



World Survey of Climatology Volume 1A

General Climatology, 1A

edited by O. M. ESSENWANGER

*610 Mountain Gap Drive,
Huntsville, AL 35803 (U.S.A.)*

Heat Balance Climatology

by A. KESSLER

*Meteorological Institute,
University of Freiburg,
Freiburg (F.R.G.)*



ELSEVIER Amsterdam-London-New York-Tokyo 1985

Contents

FOREWORD	VII
ACKNOWLEDGEMENTS	VIII
<i>Chapter 1. INTRODUCTION</i>	1
Historical remarks	1
<i>Chapter 2. HEAT AND RADIATION BUDGET OF THE EARTH-ATMOSPHERE SYSTEM</i>	5
<i>Chapter 3. NET RADIATION ON THE EARTH'S SURFACE</i>	13
Global pattern of the net radiation (calculated values)	14
Latitudinal means, annual sums	14
Latitudinal means, monthly sums	17
Mean values of hemispheres and earth as a whole	18
Geographical distribution, maps	18
Net radiation on the earth's surface (measured values)	20
Diurnal variation of net radiation, hourly sums	23
The curve segment with $Q_{ss} = 0, R = Q_{ls}$	23
The curve segment with $Q_{ss} > 0$	41
Discussions of the isopleth charts	51
Annual variation of net radiation, daily sums of R	52
Annual variation of the net radiation	52
The variability of the mean daily sums	60
The influence of the cloud cover on the daily sums	64
Annual mean values of the net radiation	65
Annual mean values	65
Variability of annual values	70

Contents

The relationship between global radiation and net radiation	71
The radiation efficiency	71
Regression equations	74
Net radiation of various surfaces and within plant stands	75
Net radiation of various types of surfaces	75
Net radiation of various surface types as compared to grass	76
Net radiation within plant stands	78
Net radiation on the earth's surface as related to altitude.	83

Chapter 4. LATENT HEAT FLUX ON THE EARTH'S SURFACE, EVAPORATION AND CONDENSATION 87

Global pattern of the latent heat flux or of water vapour flux	91
Latitudinal means, annual sums	91
Latitudinal means, monthly sums	96
Mean values of hemispheres and earth as a whole	98
Geographical distribution, maps	100
Diurnal variation of latent heat flux or of water vapour flux	103
Annual variation of latent heat flux or of water vapour flux	111
The annual variation over the continents	111
The annual variation over the oceans	118
Monthly values of dew formation	121
Variability of latent heat flux or of water vapour flux	125
Variability of evaporation of large bodies of water	125
Variability of the evaporation from the natural, solid earth's surface and of the potential evaporation	130
Latent heat flux or water vapour flux over various types of surfaces and within plant stands	131
Latent heat flux or water vapour flux on the earth's surface as related to altitude	136

Chapter 5. SENSIBLE HEAT FLUX ON THE EARTH'S SURFACE 139

Global pattern of the sensible heat flux (calculated values)	140
Latitudinal means, annual sums	140
Latitudinal means, monthly sums	140
Geographical distribution, maps	142
Diurnal variation of sensible heat flux	147
Annual variation of sensible heat flux	158
Variability of sensible heat flux	160
Sensible heat flux over various types of surfaces and within plant stands	162
Sensible heat flux on the earth's surface as related to altitude	167

<i>Chapter 6. HEAT FLUX INTO THE GROUND</i>	169
Global pattern of the heat flux into the ground (calculated values)	171
Annual sums: latitudinal means and geographical distribution	171
Monthly sums: latitudinal means and geographical distribution	173
Diurnal variation of heat flux into the ground	179
Annual variation of heat flux into the ground	181
Variability of heat flux into the ground	182
Heat flux into the ground for various ground types, heat flux into the biomass above ground and heat consumption by ablation	185
 REFERENCES	 191
 APPENDICES	 209
 REFERENCE INDEX	 213
 GEOGRAPHICAL INDEX	 219
 SUBJECT INDEX	 223