

## INDEX

- Abisko, Sweden, 254  
 acceleration, betatron, 218  
 acceleration, Fermi, 218  
 accelerometer, 235  
 ACE (satellite), 197  
 Active Magnetosphere and Planetary  
 Electrodynamics Response Experiment, 232  
 Active Magnetospheric Particle Tracer Explorer,  
 163  
 active region (solar), 101, 103, 210, 214, 295, 296,  
 305  
   bipolar active region, 210  
 adiabatic invariant  
   first adiabatic invariant, 190, 191, 195  
   second adiabatic invariant, 190  
   third adiabatic invariant, 190  
 AE (index), 255  
 aeromagnetic survey, 27, 64, 197  
 aeronomy, 4, 30, 32–3  
 AGW. *See* atmospheric gravity wave  
 Akasofu parameter, 212  
 AL (index), 164, 224  
 albedo, planetary, 210  
 Alfvén conductance, 230  
 Alfvén speed, 104, 122, 124, 142, 144, 145, 193,  
 230  
 Alfvén wave, 186, 187, 189, 229,  
 230–1  
 alternating current, 55  
 AMIE. *See* Assimilative Mapping of Ionospheric  
 Electrodynamics  
 AMPERE. *See* Active Magnetosphere and  
 Planetary Electrodynamics Response  
 Experiment  
 AMPTE. *See* Active Magnetospheric Particle  
 Tracer Explorer  
 anisotropy (magnetic), 34, 80  
 anisotropy (temperature), 196, 211  
 anomaly  
   equatorial ionization anomaly, 25, 146  
   magnetic anomaly, 33, 134, 135, 136, 137, 139,  
   275  
   mass density anomaly, 229, 238, 241  
 anthropogenic, 183, 210  
 apparent polar wander path. *See* polar wander  
 APWP, 9, 10, 12, 13. *See* polar wander  
   Africa, 10  
   North America, 13  
 Arase (satellite), 171  
 archaeological, 4, 14, 181  
 archaeology, 70  
 archeomagnetic, 35  
 Assimilative Mapping of Ionospheric  
 Electrodynamics, 239  
 Astronomical Unit, 99, 210  
 ASYM-H (index), 219  
 atmospheric drag, 144  
 atmospheric electrical circuit, 184  
 atmospheric gravity wave, 25, 239, 241  
 atom, 43, 145, 169, 211, 214, 216, 218, 258  
 attenuation, 70, 183, 196, 319  
 aurora  
   cusp aurora, 141, 153, 154  
   diffuse aurora, 153  
   flickering aurora, 153  
   proton aurora, 153  
   pulsating aurora, 153  
   shock aurora, 152  
   subauroral proton aurora, 153  
 Aurora Australis, 43  
 Aurora Borealis, 43  
 auroral arc, 143, 152, 153, 231  
 auroral breakup, 163, 166, 233  
 auroral electrojet, 25, 254, 255  
 auroral oval, 24, 71, 77, 91, 100, 108, 153, 164,  
 167, 255  
 auroral zone, 43, 141, 145, 150, 153, 172, 173, 218,  
 238, 253  
 Australia, 254  
 AWESOME (algorithm), 233, 234, 235  
 azimuthal mode number. *See* azimuthal  
 wavenumber  
 azimuthal wavenumber, 118, 188, 189, 190, 196
- Babcock–Leighton solar dynamo cycle, 213  
 Balmer- $\alpha$ , 214  
 barometric law, 236  
 Beidou (satellite constellation), 254  
 biosphere, 27, 28, 29  
 Birkeland current, 43, 86, 151. *See also*  
   field-aligned current  
 black body, 209, 210, 236  
 bounce frequency, 189  
 boundary layer, 48, 160, 161, 162, 268  
   high-latitude boundary layer, 161  
   low-latitude boundary layer, 161, 162, 197  
   magnetopause boundary layer, 189  
   plasma sheet boundary layer, 233, 234  
   plasmopause boundary layer, 175  
   plasmosphere boundary layer, 169  
 bow shock, 24, 45, 79, 104, 105, 151, 172, 187,  
 189, 212, 216  
 bremsstrahlung, 214, 290  
 bursty bulk flow, 230  
 Burton equation, 219, 220, 222
- Canadian Array for Real-time Investigations of  
 Magnetic Activity, 191  
 Canadian Magnetic Observatory System, 233,  
 246  
 CANMOS. *See* Canadian Magnetic Observatory  
 System  
 capacitance, 253  
 CARISMA. *See* Canadian Array for Real-time  
 Investigations of Magnetic Activity  
 Carrington event, 27, 181, 214, 261  
 CHAMP (satellite), 18, 25, 58, 84, 85, 86, 92, 116,  
 133, 145, 149, 235, 236–9, 240, 241, 246  
 CHAOS (magnetic field model), 88, 91–2, 93,  
 119, 120, 182, 314  
 CHAOS-6 (magnetic field model), 91, 92, 120  
 charge exchange, 43, 169, 170, 218, 220, 224, 225  
 chemical remanent magnetization, 11  
 chromosphere, 210, 211, 213, 214  
 CIR. *See* co-rotating interaction region  
 cleft. *See* polar cleft  
 climatic change, 29  
 clock angle, 104, 107, 224
- Cluster (satellite constellation), 43, 98, 100, 104,  
