## List of Events in Solar Cycle 23

<table>
<thead>
<tr>
<th>Events</th>
<th>Data currently to be available/Providers</th>
<th>Previous/on-going/planned Studies</th>
<th>Notes</th>
</tr>
</thead>
</table>
| E.2001.090 (03/31): 2001/03/29 - 04/03 |                                         |                                  | • 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 | • 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) | • 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 | • 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 |                                         |                                  | • 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 | • 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 | • Magnetic field at geosynchronous orbit  
• Ground magnetic perturbations  
• Dst Index  
• Poynting Flux | • GEM event  
• Kp_max = 9  
• F10.7 = 275 (275)  
• Dst_min= -353 nT |
• CHAMP and GRACE orbit averaged neutral density/B. Bowman | • Orbit averaged neutral density at CHAMP and GRACE orbits | • Two storm period;  
• Kp_max = 8.7, 6.0  
• F10.7 =171  
• Dst_min= -422 nT, -87 nT  
• E. Henley’s choice |
## List of Events in Solar Cycle 23

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<tr>
<th>Events</th>
<th>Data currently to be available/Providers</th>
<th>Previous/on-going/planned Studies</th>
<th>Notes</th>
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</thead>
</table>
| 2004/07/18 – 07/31 2004/11/05 – 11/14 | • HADSM orbit averaged neutral density along CHAMP and GRACE orbits/B. Bowman  
• CHAMP and GRACE orbit averaged neutral density/B. Bowman | • Orbit averaged neutral density at CHAMP and GRACE orbits | • GEM event |
• CHAMP electron density  
• CHAMP neutral density/E. Sutton (AFRL)  
• CHAMP RO NmF2 and hmF2  
• TIMED/GUVI and DMSP/SSUSI auroral data/Y. Zhang (APL) | • Poynting Flux  
• Auroral region  
• Orbit averaged neutral density at CHAMP orbit | • GEM/GEM-CEDAR event |
| E.2005.243: 2005/08/31 - 09/01 | • 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) | • 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 | • GEM/GEM-CEDAR event |
## List of Events in Solar Cycle 23

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</tr>
</thead>
</table>
| E.2006.347: 2006/12/13 - 12/16 | • 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) | • TEC_lon (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 | • 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) | • 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 |
## List of Events in Solar Cycle 24

