CONTENTS OF VOLUME 123


M. N. JUCKES—The mass flux across the tropopause: Quasigeostrophic theory 71

FRANÇOIS LOTT and MARTIN J. MILLER—A new subgrid-scale orographic drag parametrization: Its formulation and testing 101

S. B. VOSPER and S. D. MOBBS—Measurement of the pressure field on a mountain 129

M. KITCHEN—Towards improved radar estimates of surface precipitation-rate at long range 145

M. PINSKY and A. KHAI—Formation of inhomogeneity in drop concentration induced by the inertia of drops falling in a turbulent flow, and the influence of the inhomogeneity on the drop spectrum broadening. 165

I. DHARSSI, R. KERSHAW and W. K. TAO—Sensitivity of a simulated tropical squall line to longwave radiation 187

R. BOERS, J. B. JENSEN and P. B. KRUMMEL—A line of convection embedded in a strato-cumulus-topped boundary layer 207

S. GALMARINI, J. VILA-GUERAU DE ARELLANO and P. G. DUYNKERKE—Scaling the turbulent transport of chemical compounds in the surface layer under neutral and stratified conditions 223

D. M. O’BRIEN—A yardstick for global entropy flux 243

R. G. JONES, J. M. MURPHY, M. NOGUER and A. B. KEEN—Simulation of climate change over Europe using a nested regional-climate model. II: Comparison of driving and regional model responses to a doubling of carbon dioxide 265

A. SLINGO and M. J. WEBB—The spectral signature of global warming 293

M. K. SOMAN and JULIA SLINGO—Sensitivity of the Asian summer monsoon to aspects of sea-surface-temperature anomalies in the tropical Pacific Ocean 309

V. V. EMEROV, A. V. PRUSOV and M. V. SHOKUROV—Seasonal instability of Pacific sea-surface-temperature anomalies 337

SHUIYI S. CHEN and ROBERT A. HOUZE Jr—Diurnal variation and life-cycle of deep convective systems over the tropical Pacific warm pool 357

ARLENE G. LAING and J. MICHAEL FRITSCHE—The global population of mesoscale convective complexes 389

ROGER K. SMITH—On the theory of CISK 407

P. N. FRANCIS, J. P. TAYLOR, P. HIGNETT and A. SLINGO—On the question of enhanced absorption of solar radiation by clouds 419

MICHAEL T. MONTGOMERY and RANDALL J. KALLENBACH—A theory for vortex Rossby-waves and its application to spiral bands and intensity changes in hurricanes 435

HEINI WERNLI and Huw C. DAVIES—A Lagrangian-based analysis of extratropical cyclones. I: The method and some applications 467

A. STOFFELEN and D. ANDERSON—Ambiguity removal and assimilation of scatterometer data 491

Notes and Correspondence D. J. KAROLY, P. C. MCINTOSH, P. BERRISFORD, T. J. MCDougall and A. C. HIRST—Similarities of the Deacon cell in the Southern Ocean and Ferrel cells in the atmosphere 519
# Table of Contents

ROMUALDO ROMERO, CLEMENTE RAMIS and SERGIO ALONSO—Numerical simulation of an extreme rainfall event in Catalonia: Role of orography and evaporation from the sea  
N. R. EDWARDS and S. D. MOBBS—Observations of isolated wave–turbulence interactions in the stable atmospheric boundary layer  
N. R. EDWARDS and S. D. MOBBS—Modelling isolated wave–turbulence interactions in the stable atmospheric boundary layer  
GREGORY S. DUANE and JUDITH A. CURRY—Entropy of a convecting water–air system and the interpretation of cloud morphogenesis  
ANDREAS BOTT—A numerical model of the cloud-topped planetary boundary-layer: Impact of aerosol particles on the radiative forcing of stratiform clouds  
A. L. M. GRANT—An observational study of the evening transition boundary-layer  
C. GUEYMARD and H. D. KAMBEZIDS—Illuminance turbidity parameters and atmospheric extinction in the visible spectrum  
KLAUS DENGLER and MICHAEL J. REEGER—The effects of convection and baroclinicity on the motion of tropical-cyclone-like vortices  
R. BLENDER, K. FRAEDRICH and F. LUNKEIT—Identification of cyclone-track regimes in the North Atlantic  
MIHAILA CALAN and JEAN-FRANÇOIS GELEYN—Some limits to the variable-mesh solution and comparison with the nested-LAM solution  
M. E. MCCULLOCH and H. LEACH—Seasonal heat and freshwater budgets of the upper ocean in the north-east Atlantic  