 105, 106, 107, 108, 152, 160, 170, 172, 197  
 collision frequency, 45, 144  
   electron-neutral, 142  
   ion-neutral, 142  
 collision, ion-neutral, 142, 236  
 column density, 255  
 compass, 3, 4, 18, 26, 32, 34, 54, 64, 195, 218, 269,  
 277, 320, 322  
 conductivity  
   Cowling, 143, 144  
   crust. *See* crust  
   ground, 229, 242, 243, 244, 245  
   Hall, 143, 144, 196  
   ionospheric, 25, 151, 229  
   lithosphere. *See* lithosphere  
   mantle, 124. *See* mantle  
   Pedersen, 143, 145  
 conservation  
   of magnetic helicity, 295  
   of momentum, 142  
 conservation equation, 122  
 continental drift, 4, 10  
 convection, magnetospheric, 152, 229, 232, 235  
 core  
   dynamics, 4–5, 17, 18, 41, 48, 84, 115, 118–26,  
   268–71, 312–13, 318–24  
   field, 4, 5, 24, 25, 33, 54, 63, 64, 86, 87, 89, 90,  
   93, 95, 115, 135, 138, 182, 183, 312, 313, 314,  
   323  
   of Ganymede, 276–8  
   of Mars, 274–4  
   of Mercury, 272–3  
   of Moon, 275–6  
   planetary, 267, 278–80  
 core–mantle boundary. *See* mantle  
 core–mantle coupling. *See* mantle  
 Coriolis force, 123, 124, 129, 241, 271  
 coronagraph, 99, 102, 103, 215  
 coronal hole, 80, 101, 211, 212, 216, 259, 286, 301,  
 302, 303–4  
 coronal mass ejection, 24, 46, 98, 170, 181, 209,  
 213, 214, 239, 254, 255, 259, 286, 293, 294  
 coronameter, 211  
 corotating interaction region. *See* co-rotating  
 interaction region  
 co-rotating interaction region, 239  
 cosmic ray, 17, 175, 258, 303  
 Coulomb collision, 43, 141, 169  
 Coulomb interaction, 257. *See* Coulomb collision  
 coupling function, 153, 164, 165, 223, 224, 239  
 CPCP. *See* cross-polar cap potential  
 crescent electron distribution, 162  
 Cretaceous normal superchron, 48, 51, 182  
 Cretaceous–Palaeogene boundary, 50, 50  
 cross-polar cap electric field. *See* cross-polar cap  
 potential  
 cross-polar cap potential, 150  
 cross-spectral phase, 197  
 cross-tail current, 44, 152, 233  
 crust, 5, 7, 11, 17, 19–21, 54, 68–69, 84, 87, 94,  
 137–8, 139, 181, 319  
   conductivity, 5, 17, 183  
   continental, 138

- crust (cont.)  
 ocean, 134, 138, 181  
 of Mars, 273–4, 274  
 of Mercury, 272  
 of Moon, 275  
 planetary, 267, 271, 279–80  
 Curie point. *See* Curie temperature  
 Curie temperature, 17, 138, 181, 267, 280  
 current  
 direct, 242, 253  
 Pedersen, 43, 143, 144  
 region 1, 24, 25, 43, 150, 151, 229, 230, 231, 232, 235  
 region 2, 43, 44, 151, 229, 231, 232, 235  
 telluric, 242  
 current disruption, 163, 164  
 cusp. *See* polar cusp  
 cyclotron frequency  
 electron, 173  
 ion, 172, 173  
 cyclotron resonance, 170  
 Dalton minimum, 213  
 dayside cusp. *See* polar cusp  
 declination, 3, 14, 16, 26, 34, 55, 58  
 magnetic, 3, 18  
 palaeomagnetic, 14, 322  
 deep dielectric charging, 258, 259  
 DEMETER (satellite), 21, 22  
 density  
 air density, 235, 236  
 current density, 85, 106, 141, 142, 152  
 mass density, 142, 162, 186, 187, 193, 236, 237, 238, 240–1, 246  
 phase space density, 170, 189, 190  
 plasmaspheric mass density, 61  
 thermospheric density, 145, 236, 237–9, 241  
 thermospheric mass density, 236  
 depletion, density, 236  
 depletion, ozone, 216  
 depletion, radiation belt, 191  
 Dessler–Parker–Sckopke relation, 218  
 deuterium, 209  
 diffraction, 256  
 diffusion coefficient, 190, 191, 194  
 diffusion theory, 146  
 dipole field, 17  
 dipole moment, 4, 123, 182, 271, 276, 291  
 dipole tilt, 44, 222  
 dissociation, 4, 33, 211  
 disturbance storm time, 43, 219, *See* Dst (index)  
 Doppler shift, 194, 196  
 Doppler sounder, 196  
 drift bounce resonance, 189  
 drift resonance, 189, 190  
 Dst (index), 32, 88, 153, 183, 191, 209, 217, 218, 219, 222, 224, *See* disturbance storm time  
 Dungey cycle, 164, 213, 230, 235  
 earthquake, 19, 21, 76, 195, 197, 198  
 effect, space weather, 229, 242  
 EIA. *See* equatorial ionization anomaly  
 eigenfrequency, 186, 187  
 eigenmode, 191  
 ejecta (solar), 101, 212  
 electric field  
 ambipolar, 145, *See* also polarization  
 electric field  
