

# Index

- A**  
Absorption aerosol index (AAI), 266  
Acetaldehyde, 26–29, 254, 255  
Acetone, 26–29, 253, 254  
Acetylene, 253  
Acidification, 250  
Activation, activated, 174, 178, 182, 205  
Advanced Very High Resolution Radiometer (AVHRR), 257, 265  
Advective mixing, 290  
Aerobic, 18, 37  
Aerosol(s), 250–252, 255, 258, 261, 262, 266–267, 270, 280–281, 283, 287, 288, 292–293  
    concentration, 176, 225  
    mass, 176, 177, 180, 205  
    production, 174–202  
    size distribution, 172, 182, 183, 185, 202  
    sources, 171, 174, 184, 209  
Aerosol (sea salt aerosol), 9, 10, 22, 23  
Aerosol mass spectrometer (AMS), 196  
Aerosol optical depth (AOD), 175, 190, 204, 225, 266, 267  
Aerosol optical thickness (AOT), 266  
Aerosol production, 61, 62, 64, 79, 80  
Ageing, 178, 196–201, 220  
Aggregation processes (aggregates), 180, 187, 197, 199, 212, 213, 219–221, 223, 224, 227  
Aircraft, 27, 39  
Air mass climatology, 281  
Air quality, 174  
Air-sea flux  
    of CO<sub>2</sub>, 272, 273, 290  
    of heat, 257  
Air-sea gas exchange, 115, 134, 155  
Alcohols, 26, 29, 30  
Aldehydes, 26, 27, 35  
Aliphatic amines, 252  
Alkane, 31  
Alkene, 31  
Alkyl amines, 37  
Alkyl nitrates, 31–33  
Alkyl peroxy radical (RO<sub>2</sub>), 27, 33  
A Long-term Oligotrophic Habitat Assessment (ALOHA), 250  
Altimeter, 90, 99–101  
Altimetry, 256–260, 265  
Amines (R<sub>x</sub>NH<sub>y</sub>), 35–37  
Ammonia (NH<sub>3</sub>), 25, 35–37, 183  
Ammonium (NH<sub>4</sub>), 20, 35, 36, 182, 197  
Ammonium monooxygenase (AMO), 20  
AMS. *See* Aerosol mass spectrometer (AMS)  
Anaerobic, 18, 37  
Anammox, 37  
Ångström exponent/coefficient, 202, 266  
Anoxic, 18  
Anthropogenic, 113, 115–119, 121, 124–130, 135, 142, 146–150, 153, 154  
Anthropogenic aerosol, 189, 193, 202  
Anthropogenic carbon, 289  
AOD. *See* Aerosol optical depth (AOD)  
Apparent quantum yield (AQY), 29  
Aquarius/SAC-D mission, 260–261  
Aqueous phase, 28, 32, 33, 35  
ARGO, 248–250, 255, 261, 262, 271, 291, 292  
Artificial surfactant, 68  
Asian mineral dust, 287  
Atlantic Ocean, 176, 179, 180, 183, 187, 188, 191, 197, 202, 209, 218  
Atmospheric aerosol, 171, 204, 206, 217  
Atmospheric deposition, 251  
Atmospheric nitrogen inputs, 281  
Atmospheric nutrient inputs, 293  
Atmospheric observatories, 250–251  
Atmospheric pCO<sub>2</sub>, 221  
Atmospheric pressure chemical ionization tandem mass spectrometry, 21  
Atmospheric processes, 172, 188, 214  
Atmospheric stability, 71, 82  
Atmospheric stratification, 65, 71, 76  
Atomic iodine (I), 21  
Attenuation coefficients, 263  
Autonomous Ocean Flux Buoys (AOFB), 265  
Autonomous underwater vehicle (AUV), 250  
Autotroph, 221, 226  
AVHRR. *See* Advanced Very High Resolution Radiometer (AVHRR)
- B**  
Bacteria, bacterioplankton, 179, 201, 217–220, 223  
Bacterial abundance, 217  
Bacterial production, 218  
Bacterial respiration, 218  
Base, 35  
Batch, 211, 212  
BATS. *See* Bermuda Atlantic Time-series Study (BATS)  
BC. *See* Black carbon (BC)