MITCHELL W. MONCRIEFF and ERNST KLINKER—Organized convective systems in the tropical western Pacific as a process in general circulation models: A TOGA COARE case study  
ANDREAS DÖRNRACK—Broadening of convective cells  
G. M. MARTIN, D. W. JOHNSON, P. R. JONAS, D. P. ROGERS, I. M. BROOKS and R. W. BARLOW—Effects of airmass type on the interaction between warm stratocumulus and underlying cumulus clouds in the marine boundary-layer  
HANNU SAVIÄRVI, ANTTI AROLA and PETRI RAISÄNEN—Short-wave optical properties of precipitating water clouds  
HANNU SAVIÄRVI—Diurnal winds around Lake Tanganyika  
TERCIO AMBRIZZI and BRIAN J. HOSKINS—Stationary Rossby-wave propagation in a baroclinic atmosphere
## CONTENTS OF VOLUME 123

**DAVID P. STEVENS and VLADIMIR O. IVCHENKO**—The zonal momentum balance in an eddy-resolving general-circulation model of the Southern Ocean  
929

**A. M. MOORE and R. KLEEMAN**—The singular vectors of a coupled ocean–atmosphere model of ENSO. I: Thermodynamics, energetics and error growth  
953

**A. M. MOORE and R. KLEEMAN**—The singular vectors of a coupled ocean–atmosphere model of ENSO. II: Sensitivity studies and dynamical interpretation  
983

**R. BUZZA, R. GELARO, F. MOLIENI and T. N. PALMER**—The impact of increased resolution on predictability studies with singular vectors  
1007

**ZHAO-XIA PU, EUGENIA KALNAY, JOHN C. DERBER and JOSEPH G. SELA**—Using forecast sensitivity patterns to improve future forecast skill  
1035

**BRYAN C. WEARE**—Climatic variability of cloud radiative forcing  
1055

**ULRIKE LANGEMATZ and STEVEN PAWSON**—The Berlin troposphere–stratosphere–mesosphere GCM: Climatology and forcing mechanisms  
1075

**DAVID G. DRETSCHEL and MAARTEN H. P. AMBAUM**—A contour-advective semi-Lagrangian numerical algorithm for simulating fine-scale conservative dynamical fields  
1097

| R. KERSHAW and D. GREGORY—Parametrization of momentum transport by convection. I: Theory and cloud modelling results | PAGE 1133 |
| D. GREGORY, R. KERSHAW and P. M. INNESS—Parametrization of momentum transport by convection. II: Tests in single-column and general circulation models | 1153 |
| ALAN M. BLYTH and JOHN LATHAM—A multi-thermal model of cumulus glaciation via the Hallett–Mossop process | 1185 |
| G. M. MARTIN and P. R. JONAS—A simple-model study of the interaction between cumulus and stratocumulus clouds in the marine boundary layer | 1199 |
| LEON D. ROTSTAYN—A physically based scheme for the treatment of stratiform clouds and precipitation in large-scale models. I: Description and evaluation of the microphysical processes | 1227 |
| ZIAD S. HADDAD and DANIEL ROSENFELD—Optimality of empirical Z−R relations | 1283 |
| A. K. KAMRA, C. G. DESHPANDE and V. GOPALAKRISHNAN—Effect of relative humidity on the electrical conductivity of marine air | 1295 |
| KLAUS DENGLER—A numerical study of the effects of land proximity and changes in sea surface temperature on hurricane tracks | 1307 |
| L. FERRANTI, J. M. SLINGO, T. N. PALMER and B. J. HOSKINS—Relations between interannual and intraseasonal monsoon variability as diagnosed from AMIP integrations | 1323 |
| SHANG-PING Xie—Stability of equatorially symmetric and asymmetric climates under annual solar forcing | 1359 |
| B. D. COX, M. BITHELL and L. J. GRAY—Modelling of stratospheric intrusions within a mid-latitude synoptic-scale disturbance | 1377 |
| JOHN AUSTIN, NEAL BUTCHART and RICHARD SWINBANK—Sensitivity of ozone and temperature to vertical resolution in a GCM with coupled stratospheric chemistry | 1405 |