 convection, 25, 43, 169, 193, 194  
 magnetospheric, 235  
 merging, 239, 241  
 polarization, 143, 144  
 prompt penetration, 25, 141, 146, 150  
 Volland–Stern convection, 193  
 electrodynamic, 24, 151, 230, 232, 239  
 electrodynamic drift theory, 146  
 electrojet, 163, 242, 255  
 electrojet indices, 255  
 electromagnetic compatibility, 252  
 electromagnetic environment, 251  
 electromagnetic induction, 3, 181  
 electromagnetic noise, 20  
 electron diffusion region, 162, 171, 173  
 electron volt, 46, 258  
 electron, killer, 190, 258, 259  
 Electronic Geophysical Year, 32  
 electron-positron annihilation, 214  
 ELF. *See* extremely low-frequency wave  
 ellipticity, 173, 196  
 EMIC. *See* electromagnetic ion cyclotron wave  
 energetic particle radiation, 251, 257  
 energy  
 electromagnetic, 181, 232, 235  
 magnetic, 80, 115, 123, 150, 161, 171, 214, 232, 262  
 energy coupling, 141, 146, 150, 151, 193  
 energy transfer, 98, 141, 160, 161, 181, 189, 229  
 EPF. *See* equatorial plasma fountain  
 equator  
 geomagnetic, 76  
 magnetic, 209, 219, 254, 259, 302  
 equatorial electrojet, 25, 61, 86, 254  
 equatorial plane, 43, 44, 124, 153, 168, 169, 170, 175, 190, 191, 194, 212, 301  
 equatorial plasma fountain, 141, 146, 147  
 equinoctial effect, 221, 222  
 Europe, 254  
 European Geostationary Navigation Overlay Service (EGNOS), 256  
 EUV, 236, *See* extreme ultraviolet  
 excitation (magnetic field), 56  
 excitation (atomic), 55, 211  
 excitation (magnetic field), 55  
 excitation (wave), 124, 187, 188, 189, 193, 194  
 excursion, 13, 14, 28, 181–2, 183  
 extinction of species, 28  
 extreme ultraviolet, 236, 290  
 Eyjafjallajökull, Iceland, 261  
 F10.7 (index), 119, 148, 210, 236, 290  
 faculae, 210  
 failure  
 right side, 253  
 wrong side, 253  
 Faraday's law of induction, 242  
 fast Fourier transform. *See* Fourier transform  
 field aligned current. *See* field-aligned current  
 field line resonance, 72, 79, 80, 153, 186, 188, 193, 196, 233  
 field model. *See* geomagnetic field model  
 field-aligned current, 24, 25, 43, 86, 88, 143, 144, 145, 150, 151, 152, 164, 213, 225, 229, 231, 233, 237, 246  
 field-line. *See* magnetic field line  
 Finnish Meteorological Institute, 244  
 flow  
 fluid core, 5, 29, 34, 41, 54, 120, 122, 123–5, 126, 128–9, 183, 319  
 heat, 90, 137, 138, 267, 268, 269, 270, 272, 273, 274, 278, 279  
 ocean, 5, 84, 86, 312, 313, 317, 323  
 flux transfer event, 172  
 fluxgate magnetometer, 55, 56, 57, 58, 59, 60, 61, 64, 75, 100, 196, 232  
 Force Balance Theory, 151  
 Fourier analysis. *See* Fourier transform  
 Fourier spectra. *See* Fourier transform  
 Fourier transform, 73, 74, 80, 120  
 frictional heating, 144, 145, 236  
 frozen-in (condition), 98, 100, 143, 145, 212, 298, 301  
 Galileo, 254, 259  
 gamma ray, 214  
 geocentric axial dipole, 14  
 geocentric distance, 168  
 geocentric radial distance, 41, 167, *See* also geocentric distance  
 geocentric radius, 41, *See* also geocentric distance  
 Geocentric Solar Ecliptic (coordinate), 102  
 Geocentric Solar Magnetospheric (coordinate), 218  
 geocorona, 43, 169  
 geodynamo, 34  
 geodynamo simulation, 5, 115, 119, 122–3, 126–9, 313, 314  
 geoelectric field, 229, 242, 244, 246, 251, 252, 262  
 Geological Survey of Sweden, 254  
 geomagnetic activity, 46, 49, 57, 63, 160, 165, 167, 169, 170, 175, 176, 209, 212, 214, 216, 252, 261, 291  
 geomagnetic dynamo, 34  
 geomagnetic field model, 3, 15, 33–4, 84–5, 87, 89, 91–5, 115–18, 123, 126, 128, 129, 134–5, 136, 182, 312–14, 321–4  
 geomagnetic indices, 32, 72, 88, 291  
 geomagnetic jerk. *See* jerk  
 geomagnetic observatory. *See* observatory  
 geomagnetic pulsation, 55, 63  
 geomagnetic storm, 30, 43, 45, 46, 61, 146, 149, 150, 168, 169, 170, 176, 181, 190, 235, 236, 241, 252, 253, 255, 262  
 geomagnetic time scale, 4  
 geomagnetically induced current, 5, 27, 153, 214, 229, 242, 246, 251, 252  
 geomagnetism, 3, 4, 5, 30, 31, 34, 54, 55, 65, 66, 91, 126, 138  
 geophysics, 68, 71, 138, 195  
 geospace, 23, 24, 152, 185, 229, 230, 235  