- Bermuda Atlantic Time-series Study (BATS), 250, 290  
 Bioassay experiments, 215, 217  
 Bioavailable, 206, 207, 209, 210, 215  
 Biogenic detrital particles, 263  
 Biogenic volatile organic compounds (BVOC), 191–192  
 Biogeochemical sensors, 249  
 Biogeochemistry, 125, 127, 129, 173, 186, 202, 206, 209–211, 213, 221  
 Biological activity, 176, 177, 183, 205, 209, 211, 214, 225  
 Biological carbon pump, 214  
 Biological production, 120, 134, 143  
 Biomass, 201, 217, 226  
   burning, 189, 193, 194, 198, 209, 210, 226  
   burning aerosols, 267  
 Biota, 179, 184, 191, 206, 207, 221, 222, 226  
 Black carbon (BC), 177, 194  
 Bloom, 15, 38, 179, 180, 213–216, 223, 224  
 Bodélé depression, 252  
 Boundary currents, 256  
 Brine, 95, 96  
 Brine flushing, 264–265  
 Bromine (Br), 10, 13, 16–18, 21–24, 251, 255  
   (bromo-)Chloroperoxidase, 18  
 Bromodichloromethane (CH<sub>2</sub>BrCl<sub>2</sub>), 17, 18  
 Bromoform (CHBr<sub>3</sub>), 17–19, 262, 277  
 Bromiodomethane (CH<sub>2</sub>BrI), 20, 22  
 Bubble, 174–176, 179, 180, 205  
   generation, 62  
   scavenging, 62, 68  
 Bubble-mediated transfer, 62–64, 66, 85, 88, 91, 94, 97, 101  
 Budgets, 2, 7, 11, 14, 26–29, 34, 38  
 Buoyancy, 66, 67, 76, 90, 91  
 Butane, 31  
 Butyraldehyde, 29  
 BVOC. *See* Biogenic volatile organic compounds (BVOC)
- C**  
 Calcium carbonate (CaCO<sub>3</sub>), 117, 120, 121, 126, 151, 152, 263  
 Calibration algorithms, 256  
 Calibration drift, 256  
 CAM-Chem chemistry-transport model, 254  
 Canary and California Current System, 272  
 Cape Grim, 251  
 Cape Verde Atmospheric Observatory (CVAO), 251–255  
 Carbon, 173, 179, 183, 194–199, 202, 206, 209, 210, 212, 214, 215, 218–224, 226  
 Carbonate and bicarbonate ions, 290  
 Carbon cycle, 116, 118, 129, 148  
 Carbon dioxide (CO<sub>2</sub>), 113–157  
 Carbon Dioxide Information Analysis Center (CDIAC), 279, 280  
 Carbon disulphide (CS<sub>2</sub>), 6, 7  
 Carbon monoxide (CO), 33, 38–39  
 CarbonSat and CarbonSat Constellation concepts, 268  
 Carbon tetrachloride (CCl<sub>4</sub>), 14  
 Carbonyl, 29  
 Carbonyl sulfide (COS), 6, 7  
 CARBOOCEAN, 291  
 Carboxylic acids, 26, 27  
 Catalytic O<sub>3</sub> destruction, 260  
 CAVASSOO, 296  
 Cavity ring down, 21  
 CCN. *See* Cloud condensation nuclei (CCN)  
 CDIAC. *See* Carbon Dioxide Information Analysis Center (CDIAC)  
 CDOM. *See* Coloured dissolved organic matter (CDOM)  
 CERES satellite, 292  
 Chapman reactions, 26  
 Chelton effect, 259, 260  
 Chemical enhancement, 34  
 Chemical transport models (CTMs), 292, 293  
 Chemistry, 173, 175, 176, 180, 189, 191, 193, 196, 200, 210, 211, 213, 214, 221  
   chl-*a* maximum, 262, 263  
 Chlorine, 13–14, 21–23  
 Chloroform (CHCl<sub>3</sub>), 14, 16, 19  
 Chloriodomethane (CH<sub>2</sub>ClI), 15, 20, 21  
 Chloromethane (CH<sub>3</sub>Cl), 15  
 Chloroperoxidase, 16, 18  
 Chlorophyll, 262–264, 275, 282, 284, 288, 291  
 Chlorophyll (maximum), 17  
 Chlorophyll-*a*, 177, 180, 182, 183, 215, 217, 249, 264, 288, 290  
 CLAW, 2, 6, 11–13, 39  
 Cleavage, 3  
 Climate, 172, 191–193, 201, 202, 204, 211, 221, 222, 225  
   change, 113–157  
   feedback, 10, 11  
   model, 180, 193, 203  
   observing systems, 249  
   variability, 249, 290  
 Climatology, 79, 97  
 Cloud, 2, 9–13, 24, 27, 28, 31, 35  
   albedo, 172, 193, 205  
   cycling, 182  
   formation, 175, 204–206  
 Cloud condensation nuclei (CCN), 12, 13, 24–27, 39, 178, 204, 205, 225, 251  
   formation/growth, 262  
 Cloud droplets, 255, 262  
 C\* method, 274  
 Coagulation, 172, 186, 196, 197, 212  
 CO<sub>2</sub> air-sea climatologies, 156  
 COARE algorithm, 87, 90  
 Coarse mode, 172, 175, 210  
 Coastal ocean, 6, 17, 149, 151  
 Coastal sediments, 141–143, 152  
 Coccolithophores, 263, 264  
 CO<sub>2</sub> emission scenarios, 276  
 Coherent structure, 56, 58, 60, 61, 66, 74  
 Coloured dissolved organic matter (CDOM), 6, 15, 30, 37–38, 254  
 Community structure, 190, 215, 217, 226  
 Concentration, 114, 118–121, 123, 124, 130, 131, 134–144, 147, 148, 150–156  
 Concentration gradient, 28–29  
 Condensable vapour, 186  
 Conditions, 56, 59, 60, 62, 67, 68, 70, 71, 74, 76–79, 84–88, 93, 96  
   neutral conditions, 76  
 Continental shelves, 126–129, 135, 137, 139–140, 144, 150, 153  
 Convection  
   water-side convection, 66

Convective mixing, 291  
 Convective regions, 16, 26, 27  
 CO<sub>2</sub> partial pressure (pCO<sub>2</sub>), 274, 275, 289–292  
 Copper (Cu), 198, 209, 211, 217  
 CO<sub>2</sub> uptake, 271, 272, 290, 291  
 Cryosat-2, 256, 265  
 CTMs. *See* Chemical transport models (CTMs)  
 CVAO. *See* Cape Verde Atmospheric Observatory (CVAO)  
 Cyanobacteria, 18, 19, 31, 37, 38, 214, 364