**Notes and Correspondence**

**D. CHAPMAN and K. A. BROWNING**—Radar observations of wind-shear splitting within evolving atmospheric Kelvin–Helmholtz billows  
1433
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROBERT A. TOMAS and PETER J. WEBSTER</td>
<td>The role of inertial instability in determining the location and strength of near-equatorial convection</td>
<td>1445</td>
</tr>
<tr>
<td>YONGKANG XUE</td>
<td>Biosphere feedback on regional climate in tropical north Africa</td>
<td>1483</td>
</tr>
<tr>
<td>M. B. PINSKY and A. P. KHAIN</td>
<td>Turbulence effects on the collision kernel. I: Formation of velocity deviations of drops falling within a turbulent three-dimensional flow</td>
<td>1517</td>
</tr>
<tr>
<td>A. P. KHAIN and M. B. PINSKY</td>
<td>Turbulence effects on the collision kernel. II: Increase of the swept volume of colliding drops</td>
<td>1543</td>
</tr>
<tr>
<td>J. C. PETCH, G. C. CRAIG and K. P. SHINE</td>
<td>A comparison of two bulk microphysical schemes and their effects on radiative transfer using a single-column model</td>
<td>1561</td>
</tr>
<tr>
<td>K. H. PAPADOPOULOS, C. G. HELMIS, A. T. SOLEMIES, J. KALOGIROS, P. G. PAPAGEORGAS and D. N. ASMADIOPOULOS</td>
<td>The structure of katabatic flows down a simple slope</td>
<td>1581</td>
</tr>
<tr>
<td>FRANÇOIS LOTI</td>
<td>The transient emission of propagating gravity waves by a stably stratified shear layer</td>
<td>1603</td>
</tr>
<tr>
<td>G. K. VALLIS, G. J. SHUTTS and M. E. B. GRAY</td>
<td>Balanced mesoscale motion and stratified turbulence forced by convection</td>
<td>1621</td>
</tr>
<tr>
<td>IAN A. RENFREW, ALAN J. THORPE and CRAIG H. BISHOP</td>
<td>The role of the environmental flow in the development of secondary frontal cyclones</td>
<td>1653</td>
</tr>
<tr>
<td>HEINI WERNLI</td>
<td>A Lagrangian-based analysis of extratropical cyclones. II: A detailed case study</td>
<td>1677</td>
</tr>
<tr>
<td>YVAN J. ORSOLINI, VARAVUT LIMASUVAN and CONWAY B. LEONY</td>
<td>The tropical stratopause in the UKMO stratospheric analyses: Evidence for a 2-day wave and inertial circulations</td>
<td>1707</td>
</tr>
<tr>
<td>DARREN W. WAUGH</td>
<td>Elliptical diagnostics of stratospheric polar vortices</td>
<td>1725</td>
</tr>
<tr>
<td>SHIAN-JIANN LIN</td>
<td>A finite-volume integration method for computing pressure gradient force in general vertical coordinates</td>
<td>1749</td>
</tr>
</tbody>
</table>

**Notes and Correspondence**

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>J. P. DODD and I. N. JAMES</td>
<td>The impact of latent-heat release on the Hadley circulation</td>
<td>1763</td>
</tr>
<tr>
<td>BJORN STEVENS, DAVID A. RANDALL, XIN LIN and MICHAEL T. MONTGOMERY</td>
<td>Comments on 'On large-scale circulations in convecting atmospheres' by Kerry A. Emanuel, J. David Neelin and Christopher S. Bretherton (July B, 1994, 120, 1111-1143)</td>
<td>1771</td>
</tr>
<tr>
<td>KERRY A. EMANUEL, J. DAVID NEELIN and CHRISTOPHER S. BRETHERTON</td>
<td>Reply to comments by Bjorn Stevens, David A. Randall, Xin Lin and Michael T. Montgomery on 'On large-scale circulations in convecting atmospheres' (July B, 1994, 120, 1111-1143)</td>
<td>1779</td>
</tr>
<tr>
<td>R. BROWN</td>
<td>Comment on 'A numerical model of the cloud-topped planetary boundary layer: Radiation, turbulence and spectral microphysics in marine stratus' by A. Bott, T. Trautmann and W. Zdunkowski (April A, 1996, 122, 635-667)</td>
<td>1783</td>
</tr>
<tr>
<td>ANDREAS BOTT, THOMAS TRAUTMANN and WILFORD ZDUNKOWSKI</td>
<td>Reply to a comment by R. Brown on 'A numerical model of the cloud-topped planetary boundary layer: Radiation, turbulence and spectral microphysics in marine stratus' (April A, 1996, 122, 635-667/777)</td>
<td>1785</td>
</tr>
<tr>
<td>YANGANG LIU and JOHN HALLETT</td>
<td>The '1/3' power law between effective radius and liquid-water content</td>
<td>1789</td>
</tr>
</tbody>
</table>
CONTENTS OF VOLUME 123

