density and Te/J. Minow (NASA) • Ground based magnetometers data • DMSP/SSUSI auroral data/Y. Zhang (APL) • World Day Observations (WDO) (from ARO and MLH ISR stations) 	<ul style="list-style-type: none"> • Electron density and temperature • Neutral density at CHAMP orbit (orbit averaged) • Ne, Te, and etc. using WDO • Ground magnetic perturbations • Auroral region • Poynting flux 	<ul style="list-style-type: none"> • Multiple CMEs • Dst_min= -107 nT • Cheryl Huang's choice • GEM/GEM-CEDAR event
2011/09/24 – 09/29	<ul style="list-style-type: none"> • DMSP Poynting flux/C. Huang (AFRL) • DMSP/SSUSI auroral data/Y. Zhang (APL) • Neutral density from GRACE, GOCE, HASDM /C. Huang (AFRL) 	<ul style="list-style-type: none"> • Poynting flux • Auroral region • Neutral density 	<ul style="list-style-type: none"> • Dst_min= -101 nT • C. Huang's choice
2011/10/24 – 10/26	<ul style="list-style-type: none"> • DMSP Poynting flux/C. Huang (AFRL) • DMSP/SSUSI auroral data/Y. Zhang (APL) • Neutral density from GRACE, GOCE/C. Huang (AFRL) 	<ul style="list-style-type: none"> • Poynting flux • Auroral region 	<ul style="list-style-type: none"> • Multiple CMEs • Dst_min= -132 nT • C. Huang's choice
2012/01/20 – 01/23	<ul style="list-style-type: none"> • DMSP Poynting flux/C. Huang (AFRL) • DMSP/SSUSI auroral data/Y. Zhang (APL) • Neutral density from GRACE, GOCE, HASDM/C. Huang (AFRL) 	<ul style="list-style-type: none"> • Poynting flux • Auroral region • Neutral density 	<ul style="list-style-type: none"> • Dst_min= -69 nT • C. Huang's choice

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2012/03/08 - 03/11	<ul style="list-style-type: none"> • DMSP Poynting flux/C. Huang (AFRL) • ISS/FPMU electron density and Te/J. Minow (NASA) • DMSP/SSUSI auroral data/Y. Zhang (APL) • Neutral density from GRACE, GOCE/C. Huang (AFRL) 	<ul style="list-style-type: none"> • Electron density and temperature • Auroral region • Poynting flux • Neutral density 	<ul style="list-style-type: none"> • Multiple CMEs • Dst_min= -131 nT • ISS auroral charging observed • C. Huang's choice
2012/05/07 - 05/14	<ul style="list-style-type: none"> • SuperDARN ion drift velocity • GPS TEC, COSMIC TEC • Neutral wind from FPI, CHAMP and GOCE • Neutral density from GRACE, GOCE • O/N2 from GUVI • Ground based magnetometers data 	<ul style="list-style-type: none"> • Vertical drift • TEC • Neutral wind • Neutral density • O/N2 • Ground magnetic perturbations 	<ul style="list-style-type: none"> • CEDAR Grand Challenge (SSWB) event • High speed stream storm
2012/07/14 - 07/17	<ul style="list-style-type: none"> • ISS/FPMU electron density and Te/J. Minow (NASA) 	<ul style="list-style-type: none"> • Electron density and temperature • Auroral region 	<ul style="list-style-type: none"> • Single CME • Dst_min= -127 nT • ISS auroral charging observed • Y. Zheng's choice
2012/09/02 - 09/05	<ul style="list-style-type: none"> • SuperDARN ion drift velocity • GPS TEC, COSMIC TEC • Neutral wind from FPI, CHAMP and GOCE • Neutral density from GRACE, GOCE • O/N2 from GUVI • Ground based magnetometers data 	<ul style="list-style-type: none"> • Vertical drift • TEC • Neutral wind • Neutral density • O/N2 • Ground magnetic perturbations 	<ul style="list-style-type: none"> • CEDAR Grand Challenge (SSWB) event • Dst_min= -74 nT
2013/03/16 - 03/19	<ul style="list-style-type: none"> • Regional GPS TEC (North and South America)/A. Coster and L. Goncharenko (MIT) • ISS/FPMU Ne and Te/J. Minow (NASA) • DMSP/SSUSI auroral data/Y. Zhang (APL) • DMSP ion drift velocity • C/NOFS ion drift velocity, Ne, Te, Ni, Ti • Neutral wind from FPI, CHAMP and GOCE • Neutral density from GRACE, GOCE • O/N2 from GUVI • Ground based magnetometers data • Particle flux, energy flux and B field from VAP and THEMIS 	<ul style="list-style-type: none"> • TEC • Electron density and temperature • Ion density and temperature • Auroral region • Poynting flux • ion drift velocity • Neutral wind • Neutral density • O/N2 • Ground magnetic perturbations 	<ul style="list-style-type: none"> • CEDAR Grand Challenge (SSWB) event • Single CME • Dst_min= -132 nT • ISS auroral charging observed • A. Coster's choice