## D

Dark production, 38  
 Dead zones, 153, 157  
 Degradation rate, 6, 17  
 Dehalogenation, 251  
 Demethylation, 3  
 Denitrification, 130–131, 134, 135, 151, 272  
 Density stratification, 67  
 Deposition, 172, 173, 186–193, 196, 198, 206–224  
   deposition velocity, 11, 34, 35, 78–80, 92  
   direct deposition, 78, 80  
   dry deposition, 62, 74, 78–79  
   particle deposition, 78  
   wet deposition, 79–80  
 Depth profiles, 32  
 Desert dust, 172, 186–189, 207, 218, 221  
 Detrital aggregates, 19, 20  
 Diatoms, 3, 18, 31, 38, 264, 287, 288  
 Diazotrophic bacteria, 37  
 Dibromomethane, 15, 17  
 Dibromochloromethane (CH<sub>2</sub>Br<sub>2</sub>Cl), 17, 18  
 Dibromomethane (CH<sub>2</sub>Br<sub>2</sub>), 17–19  
 DIC. *See* Dissolved inorganic carbon (DIC)  
 Dichloromethane (CH<sub>2</sub>Cl<sub>2</sub>), 14–16  
 Differential optical absorption spectroscopy (DOAS), 21  
 Di-iodomethane (CH<sub>2</sub>I<sub>2</sub>), 15, 21, 22, 24  
 Dimethylammonium ((CH<sub>2</sub>)<sub>2</sub>NH<sub>2</sub>), 35  
 Dimethyl selenide, 7  
 Dimethylsulphide (DMS), 2–13, 24, 28, 36, 39, 40, 173,  
   182, 183, 185, 194, 202, 204, 214  
   climatology, 278  
   summer paradox, 250  
 Dimethylsulphoniopropionate (DMSP), 2–7, 40, 250, 282, 286  
 Dimethylsulphoxide (DMSO), 2, 3, 9, 11  
 Dinoflagellates, 3, 264  
 Direct flux, 14, 28, 36, 39  
 Direct radiative effect (DRE), 178, 202–204, 225  
 Dispersion, 175  
 Dissipation rate, 58, 65, 73, 93  
 Dissociation constant (pK<sub>b</sub>), 35  
 Dissolution, 173, 211–213, 219, 226  
 Dissolved form, 173, 211  
 Dissolved inorganic carbon (DIC), 119–122, 124, 125, 129, 148,  
   150, 155, 274, 290  
 Dissolved organic carbon (DOC), 179, 210, 262  
 Dissolved organic matter (DOM), 182, 210  
 Diurnal variation, 14, 18  
 Diurnal warm layer, 85  
 DMS. *See* Dimethylsulphide (DMS)  
 DMS climatology, 3–5, 9

DMSO. *See* Dimethylsulphoxide (DMSO)  
 DMSP. *See* Dimethylsulphoniopropionate (DMSP)  
 DMSP lyase, 2  
 DOC. *See* Dissolved organic carbon (DOC)  
 DOM. *See* Dissolved organic matter (DOM)  
 DRE. *See* Direct radiative effect (DRE)  
 Dry deposition, 172, 188, 210  
 Dry mole fraction, 113, 114, 116–118  
 Dust deposition, 251

## E

Earth observation (EO), 194, 225, 255–270, 294  
 Earth observing systems, 294  
 Earth system models, 271, 272, 284, 294  
 Earth system science, 2, 40  
 Eastern boundary upwelling regions, 273  
 Ebullition, 140–142, 146, 147, 153, 155  
 Ecosystem, 189, 191–193, 195, 202, 218–221  
   functioning, 221  
   response, 287–289  
 Eddy correlation, 28  
 Eddy dynamics, 256  
 Effective flux, 175  
 El Chichón eruption, 269  
 Electromagnetic spectrum, 266  
 El Niño, 256  
 Emission, 113–115, 117, 119, 127, 130, 134–137, 139–144,  
   146–147, 152, 153, 155–157, 172, 176, 184, 186,  
   188–196, 198, 202, 204, 205, 207, 209, 226  
 Emission inventory, 193, 226  
 Enhancement, 56, 58, 67, 69–70, 91, 94, 101  
 Enrichment, 173, 174, 176–179, 199, 205, 206, 214, 216  
 Environmental Satellite (ENVISAT), 256, 259, 268  
 ENVISAT. *See* Environmental Satellite (ENVISAT)  
 EO. *See* Earth observation (EO)  
 Estuaries, 128–130, 134, 135, 137–141, 143, 144, 147  
 Ethane, 31, 253  
 Ethanol, 26, 27, 29, 30  
 Ethyl nitrate (EtONO<sub>2</sub>), 31  
 Euphotic zone, 31, 38  
 European Iron Fertilization Experiment (EifEX), 282  
 European Remote Sensing (ERS) satellites, ERS-1 and-2, 256, 265  
 European Space Agency, 260–261, 270  
 European Station for Time-series in the Ocean Canary Islands  
   (ESTOC), 250  
 Evasion, 67, 84  
 Export of matter, 218  
 External mixing, 196

## F

fCO<sub>2</sub>. *See* Surface water (fCO<sub>2</sub>)  
 Fertilisation, 213–215, 221–224, 227  
 Fine mode, 202  
 Fine particles, 24  
 Flow structures, 81  
 Flux, 2, 5–11, 13, 16, 17, 19–21, 28, 29, 32, 34–39  
 Flux gradient, 34  
 Footprint, 82, 86  
 Forecasting capability, 249

