

Index

- advective–diffusive balance, 39, 248–250
- amplitude ratio, 119
- anisotropy of salt fingers, 241–243
- Antarctica, 185, 270–273
- applied flux, 189, 192–193
- Arctic Ocean, 165, 269–270

- baroclinicity, effects of, 127–130
- Beaufort Gyre, 185, 221
- biological productivity, 16, 264, 265
- Black Sea, 188, 273
- B*-merger, 153, 202, 209–210
- buoyancy Reynolds number, 238

- Caribbean
 - Sheets and Layers Transects (C-SALT), 173, 178, 180, 191, 193, 217–218, 221, 233, 243, 244–247, 261–262
 - staircase, 176, 246, 261
- Chen scale, 147, 151, 152
- collective instability, 11, 34, 36, 93–107
 - definition, 93
 - parametric model, 96–97
 - physical mechanism, 98–99
- core–mantle boundary (CMB), 293–294
- Cox number, 237
- crystallization, 289–292

- D'' layer, 293
- density ratio, 12
- differentiation, 289–290
- diffusive convection
 - instability conditions, 18
 - oscillatory, 7–8
 - physical mechanisms, 7–9
- diffusive density ratio, 13
- diffusive layering, 9, 19, 180–189
- diffusivity ratio, 12
- direct numerical simulations (DNS), 38, 44, 47–50, 103, 138–142, 199–202, 242, 278, 280, 285

- dissipation
 - kinetic energy, of, 234
 - ratio, 238
 - thermal variance, 236
- double-diffusion. *See* double-diffusive convection
- double-diffusive convection
 - biogeochemical applications, 263–266
 - general concept, 1
 - in astrophysics, 276–286
 - in chemistry, 295–299
 - in geology and geophysics, 286–295
 - in material science and engineering, 299–306
 - in porous media, 294–295
 - interaction with shear, 217–221
 - interaction with turbulence, 221–228
 - large-scale consequences, 248–273
 - microstructure signatures, 228–241

- efficiency factor, 235
- elevator modes, 18
- empirical models, 47
- energy production, 234

- fingering convection
 - instability conditions, 18
 - microstructure signatures, 228–241
 - parameterizations, 47
 - physical mechanism, 4
- flux ratio, 22–27
- flux Richardson number, 235
- flux-gradient laws, 33–34, 195
- four-thirds flux law, 60–62
- fractionation, 290
- freckle formation, 300–301

- γ -instability, 115–117, 195–201
- growth rate
 - balance, 43–45
 - collective instability, 97, 101–102
 - diffusive, 18

- fingering, 17
- intrusion, 111
- layer-merging, 205
- secondary instabilities, 43
- Hele-Shaw cell, 307
- high Prandtl number system, 287–289
- H*-merger, 153, 209–210
- Holyer modes, 35
- homogeneous convection, 49
- hydro-chemical systems, 296–298
- Ice-Tethered Profiler (ITP) program, 182
- igneous rocks, 287, 293
- interfaces
 - diffusive, 69–75, 138, 153, 185, 190
 - fingering, 62–69, 173, 176, 190
- interfacial flux laws. *See* four-thirds flux law
- interleaving. *See* intrusions, thermohaline
- intermittency coefficient, 222
- intrusions, thermohaline, 108–170
 - molecularly-driven, 28–30
 - observations, 155–170
 - physical mechanism, 112–115
 - scales, 117–120
- inverse model, 243–247
- isotropy assumption, 235, 237
- Jevons, Stanley, 5
- Jovian planets, 282
- Joyce interleaving model, 159–161
- Kelvin–Helmholtz instability, 101, 138, 140, 225
- kurtosis, 230
- laboratory experiments
 - crystallization, 290, 291
 - diffusive, 8, 70–72
 - fingering, 5, 27, 51–57, 62–67
 - in reactive systems, 296–299
 - interleaving, 114, 143, 146, 149–151, 153
- Lake Kivu, 186–188
- Lake Nyos, 186–188
- Laputa Project, 266–268
- laterally bounded fronts, 143–151
- layer-merging events, 142, 153, 170, 179, 185, 202, 204–210
- Ledoux criterion, 277
- magma chambers, 286–293
- meddy Sharon, 132, 157, 161, 163, 221, 239
- Mediterranean outflow, 173, 180, 229
- Meridional Overturning Circulation (MOC), 249, 251, 253, 254
- metastable equilibria, 189, 191–192
- microstructure measurements, 229–234, 239–241
- mini-staircases, 222
- mixing of nutrients, 16, 264–268
- mode waters, 263
- morphological instabilities, 299–300
- multiscale analysis, 94, 121–125
- non-convective zone (NCZ), 304, 305
- North Atlantic Tracer Release Experiment (NATRE), 240–241
- Nusselt number, 33, 61
- optical observations, 173, 217
- parametric models, 96–97, 102, 110, 115, 117, 120, 132, 135–137, 200
- Philippines Sea, 268
- planetary pollution, 284–285
- planform selection, 21, 65, 84–86
- Prandtl number, 12
- production–dissipation balance, 160, 236
- profiler approximation, 242–243
- Rayleigh–Bénard convection, 11
- Rayleigh number, 11, 62, 79
- Red Sea, 188
- Richardson number, 34
- rotation, effects of, 126–127
- Salt Finger Tracer Release Experiment (SFTRE), 173–176, 261
- salt fountain, 2, 266–268
- Sargasso Sea, 230, 233
- Schwarzschild criterion, 277
- sedimentation, 306
- seismic imaging, 161–164, 167, 180
- semiconvection
 - planetary, 281–283
 - stellar, 277–281
- shadowgraph, 57, 63, 91, 173, 217, 220, 228
- sidewall heating experiments, 151–155
- similarity interleaving solution, 120–121
- solar ponds, 299, 302–306
- solidification of metal alloys, 299–302
- spectral slope, 230, 233–234
- spiciness, 166, 258
- staircases, thermohaline
 - evolution, 204–210
 - observations, 172–189
 - origins, 189–204
- standard non-dimensionalization, 12
- Stern number, 34, 93
- Stern, Melvin, 4, 5, 6
- sub-interfaces, 221
- temperature variance equation, 160, 236–237
- thermal barrier, 271, 272
- thermal wind balance, 129
- thermocline theory, 248–251
- thermohaline Rayleigh number, 90

- T*–*S* relation, 255–261
- turbulence, effects of. *See* double-diffusive convection, interaction with turbulence
- turbulent kinetic energy (TKE) equation, 234–236
- Turner angle, 13–16
- two-layer system, 58–75
- Tyrrhenian Sea, 172, 178, 208, 262, 313
- unbounded model, 32–57
- upper bound theory, 83
- variational principles, 83
- vertically bounded model, 76–92
- weakly nonlinear models, 37–39, 85, 86
- Weddell Polynya, 271, 272
- Weddell Sea, 185, 186, 270, 271, 272