 geostationary orbit, 213, 258, 259  
 giant pulsation, 189  
 GIC. *See* geomagnetically induced current  
 GLE. *See* ground level enhancement  
 Gleissberg cycle, 209, 213  
 global electric circuit, 184  
 global navigation satellite systems, 23, 254  
 Global Positioning System, 18, 64, 195, 254  
 global warming, 184  
 Glonass, 254  
 GNSS. *See* global navigation satellite systems  
 GOES (satellite), 193, 197, 259  
 Göttingen Magnetic Union, 3  
 GPS. *See* Global Positioning System  
 GPS-aided GEO augmented navigation (GAGAN), 256  
 GRACE (satellite), 235, 236, 239, 241, 246  
 gravitational, 268, 314, 317  
 gravitational field, 255  
 greenhouse gas, 210  
 ground level enhancement. *See* ground level event  
 ground level event, 216  
 GSE. *See* geocentric solar ecliptic  
 GSM. *See* geocentric solar magnetospheric  
 gyrofrequency  
 electron gyrofrequency, 142, 194  
 ion gyrofrequency, 142, 194

- gyroradius, 161  
gyro-resonance, 196
- Halloween storm, 168, 181, 186, 237, 256  
Han Dynasty, 195  
harmonics, 55, 56, 253  
HCS. *See* heliospheric current sheet  
heliosphere, 99, 181, 209, 211, 212, 213, 296, 297, 300, 301, 302, 303  
Heliospheric Current Sheet, 98, 302  
helium, 58, 175, 209, 236  
helium magnetometer, 58  
HF radar, 187, 189, 196  
high voltage, 251  
high-speed stream, 71, 80, 212  
hot flow anomaly, 187  
Hydro Québec, 252  
hydrogen, 43, 169, 210  
hydrological cycle, 210
- IAGA. *See* International Association of Geomagnetism and Aeronomy  
IAR. *See* ionospheric Alfvén resonator  
ice core, 210  
Iceland, 13, 261  
IGRF. *See* International Geomagnetic Reference Field  
IMAGE. *See* Imager for Magnetopause-to-Aurora Global Exploration  
Imager for Magnetopause-to-Aurora Global Exploration (satellite), 63  
IMP8 (satellite), 197  
impedance, surface, 244  
impulsive penetration, 104  
inclination, 14, 55, 58  
inclination shallowing, 9  
inductance, 253  
induction coil, 55, 61, 196  
inductive feedback, 196  
inertia, electron, 143  
inertia, ion, 142  
instabilities, 256  
instabilities, ionospheric, 256  
interchange reconnection, 211  
INTERMAGNET, 30, 32, 57, 59, 60, 61, 63, 72, 74, 75, 76, 81, 196, 262  
International Association of Geomagnetism and Aeronomy, 4, 32, 57, 133  
International Association of Terrestrial Magnetism and Electricity, 4  
International Geomagnetic Reference Field, 4, 33, 88, 129, 134, 182, 319  
International Geophysical Year, 4, 31, 60  
International Heliophysical Year, 32  
International Polar Year, 4, 31  
International Quiet Sun Year, 31  
International Real-time Magnetic Observatory Network, 59. *See* INTERMAGNET  
International Service on Rapid Magnetic Variations, 255  
International Union of Geodesy and Geophysics, 30, 37, 133  
interplanetary magnetic field, 24, 45, 46, 71, 72, 79, 81, 86, 99, 141, 150, 153, 161, 163, 211, 212, 218, 229, 238, 242, 292, 296  
interplanetary shock, 152, 170  
ion outflow, 172  
  molecular ion outflow, 172  
  Type 1 ion outflow, 145  
  Type 2 ion outflow, 145  
ionization, 4, 28, 33, 148, 153, 211, 216, 299  
ionosphere, auroral, 25, 61, 143, 173, 235  
ionosphere, conjugate, 197  
ionosphere, high latitude, 25, 150, 151, 160, 162  
ionosphere, polar cap, 150, 151  
ionosphere–thermosphere, 25, 141  
ionospheric Alfvén resonator, 231  
ionospheric outflow. *See* ion outflow  
isotope, 210  
IUGG. *See* International Union of Geodesy and Geophysics
- jerk, 60, 115, 118–22, 324  
Joule dissipation. *See* Joule heating  
Joule heating, 145, 229, 235, 236, 237, 238, 239, 240, 241  
Jupiter, 100, 108, 160, 258, 277, 278, 279, 280
- KAGUYA (satellite), 175, 176  
Kelvin–Helmholtz instability, 45, 104, 160, 185, 188  
KHI. *See* Kelvin–Helmholtz instability  
Kp (index), 32, 88, 153, 175, 191, 197, 218, 241
- Landau damping, 186  
Laschamp, 28  
Laschamp event. *See* Laschamp excursion  
Laschamp excursion, 182  
latitude, magnetic, 72, 146, 147, 150, 153, 238, 239, 259  
lightning, 7, 173, 181, 183, 184  
lithosphere, 10, 48, 64, 84, 86, 133–4, 136, 138, 181  
  conductivity, 5, 70, 183  