- Forecast mode, 270, 271  
 Formaldehyde (HCHO), 27, 29, 270  
 Formic acid, 26, 27  
 Free troposphere, 34  
 Freons, 15  
 Friction velocity, 56, 58, 60, 61, 65, 66, 70, 71, 76, 93, 101  
 Frost flowers, 265  
 Fugacity, 118, 119
- G**
- Gases  
   poorly soluble gases, 62  
   soluble gases, 56, 62, 63, 72, 74, 90, 92, 94, 97  
 Gas exchange parametrisation, 275  
 Gas phase, 9, 10, 12, 21–25, 28, 31, 32, 35, 36  
 Gas transfer velocity, 59, 64, 65, 73, 78, 80, 81, 83, 85, 87, 88, 91, 93, 97, 98, 119, 257  
 GCOS. *See* global climate observing systems (GCOS)  
 Geo-engineering, 205  
 Geosat, 256  
 GEOTRACES, 281, 283  
 GFED. *See* Global fire emissions database (GFED)  
 GHRSSST Multi-product Ensemble (GMPE), 257, 258  
 Gliders, 250, 265  
 Global annual sea-to-air DMS flux, 285  
 Global array, 248  
 Global budgets, 113  
 Global burden of SSA, 292  
 Global change, 147–154  
 Global climate observing systems (GCOS), 255, 260  
 Global fire emissions database (GFED), 194  
 Global Ocean Data Assimilation Experiment (GODAE), 262  
 Global Ocean Observing System, 255  
 Global prognostic models, 276  
 Global SSA burdens, 297  
 Global whitecap coverage, 297  
 Glyoxal, 274  
 GMPE. *See* GHRSSST Multi-product Ensemble (GMPE)  
 Gravitational settling, 193  
 Grazing, grazers, 218, 219, 221  
 Greenhouse gas, 34, 38  
 Greenhouse gases Observing SATellite (GOSAT), 274  
 Groundtruthing, 261
- H**
- Halocarbons, 14, 19  
 Halocarbons in the Ocean and Atmosphere (HalOcat), 282–283, 288  
 HalOcat. *See* Halocarbons in the Ocean and Atmosphere (HalOcat)  
 Halogen, 14, 15, 18, 19, 21–26, 40  
 Halogenated hydrocarbons, 282  
 Haloperoxidase, 16, 21  
 Haptophytes, 3  
 Hard tissue pump, 123, 124  
 HCN. *See* Hydrogen cyanide (HCN)  
 Heat flux, 60, 63, 68, 69, 71, 73, 75, 76, 79, 84, 93  
 Heterogeneous, 9, 10, 22  
 Heterogeneous processes, 189, 202  
 Heterotrophic bacteria, 268  
 Heterotrophic organisms, 214  
 High-nutrient low-chlorophyll (HNLC), 211, 214, 218–227, 230, 231, 286  
 Hindcast mode, 275  
 HNLC. *See* High-nutrient low-chlorophyll (HNLC)  
 HOBr, 9, 22  
 HOCl, 9, 11, 17  
 HOI, 21–24, 26  
 Hot spot volcanic islands, 291  
 HO<sub>x</sub>, 21, 22, 27  
 HO<sub>x</sub> radical, 256  
 H<sub>2</sub>SO<sub>4</sub>, 9, 24, 25  
 Humic substances, 30  
 Hurricanes, 263, 295  
 HYbrid Coordinate Ocean Model (HYCOM), 278  
 Hydration, 72  
 Hydrazine (N<sub>2</sub>H<sub>4</sub>), 37  
 Hydrogen (H<sub>2</sub>), 27, 37–38  
 Hydrogen cyanide (HCN), 33–34  
 Hydrogenolysis, 19  
 Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>), 18, 21, 256  
 Hydrogen sulphide (H<sub>2</sub>S), 7, 9  
 Hydrolysis, 6, 7, 17, 19, 20, 33  
 Hydroperoxyl (HO<sub>2</sub>), 256, 259, 260  
 Hydrostation S, 255  
 Hydroxide (OH), 256, 259  
 Hygroscopic, 176, 177, 179, 182, 200, 201, 207, 229  
 Hypobromite (BrO), 274  
 Hypoxic zones, 155, 157
- I**
- Ice-atmosphere exchanges, 270  
 Ice cores, 118–121  
 Indirect radiative effect, 209–211  
 Inductively coupled plasma mass spectrometry, 22  
 Infrared imaging, 76  
 Infrared radiometer, 262  
 Inorganic nutrients, 221  
 In situ mesocosms, 223–225, 229  
 In-situ observations, 253–288  
 Integrated Arctic Ocean Observing System (IAOOS), 271  
 Interannual variability, 279, 281, 290, 295  
 Interfacial flux, 179, 180  
 Internal mixing, 201–205  
 Inventory, 86, 90, 92, 96, 99, 102–103  
 Inverse modelling, 279–280  
 I<sub>2</sub>O<sub>5</sub>, 25, 26  
 IO<sub>3</sub>, 26  
 Iodine, 14, 19–26, 190, 260  
 Iodine dioxide (OIO), 22–25  
 Iodine monoxide (IO, iodine oxide), 22  
 Iodine monoxide (IO) radicals, 260  
 Iodobutanes (C<sub>4</sub>H<sub>9</sub>I), 20  
 Iodocarbon, 19–21, 24  
 Iodoethane (C<sub>2</sub>H<sub>5</sub>I), 20, 22  
 Iodoform (CHI<sub>3</sub>), 21  
 1-and 2-iodopropane (C<sub>3</sub>H<sub>7</sub>I), 20, 22  
 IONO<sub>2</sub>, 22–24