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2013/05/31 – 06/04	<ul style="list-style-type: none"> • DMSP/SSUSI auroral data/Y. Zhang (APL) 	<ul style="list-style-type: none"> • Auroral region 	<ul style="list-style-type: none"> • Single CME + HSS • Dst_min= -119 nT • L. Mays and Y. Zheng's choice
2013/06/26 – 06/30	<ul style="list-style-type: none"> • ISS/FPMU electron density and Te/J. Minow (NASA) • DMSP/SSUSI auroral data/Y. Zhang (APL) 	<ul style="list-style-type: none"> • Electron density and temperature • Auroral region 	<ul style="list-style-type: none"> • Single CME + HSS • Dst_min= -98 nT • ISS auroral charging observed • L. Mays and Y. Zheng's choice
2013/07/05– 07/09	<ul style="list-style-type: none"> • DMSP/SSUSI auroral data/Y. Zhang (APL) 	<ul style="list-style-type: none"> • Auroral region 	<ul style="list-style-type: none"> • Multiple CMEs • Dst_min= -79 nT • L. Mays and Y. Zheng's choice
2013/11/08– 11/13	<ul style="list-style-type: none"> • DMSP/SSUSI auroral data/Y. Zhang (APL) 	<ul style="list-style-type: none"> • Auroral region 	<ul style="list-style-type: none"> • Multiple CMEs + HSS • Two storm period; • Dst_min= -81 nT, -70 nT • L. Mays and Y. Zheng's choice
2014/02/18– 02/23	<ul style="list-style-type: none"> • DMSP/SSUSI auroral data/Y. Zhang (APL) 	<ul style="list-style-type: none"> • Auroral region 	<ul style="list-style-type: none"> • Multiple CMEs • Three storm period; • Dst_min= -112 nT, -86 nT, -66 nT • L. Mays and Y. Zheng's choice
2015/03/16– 03/19			<ul style="list-style-type: none"> • CMEs + HSS • Dst_min= -223 nT
2015/06/21-06/24			<ul style="list-style-type: none"> • CMEs • Dst_min= -204 nT
2015/10/06-10/09			<ul style="list-style-type: none"> • CME(unknown) + HSS • Dst_min= -124 nT

ISR WDO

Operating days		Kp_max	F10.7/F107ave	Stations
2001	04/17-19	7.3	133/169	JRO, MLH, SON
	09/25-27	7.3	277/210	ESR
	10/10-12	5.3	174/217	MLH, SON
2002	04/17-24	7.3	195/184	JRO, ARO, MLH, IST, SON, ESR
	10/05-31	6.3	159/167	JRO, MLH, SON
2003	03/19-23	5.0	90/128	JRO, SON
	05/27-29	5.7	134/127	SON
	09/22-26	5.7	134/131	JRO, SON
	10/21-23	6.0	150/135	MLH, SON
	11/11-16	6.0	100/133	JRO, SON
2004	11/09-13	8.7	138/102	JRO, MLH, SON
2005	06/13-18	6.0	101/99	JRO, MLH, SON
	09/01-30	7.7	120/89	JRO, MLH, SON
2006	03/17-31	6.3	86/81	JRO, MLH, SON
2011	08/01-10	7.7	113/105	ARO, MLH
2012	06/12-14	5.0	147/129	ARO, MLH

JRO: Jicamarca, ARO: Arecibo, MLH: Millstone Hill, IST: Irkutsk, SON: Sondrestrom, ESR: EISCAT Svalbard Radar