  continental, 71  
  oceanic, 70  
Lorentz force, 123, 124, 129, 186, 271  
Lorentz torque, 124, 126  
loss cone, 170, 173, 190, 194, 195  
low Earth orbit, 84, 182, 254, 312  
Lyman-alpha. *See* Lyman- $\alpha$   
Lyman- $\alpha$ , 286  
Ly- $\alpha$ . *See* Lyman- $\alpha$
- magnetic field  
  coronal, 212, 297, 301, 302  
  magnetosheath, 162  
  magnetospheric, 89, 104, 162  
  photospheric, 210, 212, 213, 286, 292, 297, 301, 302  
magnetic field line, 3, 24, 41, 43, 45, 72, 98, 100, 101, 102, 104, 106, 107, 143, 146, 147, 161, 168, 212, 216, 230, 297, 301, 302  
magnetic flux, 25, 101, 103, 104, 210, 211, 230, 292, 293, 295, 302, 303  
magnetic flux density, 292, 302, 303, 304  
magnetic flux rope, 102  
magnetic flux tube, 151, 295, 297  
magnetic helicity, 102, 214  
magnetic local time, 170, 175, 238, 242  
magnetic moment, 41, 57, 274, 292  
  spin magnetic moment, 57  
magnetic monitoring  
  earthquakes, 19  
  volcanoes, 21  
magnetic poles, 3  
magnetic reconnection, 104, 151, 152, 160, 161, 162, 163, 164, 167, 171, 172, 209, 211, 213, 218, 229, 230, 233, 295, 299  
magnetic reconnection, asymmetric, 162  
magnetic reconnection, guide field, 172  
magnetic shear angle, 213  
magnetic storm, 3, 5, 25, 27, 43, 54, 72, 88, 101, 104, 141, 150, 163, 167, 168, 169, 176, 181, 184, 190, 191, 209, 213, 217, 218, 219, 223, 224, 229, 236, 237, 238, 239, 241, 242  
magnetic substorm. *See* substorm  
magnetic surveying, 17, 18  
magnetization  
  remnant magnetization, 274, 275  
magnetoacoustic mode  
  fast, 230  
  slow, 186  
magnetohydrodynamic, 19, 48, 152, 186, 230, 296, 298, 305  
magneto-hydrodynamic. *See* magnetohydrodynamic  
magneto-ionic, 181  
magnetopause current layer, 45, 161  
magnetopause shadowing, 169, 190, 191, 195  
magnetoseismology, 186  
magnetosheath, 45, 79, 81, 98, 100, 104, 105, 106, 107, 108, 151, 153, 160, 161, 162, 172, 218  
magnetosphere, 28  
magnetosphere–ionosphere, 4, 26, 44, 61, 106, 150, 230, 231  
magnetosphere–ionosphere coupling, 25, 186, 229, 235  
magnetosphere–ionosphere–thermosphere, 141, 144, 146  
magnetospheric convection, 216, 225  
magnetospheric cusp, 161  
Magnetospheric Multiscale Mission (satellite mission), 100, 160, 162, 170  
magnetospheric substorm, 43, 46, 163, 165, 167, 233, 234, 235, 240, 241. *See* also substorm  
magnetospheric tail. *See* magnetotail  
magnetostratigraphy, 15  
magnetotail, 5, 44, 45, 100, 104, 107, 152, 160, 161, 162, 165, 186, 188, 213, 230, 233, 234, 235  
magnetotail current, 44  
magnetotelluric, 7, 18, 27, 68, 184  
mantle, 10, 17, 29, 86, 90, 115, 126, 181, 267, 268, 275  
  conductivity, 5, 7–8, 68–70, 122, 124, 183, 313, 317  
  core–mantle–boundary, 41, 48, 268, 270, 273, 278, 279, 280, 318  
  core–mantle–coupling, 4, 124, 126, 320  
  planetary, 267, 270, 274, 275, 276, 277, 278, 279  
Mäntsälä, Finland, 244  
mass extinction, 29  
Maunder Minimum, 213, 287  
McIlwain L parameter, 259  
McMAC. *See* Mid-continent Magnetoseismic Chain  
mean free path, 216, 236  
MHD. *See* magnetohydrodynamic  
Mid-continent Magnetoseismic Chain, 62, 233  
mid-latitude positive bay (index), 164, 165, 167  
MLT. *See* magnetic local time  
MMS. *See* Magnetospheric Multiscale Mission  
molecule, 211, 236, 238, 239  
momentum equation, 122, 123, 141, 142  
momentum transfer, 141, 230  
Moon, 4, 100, 164, 172, 267–8, 271, 272, 275, 276, 280, 314, 317  
moons  
  of Jupiter, 108, 160, 276, 279, 280  
  of Saturn, 100, 160  
MPB. *See* mid-latitude positive bay  
MT method. *See* magnetotelluric
- NARMAX, 209, 224, 225  
Naval Research Lab Mass Spectrometer  
  Incoherent Scatter Extended Model, 147

- near-Earth neutral line, 163, 164  
NENL. *See* near-Earth neutral line  
neural network, 209, 223, 225  
neutron capture, 214  
New Zealand, 254  
Nonlinear Autoregressive Moving Average Model with Exogenous Inputs. *See* NARMAX  
North America, 254  
Northern Hemisphere, 28, 34, 77, 94, 120, 146, 196, 236, 237, 242, 273, 280, 292  
northern light, 26. *See also* Aurora Borealis  
NRLMSISE. *See* Naval Research Lab Mass Spectrometer Incoherent Scatter Extended Model  
  