- Iron (Fe), 256, 257, 285–287, 291–293  
 binding capacity, 216  
 binding ligands, 216  
 Iron addition experiments, 287, 291  
 Iron fertilisation, 291  
 Isoprene, 16, 31, 32, 40, 268  
 Isopropyl nitrate, 32
- K**  
 Kelp, 21  
 Ketones, 26, 28, 35
- L**  
 Labrador current, 295  
 Langmuir circulation, 67, 69  
 Langmuir number, 69  
 La Niña, 261, 262  
 Laser speckle velocimetry (LSV), 83  
 Layer  
   atmospheric boundary layer (ABL), 73, 74, 77, 89  
   atmospheric surface layer, 73  
   deposition layer, 81, 82  
   interfacial turbulent boundary-layer, 77  
   mass boundary layer (MBL), 60, 72, 74, 75, 79, 80  
   mixed layer, 68, 69, 77, 86, 87, 89  
   molecular diffusion layer, 73  
   sea surface microlayer, 65, 71  
   turbulent boundary layer, 77  
   turbulent shear layer, 63  
 Lidar altimetry, 270  
 Limitations, 86–87, 211, 213, 214, 219, 221, 223, 226  
 Lithogenic, 223, 224, 227–229, 231  
 LNLC. *See* Low-nutrient-low chlorophyll (LNLC)  
 Low-molecular-weight dicarboxylic acids (DCAs), 259  
 Low-nutrient-low chlorophyll (LNLC), 211, 214, 218–227, 231
- M**  
 Mace head, 180–182, 184, 185, 187–190, 256, 272  
 (Macro)algae, 14, 17, 18, 24, 38  
 Macrophyte, 17  
 Mangrove ecosystems, 137, 141, 147  
 Marine aerosols, 259, 263, 267, 272, 285, 298  
 Marine atmosphere, 177–206, 229  
 Marine boundary layer (MBL), 9–11, 14, 21–26, 31, 33–35, 185–191, 259, 274  
 MarinE MethanE and NiTrous Oxide (MEMENTO) database, 281, 287  
 Marine productivity, 191, 226, 231  
 Mass, 177, 178, 180–185, 187–189, 191, 193, 194, 196, 197, 201–204, 206, 207, 209, 214, 228  
 Mass median diameter, 192  
 Mauna Loa CO<sub>2</sub> record, 298  
 Mauna Loa Observatory, 272  
 MBL. *See* Marine boundary layer (MBL)  
 Mean square slope (mss), 264  
 Mean-square wave slope, 60, 62, 72  
 Mechanisms, 6, 12, 17, 20, 21, 32, 33, 35, 37  
 Mediterranean Sea, 193, 214, 223, 227, 228  
 Medium Resolution Imaging Spectrometer (MERIS), 267, 269, 271  
 Medium scale in situ enrichments, 287  
 MEMENTO. *See* MarinE MethanE and NiTrous Oxide (MEMENTO) database  
 MERCATOR, 278  
 MERIS. *See* Medium Resolution Imaging Spectrometer (MERIS)  
 Mesocosm, 217, 218, 223–225, 228, 229, 231  
 Mesoscale eddies, 261  
 Mesoscale ocean enrichment, 218  
   experiments, 286  
 Metabolic activity/rates, 221–223, 231  
 Methane (CH<sub>4</sub>), 2, 20, 28, 31, 37, 117–161, 256, 259, 272–274, 281  
 Methane hydrate, 120, 148–150, 158–159  
 Methane monooxygenase (MMO), 20  
 Methanesulphonic acid (MSA), 9, 11, 13, 256, 259  
 Methanethiol (CH<sub>3</sub>SH, methylmercaptan), 7  
 Methanogenesis, 142–148, 151  
 Methanol, 26–31, 258, 259  
 Methanotrophic/nitrifying bacteria, 20  
 Methylating agents, 20  
 Methyl bromide (CH<sub>3</sub>Br), 15, 17–18  
 Methyl cyanide (acetonitrile, CH<sub>3</sub>CN), 33–34  
 Methyl ethyl ketone, 28  
 Methyl halide, 20  
 Methyl iodide (CH<sub>3</sub>I, iodomethane), 15, 19, 20, 22  
 Methyl nitrate (MeONO<sub>2</sub>), 32  
 Methyltransferase, 20  
 Microbes, 206, 218, 231  
 Microcosm, 211, 219–225, 231  
 Microlayer, 14, 26, 35, 65, 71, 72, 217, 231  
 Micrometeorology (micrometeorological), 181, 197  
 Microorganism, 206, 215  
 Microscale wave breaking, 59–63, 67, 83  
 Mid Term Strategy Initiatives, 293  
 Mixed layer, 213, 217, 219, 221  
 Mixed-layer depth (MLD), 268  
 Mixing ratios, 256, 258–260, 272, 279, 280  
 Model(s), 3–5, 9–13, 17–20, 22, 24–27, 32, 35, 39, 180, 185, 186, 192, 196–199, 201, 205, 207–211, 215, 217, 223–226, 229–231  
   aerosol transport model, 82  
   surface penetration model, 76, 84  
   surface renewal model, 75, 76, 84  
 Moderate Resolution Imaging Spectroradiometer (MODIS), 262, 267–272, 292, 293  
 Molecular iodine (I<sub>2</sub>), 22, 25  
 Momentum, 63, 69, 70, 73, 74, 76, 78–80, 83, 84, 93, 94  
 Monin-Obukhov length, 73  
 Monin-Obukhov Similarity Theory (MOST), 73  
 Monoterpene, 28, 32, 196, 197  
 MSA. *See* Methanesulphonic acid (MSA)  
 Multispectral ocean colour sensors, 269
- N**  
 National Centers for Environmental Prediction (NCEP), 262, 263, 296  
 Natural aerosol, 216, 221  
 Naval Oceanographic Office (NAVOCEANO), 262