<table>
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<tr>
<th>Events</th>
<th>Data currently to be available/Providers</th>
<th>Previous/on-going/planned Studies</th>
<th>Notes</th>
</tr>
</thead>
</table>
| E.2010.095:  | • 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) | • Electron density and temperature  
• Neutral density at CHAMP orbit (orbit averaged)  
• Ground magnetic perturbations  
• Auroral region | • Single CME  
• Dst_min= -81 nT  
• ISS auroral charging observed  
• GEM/GEM-CEDAR event |
| 2010/04/05 - 04/07 |                                                                                                        |                                                                                                  |                                                                        |
| 2011/04/27 – 05/04 | • 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 | • Vertical drift  
• TEC  
• Neutral wind  
• Neutral density  
• O/N2  
• Ground magnetic perturbations | • CEDAR Grand Challenge (SSWB) event  
• High speed stream storm |
| E.2011.217:  | • 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) | • Electron density and temperature  
• Neutral density at CHAMP orbit (orbit averaged)  
• Ne, Te, and etc. using WDO  
• Ground magnetic perturbations  
• Auroral region  
• Poynting flux | • Multiple CMEs  
• Dst_min= -107 nT  
• Cheryl Huang’s choice  
• GEM/GEM-CEDAR event |
| 2011/08/05 - 08/07 |                                                                                                        |                                                                                                  |                                                                        |
| 2011/09/24 – 09/29 | • DMSP Poynting flux/C. Huang (AFRL)  
• DMSP/SSUSI auroral data/Y. Zhang (APL)  
• Neutral density from GRACE, GOCE, HASDM/C. Huang (AFRL) | • Poynting flux  
• Auroral region  
• Neutral density | • Dst_min= -101 nT  
• C. Huang’s choice |
| 2011/10/24 – 10/26 |                                                                                                        |                                                                                                  |                                                                        |
| 2012/01/20 – 01/23 | • DMSP Poynting flux/C. Huang (AFRL)  
• DMSP/SSUSI auroral data/Y. Zhang (APL)  
• Neutral density from GRACE, GOCE, HASDM/C. Huang (AFRL) | • Poynting flux  
• Auroral region  
• Neutral density | • Dst_min= -69 nT  
• C. Huang’s choice |
<table>
<thead>
<tr>
<th>Events</th>
<th>Data currently/to be available/Providers</th>
<th>Previous/on-going/planned Studies</th>
<th>Notes</th>
</tr>
</thead>
</table>
| 2012/03/08 - 03/11 | • 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) | • Electron density and temperature  
• Auroral region  
• Poynting flux  
• Neutral density | • Multiple CMEs  
• Dst_min= -131 nT  
• ISS auroral charging observed  
• C. Huang’s choice |
| 2012/05/07 - 05/14 | • 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 | • Vertical drift  
• TEC  
• Neutral wind  
• Neutral density  
• O/N2  
• Ground magnetic perturbations | • CEDAR Grand Challenge (SSWB) event  
• High speed stream storm |
| 2012/07/14 - 07/17 | • ISS/FPMU electron density and Te/J. Minow (NASA) | • Electron density and temperature  
• Auroral region | • Single CME  
• Dst_min= -127 nT  
• ISS auroral charging observed  
• Y. Zheng’s choice |
| 2012/09/02 - 09/05 | • 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 | • Vertical drift  
• TEC  
• Neutral wind  
• Neutral density  
• O/N2  
• Ground magnetic perturbations | • CEDAR Grand Challenge (SSWB) event  
• Dst_min= -74 nT |
| 2013/03/16 - 03/19 | • 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 | • 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 | • CEDAR Grand Challenge (SSWB) event  
• Single CME  
• Dst_min= -132 nT  
• ISS auroral charging observed  
• A. Coster’s choice |
## List of Events in Solar Cycle 24

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<th>Notes</th>
</tr>
</thead>
</table>
| 2013/05/31 – 06/04 | • DMSP/SSUSI auroral data/Y. Zhang (APL) | • Auroral region                 | • Single CME + HSS  
• Dst_min= -119 nT  
• L. Mays and Y. Zheng’s choice |
| 2013/06/26 – 06/30 | • ISS/FPMU electron density and Te/J. Minow (NASA)  
• DMSP/SSUSI auroral data/Y. Zhang (APL) | • Electron density and temperature  
• Auroral region | • Single CME + HSS  
• Dst_min= -98 nT  
• ISS auroral charging observed  
• L. Mays and Y. Zheng’s choice |
| 2013/07/05– 07/09 | • DMSP/SSUSI auroral data/Y. Zhang (APL) | • Auroral region                 | • Multiple CMEs  
• Dst_min= -79 nT  
• L. Mays and Y. Zheng’s choice |
| 2013/11/08– 11/13 | • DMSP/SSUSI auroral data/Y. Zhang (APL) | • Auroral region                 | • Multiple CMEs + HSS  
• Two storm period;  
• Dst_min= -81 nT, -70 nT  
• L. Mays and Y. Zheng’s choice |
| 2014/02/18– 02/23 | • DMSP/SSUSI auroral data/Y. Zhang (APL) | • Auroral region                 | • 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 |                                           |                                  | • CMEs + HSS  
• Dst_min= -223 nT |
| 2015/06/21-06/24 |                                           |                                  | • CMEs  
• Dst_min= -204 nT |
| 2015/10/06-10/09 |                                           |                                  | • CME(unidentified) + HSS  
• Dst_min= -124 nT |
## ISR WDO

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