Observatori de l'Ebre, 32, 254, 255  
observatory, 4, 7, 14, 27, 32, 54, 59–60, 61, 64, 65–6, 72–8, 87, 115, 116, 117, 118, 120, 242, 315, 317, 322, 323  
ocean flow. *See* flow  
Oersted (satellite), 7, 116  
Ohm's law, generalized, 172  
optical fibre, 252  
orbital change, 29  
OVATION Prime (model), 153  
oxygen, 28, 43, 145, 267, 298, 299  
oxygen ion, 142  
ozone hole, 28  
  
palaeopoles, 9, 13. *See* palaeopoles  
palaeointensity, 16, 28  
palaeomagnetism, 5, 8, 10, 11, 17, 34, 35  
  database, 15, 34  
  palaeomagnetic dating, 13, 14  
  palaeomagnetic reconstructions, 10  
  tectonic palaeomagnetism, 11  
palaeopoles, 8, 9  
Parker spiral, 105, 212, 216  
particle precipitation, 25, 229, 237  
Pc3 index, 197  
PCA. *See* polar cap absorption  
Pedersen conductance. *See* Pedersen conductivity  
perturbation, 25, 48, 122, 124, 139, 144, 163, 187, 193, 218, 219, 220, 224  
perturbation, electric field, 230  
perturbation, magnetic. *See* perturbation, magnetic field  
perturbation, magnetic field, 144  
perturbation, mass density, 229  
phase scintillation, 256  
photo-chemical equilibrium, 148  
photoelectron, 258  
photoemission, 258  
Photometric Sunspot Index, 210  
photosphere, 209, 210, 212, 214, 288, 290, 292, 295, 296, 301  
Pi1/2. *See* Pi1/2 band wave  
Pi1/2 wave. *See* Pi1/2 band wave  
pipeline, 27, 242, 245, 246, 252  
pitch angle scattering, 152, 153, 190  
Planck spectrum, 210  
plasma beta, 151, 161  
plasma convection, 25, 235  
plasma fountain, 146, 149  
plasma instability, 163  
plasma mantle, 161, 197  
plasma sheet, 24, 25, 43, 45, 107, 163, 164, 165, 169, 197, 213, 216  
plasma trough, 175, 176  
plasmashet. *See* plasma sheet  
plasmosphere refilling. *See* refilling, plasmaspheric  
plasmaspheric cavity, 189, 233  
plasmaspheric density plume. *See* plume (plasmaspheric)  
plasmaspheric drainage plume. *See* plume (plasmaspheric)  
plasmaspheric hiss, 171, 173, 184, 190  
plasmatrough. *See* plasma trough  
plate tectonic, 4, 11, 19, 64, 95, 133, 270, 274  
plume (mantle), 48  
plume (plasmaspheric), 106, 107, 169, 172, 175, 176, 194, 196, 198, 216  
plume generation zones, 10  
polar cap, 25, 45, 141, 150, 164, 198, 230, 238, 239  
polar cap absorption, 216  
polar cleft, 150  
polar cusp, 5, 104, 107, 108  
polar potential saturation, 150. *See also* cross-polar cap potential  
polar substorm. *See* substorm; magnetospheric substorm  
polar wander, 9  
polarization, 232. *See* polarization  
  poloidal, 187  
  toroidal, 187  
polarity, 49  
  change. *See* reversal  
  excursions, 14  
  reversal. *See* reversal  
  solar field, 292–3, 295, 303, 305  
  sub-chrons, 14  
  time scale, 13–14  
polarity sector, 212  
polarization, 58, 72, 173  
  poloidal, 187  
  toroidal, 188  
poleward boundary intensification, 163, 164, 167  
poloidal polarization, 189  
power grid, 209, 229, 242, 245, 246, 251, 252, 253, 254, 261, 262  
Poynting flux, 145, 173, 187, 230, 232  
Poynting's theorem, 145. *See also* Poynting flux  
PPEF. *See* prompt penetration electric field  
PRE. *See* pre-reversal enhancement  
prediction efficiency, 219–24, 225  
pre-reversal enhancement, 146  
pressure, kinetic, 101  
pressure, magnetic, 101, 151, 160, 186, 219  
pressure, solar wind, 45, 78, 151  
pressure, solar wind dynamic. *See* pressure, solar wind  
prominence, 215, 252  
pseudo breakup, 163, 166, 167  
PSI. *See* Photometric Sunspot Index  
pulsar, 255  
pulsation, geomagnetic, 153  
  
quarter-mode resonance, 197  
quasi-biennial oscillation, 93, 213, 288  
  
radial diffusion, 170, 190–1, 195  
radiation belt, 28. *See* Van Allen belt  
Radiation Belt Storm Probes, 192. *See* Van Allen Probes (satellite mission)  
radiative transfer, 210, 211  
range time intensity map, 149  
Rayleigh-Taylor instability, 256  
RBSP. *See* Radiation Belt Storm Probes  
recombination, 148, 255  
refilling, plasmaspheric, 170, 176  
refractive index, 255  
regression, nonlinear, 220, 221  
  
Reiger-type oscillation, 213  
relativistic, 168, 169, 170, 172, 173, 175, 190, 194, 195, 216, 255  