- NCEP. *See* National Centers for Environmental Prediction (NCEP)
- Neutral stability, 81
- New particle formation, 189–191
- NH<sub>x</sub>, 36
- Nitrate, 255, 259, 287
- Nitric acid (HNO<sub>3</sub>), 187, 259
- Nitric oxide (NO), 21, 22, 24, 33, 35
- Nitrification, 135, 136, 138, 141, 156, 157
- Nitrification/denitrification, 33
- Nitrogen dioxide (NO<sub>2</sub>), 274
- Nitrogen (N<sub>2</sub>) fixation, 213, 222, 226, 256, 260
- Nitrous oxide (N<sub>2</sub>O), 117–161, 276, 277, 281
- Nitryl chloride (ClNO<sub>2</sub>), 21
- NMHC. *See* Non-methane hydrocarbons (NMHC)
- NMVOC. *See* Non-methane volatile organic compounds (NMVOC)
- NO<sub>3</sub>, 9, 10, 23, 24, 30, 31
- Non-methane hydrocarbons (NMHC), 26–34, 40, 259
- Non-methane volatile organic compounds (NMVOC), 198
- Non-sea-salt-(nss) sulphate aerosol, 256
- Normalised water leaving radiances, 269
- North Atlantic, 3, 7, 8, 10, 20, 24, 29, 31, 32, 36
- North Atlantic Oscillation (NAO), 295
- NO<sub>x</sub>, 10, 21–25, 28, 31
- n-propyl nitrate, 32
- Nucleation, 177, 185, 189–191, 197
- Nucleophilic substitution, 20
- Numerical Weather Prediction (NWP) models, 263
- Nutrients, 178, 193, 194, 198, 200, 204, 205, 211, 213–216, 218, 219, 221–228, 230, 231
- O**
- Ocean acidification, 115, 117, 121, 130, 149–152, 156
- Ocean-atmosphere exchanges, 147, 148
- Ocean-atmosphere interaction, 171–227
- Ocean-atmosphere interface (air-sea interface), 1
- Ocean-Atmosphere-Sea Ice-Snow (OASIS), 265
- Ocean Carbon-cycle Model Intercomparison Project, 97
- Ocean colour, 177, 255, 262, 263, 275
- Oceanflux, 270
- Oceanic fertilisation by volcanic eruptions, 289
- Oceanic observatories, 248
- Oceanic transport inversion, 274
- Ocean inversion model, 291
- Ocean surface winds, 257
- Ocean turbulence, 256
- OH, 9–11, 14, 21–23, 26–28, 31, 34, 35, 38
- OIO. *See* Iodine dioxide (OIO)
- Oligotrophic, 30, 38, 179, 211, 217, 219–222
- Oligotrophic environments, 217, 219
- Oligotrophic waters, 263, 282–283
- OMI, 266, 269
- OMZ. *See* Oxygen minimum zone (OMZ)
- Open ocean, 115, 117, 121–126, 131, 135–139, 143, 144, 146–150, 152–157
- O<sub>3</sub> photochemistry, 251
- O<sub>3</sub> photolysis rate, 251
- Optical measurements, 220–221, 224
- Orbiting Carbon Observatory (OCO), 268
- Organic carbon, 179, 194, 198, 210, 212, 218, 221, 223
- Organic carbon pump, 120
- Organic matter (OM), 174, 176–182, 184, 197, 200, 205–206, 210, 212, 220–221, 223, 224
- Organic nutrients, 210
- Organic radicals, 254
- Organohalides, 265
- OSTIA, 257
- OVOCs. *See* Oxygenated volatile organic compounds (OVOCs)
- Oxidation, 2, 7, 9–13, 18, 20, 24, 27, 29, 30, 35–38
- Oxidative stress, 20
- Oxidising capacity, 254
- Oxygen, 249, 268, 272, 275
- Oxygenated volatile organic compounds (OVOCs), 26–31, 254, 270
- Oxygen minimum zone (OMZ), 131, 132, 137, 139, 151–153, 293
- Ozone (O<sub>3</sub>), 9, 17, 20–27, 31
- Ozone destruction, 251, 255, 269–270
- P**
- Palaeo-proxies, 271
- Parameterisation, 56, 62, 64, 66, 70, 73, 75, 79, 87–95, 97–99
- Parasitic capillary wave, 56, 74
- Partial pressure, 118, 119  
difference, 56, 85, 98
- Particle  
backscattering, 263  
burst, 24  
concentration, 185, 186, 206  
fluxes, 78, 79  
settling, 212, 213  
size distribution, 172, 187, 263
- Particle image velocimetry (PIV), 59, 80
- Particles (IOP), 24
- Particle tracking velocimetry (PTV), 80
- Particulate carbon, 249
- Particulate inorganic carbon (PIC), 261–264
- Particulate organic carbon (POC), 179, 210, 224, 227, 261–264
- Particulate organic matter (POM), 182, 197, 224
- Partitioning, 183, 193, 199, 209, 226
- Passive polarimetric sensors, 258
- Pathfinder algorithm, 257
- pCO<sub>2</sub>. *See* CO<sub>2</sub> partial pressure (pCO<sub>2</sub>)
- pCO<sub>2</sub> mapping, 291
- Péclet (Pe) number, 57
- Perchloroethylene (PCE tetrachloroethylene), 14
- Peroxyacetylnitrate (PAN), 27, 254
- PFTs. *See* Phytoplankton functional types (PFTs)
- pH, 117, 121, 122, 130, 150, 151, 189, 211, 222, 250, 288
- Phaeocystis, 15, 17
- Phosphorus, 173, 206–212, 219, 226, 251, 289
- Photobleaching, 30
- Photochemical/photochemistry, 7, 14, 19, 29, 30, 32, 33, 36–38
- Photochemistry, 251
- Photodecomposition, 254
- PhytoDOAS, 264
- Phytoplankton, 2, 3, 6, 14, 15, 17–20, 31–33, 36, 38, 120, 138, 151, 173, 176, 180, 188, 190, 210, 213–220, 223, 261, 263, 270, 274, 284, 287

Phytoplankton functional types (PFTs), 263  
Phytoplankton size classes (PSCs), 263, 264  
PIC. *See* Particulate inorganic carbon (PIC)  
Picoplankton, 217  
PIV. *See* Particle image velocimetry (PIV)  
Planetary wave dynamics, 256  
Plankton, 176, 179, 182, 215, 218  
PM10, 193, 201  
POC. *See* Particulate organic carbon (POC)  
Polybrominated methanes, 17–19  
Polynias, 265  
Precipitation, 62, 78–80, 83, 96  
Precursor hydrocarbons, 270  
Primary production, 17, 71, 96, 216–218, 220, 261, 287, 291  
*Prochlorococcus*, 19, 217  
Production, 172–202, 204, 215–223  
Production flux, 174, 175, 225  
Production rate, 19, 27, 31  
Profile, 58, 61, 66, 70–72, 74, 75, 80, 84–86, 93  
Profiling floats, 248  
Propanal (propional), 27, 29  
Propane, 31  
Propanol, 29, 30  
Propene, 31  
PSCs. *See* Phytoplankton size classes (PSCs)  
Pyruvate, 29