N. R. GIMSON—Pollution transport by convective clouds in a mesoscale model . 1805
J. E. STOUT and G. S. JANOWITZ—Particle trajectories above sinusoidal terrain . 1829
W. WENG, L. CHAN, P. A. TAYLOR and D. XU—Modelling stably stratified boundary-layer flow over low hills . 1841
RICHARD ESSEY—Modelling fluxes of momentum, sensible heat and latent heat over heterogeneous snow cover . 1867
J. S. WALLACE—Evaporation and radiation interception by neighbouring plants . 1885
J. M. HAYWOOD and K. P. SHINE—Multi-spectral calculations of the direct radiative forcing of tropospheric sulphate and soot aerosols using a column model . 1907
P. F. COLEY and P. R. JONAS—The contribution of cloud inhomogeneities and droplet concentration to the albedo of broken-cloud fields . 1931
THOMAS HAIDEN—An analytical study of cumulus onset . 1945
VASSILIKI KOTRONI, GEORGE KALLOS and CONSTANTINOS LAGOUVARDO—Convergence zones over the Greek peninsula and associated thunderstorm activity . 1961
X. LI, P. L. READ and D. G. ANDREWS—Mode selection, wave breaking and parametric sensitivity in the quasi-biennial oscillation . 2041
SANDRINE EDOUARD, ROBERT VAUTARD and GILBERT BRUNET—On the maintenance of potential vorticity in isentropic coordinates . 2069
Z. ZHU and E. K. SCHNEIDER—Improvement in stratosphere simulation with a hybrid σ-Θ coordinate GCM . 2095
JINGXI LU and WILLIAM W. HSIEH—Adjoint data assimilation in coupled atmosphere-ocean models: Determining model parameters in a simple equatorial model . 2115
FRED KUCHARSKY—On the concept of exergy and available potential energy . 2141
Notes and Correspondence
H. R. BIRKETT and A. J. THORPE—Superposing semi-geostrophic potential-vorticity anomalies . 2157

PAGE
J. E. HARRIES—Atmospheric radiation and atmospheric humidity . 2173
QINGQIU SHAO, DAVID A. RANDALL, CHIN-HOH MOENG and ROBERT E. DICKINSON—A method to determine the amounts of cloud-top radiative and evaporative cooling in a strato-cumulus-topped boundary layer . 2187
NIKOS HATZIANASTASSIOU, WOLFRAM WOBRICK and ANDREA I. FLOSSMANN—The role of droplet spectra for cloud radiative properties . 2215
# TABLE OF CONTENTS

U. AMATO, V. CUOMO, R. RIZZI and C. SERIO—Evaluating the effect of the inter-relationships among the different spectral bands on IASI performance .............................. 2231

PHILIP R. A. BROWN and HUGH A. SWANN—Evaluation of key microphysical parameters in three-dimensional cloud-model simulations using aircraft and multiparameter radar data 2245

CAROLIN RICHTER and MARTIN HAGEN—Drop-size distributions of raindrops by polarization radar and simultaneous measurements with disdrometer, windprofiler and PMS probes 2277

F. GUITCHARD, J.-P. LAFORÉ and J.-L. REDELSPERGER—Thermodynamical impact and internal structure of a tropical convective cloud system ......................................................... 2297

ALTAF M. ARAIN, W. JAMES SHUTTLEWORTH, Z.-LIANG YANG, JENÉ MICHAUD and JOHANNES DOLMAN—Mapping surface-cover parameters using aggregation rules and remotely sensed cover classes ................................................................. 2325

K. A. BROWNING, N. M. ROBERTS and A. J. ILLINGWORTH—Mesoscale analysis of the activation of a cold front during cyclogenesis ................................................................. 2349

A. J. THORPE—Attribution and its application to mesoscale structure associated with tropopause folds ................................................................. 2377

ZHUIN LI and LIREN JI—Efficient forcing and atmospheric teleconnections ......................................................... 2401

S. CORTI and T. N. PALMER—Sensitivity analysis of atmospheric low-frequency variability ......................................................... 2425

PHILIPPE COURTIER—Dual formulation of four-dimensional variational assimilation ......................................................... 2449

WEN-YIH SUN and KAO-SAN YEE—A general semi-Lagrangian advection scheme employing forward trajectories ......................................................... 2463

SHIAN-JIANN LIN and RICHARD B. ROOD—An explicit flux-form semi-Lagrangian shallow-water model on the sphere ......................................................... 2477