remagnetization, 9, 11  
reversal, 4, 17, 27–9, 34, 41, 48–52, 115, 126, 181–2, 183, 213, 274, 293, 320, 321  
right side failure. *See* failure, right side  
ring current, 24, 25, 43, 85, 87, 106, 146, 160, 168–9, 173, 183, 186, 187, 189, 209, 212, 213, 218–20, 221, 223, 224, 225, 240, 254  
riometer, 60, 196  
RTI. *See* range time intensity map  
Runge-Kutta, 221  
Russell-McPherron effect, 222  
  
San Juan, Puerto Rico, 254  
satellite navigation, 251, 254  
satellite-based augmentation system, 256  
Saturn, 100, 160  
sawtooth event, 163, 167  
SC. *See* sudden commencement  
scale height, 145, 236, 238, 239  
Schumann resonance, 54, 183, 184  
scintillation, 25, 256, 260  
secular acceleration, 91–2, 115, 119–22, 182  
secular variation, 3, 5, 13, 14–16, 17, 18, 33, 34, 48–52, 58, 60, 64, 92, 118, 153, 182, 183, 219, 242, 312  
SEE. *See* single event effect  
SEP. *See* solar energetic particle  
SEU. *See* single event upset  
sferics, 181, 183, 184  
sfu. *See* solar flux units  
shear angle. *See* magnetic shear angle  
Sheffield University Plasmasphere Ionosphere Model, 146  
shielding, 25, 170, 257, 259  
single event burnout, 257  
single event effect, 257, 260  
single event gate rupture, 257  
single event latch-up, 257  
single event upset, 257  
SIR. *See* stream interaction region  
situational awareness. *See* space situational awareness  
SMC. *See* steady magnetospheric convection  
SML. *See* SuperMAG Lower  
socio-economic assessment, 251, 262  
solar activity, 27  
solar array, 258  
solar atmosphere, 99, 209, 214, 293, 295, 296, 297  
solar corona, 100, 102, 209, 211, 216, 305  
solar cycle, 71, 77, 79, 80, 100, 101, 104, 164, 183, 184, 195, 197, 210, 211, 212, 213, 215, 217, 239, 241, 255, 259, 287, 288, 290, 291, 292, 293, 294, 296, 297, 299, 302, 303, 305, 316, 317, 323  
solar dynamo, 213, 288, 292, 293, 305  
solar energetic particle, 257, 260, 261, 262  
solar energetic proton, 168, 258  
solar EUV. *See* EUV  
solar flare, 3, 17, 27, 30, 45, 99, 151, 163, 209, 214, 216, 218, 286, 293, 295, 296  
solar flux, 213, 236, 239, 304  
solar flux units, 236  
solar irradiance, 80, 210, 286, 303  
  spectral solar irradiance, 210  
  total solar irradiance, 209, 286, 287  
solar magnetic (coordinate), 218  
solar maximum, 104, 211, 212, 213, 215, 217, 236, 238, 239, 286, 287, 289, 291, 298, 299, 301, 302

## Index

331

- solar minimum, 104, 210, 211, 215, 217, 235, 236, 239, 287, 289, 290, 291, 292, 293, 297, 299, 301, 302, 303
- solar quiet (Sq), 77, 219, 230, 314
- solar rotation, 101, 183, 209, 211, 212, 213, 236, 298, 302
- solar wind  
 pressure pulse, 151, 187, 300
- South Africa, 9, 254
- South Atlantic Anomaly, 183
- South Atlantic Magnetic Anomaly. *See* South Atlantic Anomaly
- Southern Hemisphere, 28, 77, 89, 91, 147, 151, 233, 237, 238, 273, 273, 280, 293
- southern light. *See also* Aurora Australis
- space debris, 235, 237
- space physics, 98, 190, 195
- space radiation, 251, 260
- space situational awareness, 262
- space weather, 5, 23, 24, 26, 27, 33, 43, 46, 60, 63, 65, 72, 108, 152, 168, 169, 176, 181, 182, 196, 212, 213, 215, 216, 229, 251–62, 286, 295, 296, 298, 303, 305
- space weather forecast, 253, 262, 305
- Space Weather Integrated Forecasting Framework, 176
- spherical harmonic, 3, 15, 30, 34, 49, 84, 85–7, 89, 91–4, 115–16, 128, 129, 136, 138–9, 182, 314, 317, 319, 322
- SSC. *See* sudden storm commencement
- stagnation line, 162
- steady magnetospheric convection, 160, 163, 166, 167
- stream interaction region, 101, 212, 298
- streamer belt, 211
- substorm, 5, 25, 43, 61, 72, 104, 163, 164, 165, 166, 167, 169, 176, 184, 186, 197, 213, 224, 229, 230, 235, 240, 241, 246, 254, 255  
 current wedge, 163, 213, 233, 235  
 expansion phase, 152, 163, 164, 165, 234, 235  
 growth phase, 152, 164, 167  
 injection, 153  
 onset, 107, 165, 166, 167, 186, 230, 233, 234, 235, 240, 242, 245
- sudden commencement, 217, 218, 219, 298
- sudden impulse, 245, 254, 255
- Sun–Earth connection, 181, 209, 210
- sunspot cycle, 7, 27, 78, 209, 210, 212, 287, 288, 291
- super-Alfvénic (velocity), 98, 104, 211, 212