## Q

Quality-flagged controlled data sets, 250

## R

Radar altimeter, 256, 265  
Radar backscatter, 259  
Radiative balance, 251  
Radiative budget, 202  
Radiative forcing, 24  
Radical recombination, 19  
Radio-frequency interferences (RFI), 261  
Radiometers, 256–258  
Rain, 56, 67–68, 78, 79, 93, 101  
Rainwater chemistry, 280–281, 283  
Reactive bromine, 17  
Reactive marine-derived halogens, 255  
Reactive trace gases, 250, 251  
Reactive trace species, 251–255  
Relative humidity (RH), 172, 174, 176–180, 198, 202  
Remineralisation, 214, 218, 224  
Removal, 172–174, 194–196, 200  
Resonance fluorescence, 21  
RH. *See* Relative humidity (RH)  
Rivers, 115, 125, 129, 130, 134, 142, 151, 153–155  
Roughness length, 71, 82

## S

S-adenosyl-L-methionine (SAM), 20  
Sahel region, 251, 252, 254  
Salinity, 175, 176, 248, 250, 255, 260–261, 265, 290

SAR. *See* Synthetic aperture radar (SAR)  
Satellite, 21, 27, 33, 39, 175, 177, 182, 191, 194, 201, 202, 204, 213–216, 223, 225  
  measurement, 99  
  oceanography, 255  
  retrieval, 190, 202  
  wind speeds, 90, 99, 101  
Saturation (state, super, under), 16–18, 30, 32, 37  
Saturation anomaly, 32  
SCanning Imaging Absorption spectrometer for Atmospheric Cartography (SCIAMACHY), 264, 266–270  
Scatterometer, 90, 99–101, 258, 259  
Scavenging, 211–213, 220, 221, 226  
Schmidt number ( $Sc$ )  
  dependence, 63, 84, 100  
  exponent, 72, 78, 93  
SCIAMACHY. *See* SCanning Imaging Absorption spectrometer for Atmospheric Cartography (SCIAMACHY)  
SDS. *See* Sodium dodecyl sulphate (SDS)  
Sea ice, 95–96, 121, 125–126, 141, 147–151, 155  
  bulk salinity, 265  
  distribution and motion, 264  
  transfer estimates, 96  
Sea-ice fraction, 97  
Sea salt, 174–183, 200, 204–207  
  aerosol production, 61–62  
  source function, 292  
Sea salt aerosols (SSA), 175, 176, 200, 203, 206, 207  
  emissions, 293  
  mass concentrations, 293  
  reflectance, 292  
  source functions, 293  
Seasat, 256  
Seasonal(ity, cycles), 3, 14, 16–18, 32, 33, 35, 39, 180  
Seasonal ice zones, 249  
Sea spray, 174, 176, 178–180, 184, 205, 206  
  particles, 62  
Sea spray aerosol (SSA), 172–182, 224–226  
Sea spray aerosol source function (SSSF), 175  
Sea spray source function (SSSF), 62, 64  
Sea state, 256–260  
Sea surface salinity (SSS), 255, 260–261, 290  
Sea surface temperature (SST), 14–17, 34, 176, 224, 256–260, 267, 273, 284, 290–292  
SeaWiFS, 177, 182, 223, 262–264, 267, 290  
Secondary organic aerosol (SOA), 37, 183, 184, 191, 193, 196, 199–200  
Secondary production, 174, 183  
Sediment core studies, 287  
Self-organising maps, 291  
Sensor  
  closed path sensors, 83  
  open path sensor, 83, 95  
Sesquiterpene, 191  
Shear  
  air-side, 67  
  wind shear, 76  
Ship emissions, 172, 194–195, 293

