

Arnt Eliassen and Kaare Pedersen

METEOR OLOGY

an Introductory Course

Volume II
Application to
Weather and
Weather Systems



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Application to Weather and
Weather Systems

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Contents

- Chapter 6. Meteorological instruments and observations.
Synoptic charts 9
- Chapter 7. Weather phenomena caused by the influence of the earth's
surface 37
- Chapter 8. Wind systems caused by surface effects.
Local winds. Monsoon 69
- Chapter 9. The middle latitude westerlies and the long planetary waves 81
- Chapter 10. Fronts, cyclones, anticyclones 99
- Chapter 11. Clouds and weather in cyclones and anticyclones 113
- Chapter 12. Tropical meteorology 127
- Chapter 13. The mean atmospheric flow pattern 135
- Chapter 14. Climate 145

Chapter 6

Chapter 6. Meteorological instruments and observations. Synoptic charts

- 6.1 Measurement of atmospheric pressure 11
- 6.2 Measurement of temperature 14
- 6.3 Measurement of atmospheric humidity 18
- 6.4 Observation and measurement of wind 20
- 6.5 Observation and measurement of precipitation 25
- 6.6 Cloud observations 27
- 6.7 Visibility 30
- 6.8 Synoptic charts 30

6.1 Measurement of atmospheric pressure

There are two types of barometers — mercury barometers and aneroid barometers. The very first barometer, constructed by Torricelli 1643, was a mercury barometer. The principle of this instrument is illustrated in Fig. 6.1.1. The space in the glass tube above the upper mercury surface is a vacuum (except for the mercury vapor).

Mercury is the fluid that is used, almost exclusively, in barometers of this type for the following reasons: large density, very low vapor pressure, the meniscus is convex upwards, and it is easily cleaned and purified. The height difference h

Chapter 7. Weather phenomena caused by the influence of the earth's surface

- 7.1 Energy budget of the earth's surface 38
- 7.2 Diurnal and annual variations of air temperature 42
- 7.3 Clouds in unstable air: convective clouds 43
- 7.4 Electricity in the atmosphere 55
- 7.5 Clouds in stable air: Fog and stratus 58
- 7.6 Wave clouds 62
- 7.7 Air masses 63

Chapter 8. Wind systems caused by surface effects.

Local winds. Monsoon

- 8.1 Land and sea breeze 70
- 8.2 Mountain and valley winds 71
- 8.3 Drainage wind, glacier wind 72
- 8.4 Fall wind 72
- 8.5 Foehn 73
- 8.6 Thermal cyclones and anticyclones 74
- 8.7 Monsoon 76

Chapter 9. The middle latitude westerlies and the long planetary waves

- 9.1 The large scale temperature field 82
- 9.2 The middle latitude westerlies. Jet-streams 84
- 9.3 Waves in the upper westerlies 86
- 9.4 The long waves in the upper westerlies.
Cold cyclones, warm anticyclones 87
- 9.5 Causes of the long waves: forced and free waves 88
- 9.6 Short waves in the upper westerlies 95
- 9.7 The zonal index and index cycles 95

Chapter 10. Fronts, cyclones, anticyclones

- 10.1 Fronts in the atmosphere 100
 10.2 Frontogenesis. Mean position of main fronts 103
 10.3 Frontal cyclones 105
 10.4 Cyclone families and tracks 111
 10.5 Anticyclones associated with frontal cyclones 112

A temperature sounding along the vertical AB in Fig. 10.1.1 will cut through the frontal layer, and this layer will be distinguished on the temperature-sounding curve by its high static stability (a temperature inversion or at least a reduced lapse rate) as shown in Fig. 10.1.2.

If the earth were not rotating, a front could not be in equilibrium in a sloping position; the colder, heavier air would then tend to undercut the warmer air until the frontal transition layer became horizontal. Because of the rotation of the earth, however, fronts are kept in a sloping position by differential Coriolis forces (F_1 and F_2) on the two sides, as shown in Fig. 10.1.3. This requires that the wind velocities V_1 and V_2 in the direction along the front are different on the two sides, so that the two air masses slide relative to each other. It is not necessary that the velocities along the front have opposite directions on both sides, as indicated on Fig. 10.1.3; it is the velocity difference which counts. This velocity difference, or shear, may be a horizontal shear between two air masses, or it may correspond to a rotation in the same sense as the earth's rotation. The possible arrangements of along-front velocities on the two hemispheres are shown in Fig. 10.1.4. Note that the cyclonic sense of rotation is opposite in the two hemispheres.

Chapter 11. Clouds and weather in cyclones and anticyclones

- 11.1 The large-scale motions and weather 114
- 11.2 Clouds, precipitation and weather in polar front cyclones 115
- 11.3 Clouds, precipitation and weather in cold cyclones 121
- 11.4 Weather characteristics of warm anticyclones 121
- 11.5 Cold thermal anticyclones 122
- 11.6 Migrating frontal anticyclones or ridges 122
- 11.7 Weather in relation to the long waves in the upper westerlies 122

Chapter 12. Tropical meteorology

- 12.1 General characteristics of the tropical atmosphere 128
- 12.2 The mean motion field 129
- 12.3 Tropical disturbances 130
- 12.4 Tropical waves 130
- 12.5 Convective systems 130
- 12.6 Tropical cyclones 132

Chapter 13. The mean atmospheric flow pattern

- 13.1 The hydrologic cycle and the water balance of the atmosphere 136
- 13.2 Energy considerations 137
- 13.3 The mean flow pattern at the surface. Meridional cells 137
- 13.4 The mean wind field in the mid-troposphere 139
- 13.5 The mean wind field close to the jet core levels 141

Chapter 14. Climate

- 14.1 Definition 146
- 14.2 Köppen's climate classification 147
- 14.3 Climatic controls 153
- 14.4 Indicators of climate. Climate variations 155
- 14.5 Possible causes of climate variations 157
- 14.6 Man's impact on climate 159