- superchons, 29
- supercontinents, 10  
 Pangea, 10  
 Precambrian, 10
- SuperDARN, 189, 196. *See also* HF radar
- SuperMAG, 63, 167, 196
- SuperMAG Lower (index), 164, 165
- superposed epoch analysis, 163, 164, 165, 218
- supersonic (velocity), 45, 98, 104, 211, 212, 296
- SUPIM. *See* Sheffield University Plasmasphere Ionosphere Model
- surface charging (satellite), 258, 259
- Svalgaard function, 222
- Swarm, 230–3
- Swarm (satellite constellation), 7, 18, 24, 25, 41, 58, 60, 64, 84, 86, 87, 89, 116, 117, 119, 129, 133, 182
- SWIFF. *See* Space Weather Integrated Forecasting Framework
- SWIFF Plasmasphere Model, 176
- SYM-H (index), 183, 219, 240
- TAD. *See* traveling atmospheric disturbance
- tail current. *See* magnetotail current
- tail lobe, 45
- tectonic deformation, 11
- telluric, 68, 242
- temperature, sea surface, 210
- THEMIS. *See* Time History of Events and Macroscale Interactions during Substorms
- thermal emission, 214
- thermo-remnant magnetization, 11
- thermosphere, 144, 146, 229, 235, 236, 237, 239, 240, 241, 255
- Thermosphere Ionosphere Mesosphere Electrodynamic General Circulation Model, 145
- thermosphere–ionosphere coupling. *See* ionosphere–thermosphere coupling
- Thermosphere–Ionosphere Electrodynamic General Circulation Model, 239
- thermospheric wind, 255
- thunderstorm, 68, 184
- TIEGCM. *See* Thermosphere–Ionosphere Electrodynamic General Circulation Model
- Time History of Events and Macroscale Interactions during Substorms (satellite mission), 100, 233
- TIME-GCM. *See* Thermosphere Ionosphere Mesosphere Electrodynamic General Circulation Model
- total electron content, 25, 196, 255
- total solar luminosity, 209
- TPW, 10. *See* polar wander
- track circuit, 251, 252, 253
- transfer function, 244
- transfer function, sigmoid, 223
- transformer, 27, 197, 253, 254, 255
- transition region (solar), 210, 211
- trans-polar arc, 172. *See also* auroral arc
- traveling atmospheric disturbance, 237, 241
- traveling convection vortice, 151
- travel-time (method), 197
- turbulence, 71, 79, 80, 81, 172, 211, 212, 216, 301
- 2 minute problem, 164
- UK Solar System Data Centre, 255
- UK Space Agency, 262
- ULF. *See* ultra-low-frequency wave
- ULF index. *See* Pc3 index
- ultra-relativistic, 168, 169, 170, 194
- ultra-violet, 80, 99, 258
- US Geological Survey, 254
- upper atmosphere, 32, 33, 43, 181, 183, 216, 235, 251, 290, 317, 323
- upwelling, 25, 145, 229, 236, 237, 238, 239
- Van Allen belt, 46, 167, 168, 190, 192, 193, 194, 212
- Van Allen Probes (satellite), 160, 167, 168, 170, 173, 174, 175, 191, 192, 193, 194
- VGP. *See* virtual geomagnetic pole
- VHF radar, 149
- virtual geomagnetic pole, 9, 48, 49
- VLF. *See* very-low-frequency wave
- wave  
 Alfvén wave, 98, 105, 123, 124, 143, 145, 146, 153, 186, 188, 189, 191, 230–1, 232, 233, 234, 235  
 chorus wave, 153, 169, 170, 173, 190, 198  
 continuum radiation, 160, 173, 174  
 electromagnetic ion cyclotron wave, 153, 173, 190, 192, 194  
 electron cyclotron harmonics wave, 153, 174  
 extremely low-frequency wave, 183  
 Kelvin–Helmholtz wave, 172  
 magnetosonic wave, 153, 172, 173  
 Pc1 band, 153, 190, 194, 196, 197  
 Pc2 band, 197  
 Pc3 band, 187, 197, 198  
 Pc4–5 pulsation, 153, 198  
 Pc5 band, 187, 190, 196, 197, 198  
 Pi1/2 band, 233, 234, 235  
 ultra-low-frequency wave, 54, 160, 173, 181, 185, 195  
 upper hybrid wave, 160, 173, 174  
 very-low-frequency wave, 142, 181  
 very-low-frequency hiss wave, 170  
 whistler wave, 153, 173, 175, 183, 184, 194, 197
- wave-particle correlator, 173
- wave-particle excitation. *See* wave-particle interaction
- wave-particle interaction, 43, 160, 169, 189, 190, 193, 195, 197
- wave-particle scattering. *See* wave-particle interaction
- WDMAM. *See* World Digital Magnetic Anomaly Map
- westward travelling surge, 152, 233, 234
- Wide Area Augmentation System (WAAS), 256
- WIND (satellite), 197
- wind, neutral, 141, 146, 147
- wind, zonal, 241
- work function, 258
- World Data Center, 32
- World Data System, 32
- World Digital Magnetic Anomaly Map, 33
- X-line, 162, 163, 167