- Short-lived brominated and iodinated trace gases, 277
- Short lived trace gases, 1–40
- Silicate (Si), 188, 214, 222, 226
- Simulation
- direct numerical simulation (DNS), 74–76
  - large-eddy simulation (LES), 74–76
  - large-wave simulation (LWS), 75
- Single scattering albedo, 202
- Sink, 6, 17, 19, 27, 28, 30, 32–39
- Sinking particles, 214, 224
- Skin temperature (SST<sub>skin</sub>), 256, 265
- Slick, 68, 99
- SMOS. *See* Soil Moisture and Ocean Salinity (SMOS)
- SOA. *See* Secondary organic aerosol (SOA)
- SOCAT. *See* Surface Ocean CO<sub>2</sub> Atlas (SOCAT)
- Sodium dodecyl sulphate (SDS), 179
- Soil Moisture and Ocean Salinity (SMOS), 261, 262, 290
- Solar radiation dose (SRD), 2, 12
- Solubility, 56, 63, 64, 71, 76–77, 90–91, 95, 100, 101, 178, 189, 205, 209, 212, 215, 221
- Solubility pump, 120
- Soluble organic iodide (SOI), 26
- Source, 2, 3, 6–9, 11, 13–23, 26–40
- SRD. *See* Solar radiation dose (SRD)
- SSA. *See* Sea salt aerosols (SSA); Sea spray aerosol (SSA)
- SSM/I series satellites, 264
- SSS. *See* Sea surface salinity (SSS)
- SSS scattering, 261
- SST. *See* Sea surface temperature (SST)
- SST<sub>skin</sub>. *See* Skin temperature (SST<sub>skin</sub>)
- Stoichiometry, 214
- Stoke's drift, 65, 66
- Stratification, 65, 67, 70, 71, 76, 85, 93, 124, 147, 149, 150
- atmospheric stratification, 65, 70, 71, 76
- Stratosphere, 13, 17, 33
- Stratosphere-troposphere exchange, 26
- Stress
- kinematic stress, 76
  - surface stress, 76, 99
- Submersibles, 250
- Sub-mesoscale variability, 250
- Subpolar gyre, 291
- Subtropical gyre, 250
- Sulphate aerosols, 251, 262, 287
- Sulphate/sulfate, 7, 9, 12, 36, 177, 178, 182–184, 186, 189, 190, 196–200, 204, 205, 209
- Sulphur cycle, 4, 9, 11, 12
- Sulphur dioxide (SO<sub>2</sub>), 9–11, 269
- Sulphuric acid clusters, 254
- Summer paradox (or DMS summer paradox), 2, 5, 250, 284
- Sun synchronous orbit, 268
- Supersaturation, 118, 133, 139, 150
- Surface
- divergence, 57, 58, 60
  - renewal, 57, 59, 68, 74, 81
  - roughness, 59, 82, 87, 90, 92
  - steepness, 74
- Surface Ocean CO<sub>2</sub> Atlas (SOCAT), 279–280, 283, 289
- Surface ocean pCO<sub>2</sub>, 288
- Surface water (fCO<sub>2</sub>) (fugacity of CO<sub>2</sub>), 117–126, 129, 137, 156, 279, 280
- Surface Water and Ocean Topography (SWOT), 256
- Surfactants, 8, 34, 59, 65, 68–69, 82, 88, 90, 93
- soluble surfactants, 68
- Synechococcus*, 217, 218
- Synthetic aperture radar (SAR), 258, 265
- T**
- TCE. *See* Trichloroethylene (TCE)
- Technique
- disjunct eddy covariance (DEC), 82, 83
  - dual tracer technique, 68, 84–86, 94, 99
  - eddy-covariance (EC), 63, 81–83, 85–88, 92–94, 101
  - flow-measurement technique, 80
  - mass balance technique, 80, 84, 85, 88, 89, 101
  - micrometeorological technique, 62, 81–83, 85
  - radon deficit, 84
  - small-scale technique, 80–87
  - thermographic technique, 81, 85
- Ternary nucleation, 37
- Terrestrial, 174, 189, 191–193
- Tert-butyl alcohol, 29
- Thermal structure, 58
- Thermography, 85
- Tidal cycles, 24
- Tidal pumping, 135, 142
- TOPEX/Poseidon, 256
- Total Ozone Mapping Spectrometer (TOMS), 269
- Trace gas cycling, 1
- Trace gas exchange, 21
- Transfer resistance, 21, 77, 78
- Transfer velocity, 56, 57, 59, 62–65, 69–74, 76–81, 84, 87–92, 94, 97–99, 101, 257, 289
- Transport, 9, 14, 18, 26, 33–36, 172, 174–202, 209–211, 220, 223, 226
- Transport model, 180, 181, 191, 193
- eddy renewal model, 73
  - surface penetration model, 73, 81
  - surface renewal model, 73, 81
  - thin film model, 72
- Trichloroethylene (TCE), 14–16
- Trichodesmium, 37
- Tropical circulation, 256
- Troposphere, 13, 17, 21, 22, 26–28, 31, 34, 35, 38, 39, 116–119, 121, 129, 130, 134, 137, 139–143, 147–150, 153, 154, 156
- Tropospheric gases, 251
- Tropospheric ozone, 251, 254, 255
- Turbulence
- coherent turbulence, 60, 61
  - Kolmogoroff scale turbulence, 74
  - near-surface turbulence, 57, 58, 60, 67
  - shear induced turbulence, 60, 65, 92
  - surface water turbulence, 93
- Turbulent kinetic energy, 60, 65, 87
- Turbulent kinetic energy dissipation, 58
- Turbulent transport, 72
- Turnover, 3, 36



**U**

Ultrafine particles, 24, 25  
Upper ocean dynamics, 66  
Uptake, 2, 12, 15, 22, 23, 25, 30, 34–36, 178, 192, 196–199, 209, 211, 214, 216, 218  
Upwelling, 7, 17, 30, 32, 38  
UV radiation, 2, 3, 12, 30, 33, 38

**V**

Velocity parameterisation, 276  
Volcanic ash, 190, 191, 209, 226, 287–289  
Volcanic ash fertilisation, 288  
Voluntary Observing Ships (VOS), 289, 291  
VOS. *See* Voluntary Observing Ships (VOS)

**W**

Water insoluble organic carbon (WIOC), 176  
Water insoluble organic matter (WIOM), 177, 180, 181, 205  
Water soluble organic carbon (WSOC), 183  
Water soluble organic matter (WSOM), 177, 178, 180, 205  
Water temperature, 175, 176, 180  
Wave  
    capillary wave, 56, 60, 87  
    gravity wave, 59, 60, 71, 74–76, 90

    mean square slope, 90, 99, 101

    wave age, 66

    wind-generated surface wave, 77

    wind-generated wave, 65–66, 74

**Wave breaking**

    large wave breaking, 61

    microscale wave breaking, 56–60, 65, 81

Wave field, 59, 60, 65, 72, 94

Wave height, 255, 259

Wet deposition, 172, 188, 211

Whitecap, 56, 62–64, 88, 91, 95, 174, 225, 267

    whitecap coverage, 63, 64, 292

    whitecap fraction, 175, 225, 267

Wind speed, 175, 176, 180, 187, 188, 202, 204, 205, 225

Wind stress divergence, 260

Wind surface stress, 259

WIOC. *See* Water insoluble organic carbon (WIOC)

WIOM. *See* Water insoluble organic matter (WIOM)

WSOC. *See* Water soluble organic carbon (WSOC)

WSOM. *See* Water soluble organic matter (WSOM)

**Z**

Zooplankton, 190, 224