

VOL. I
No. 1

**METEOROLOGICAL
MONOGRAPHS**

PUBLISHED BY THE AMERICAN METEOROLOGICAL SOCIETY

**Wartime
Developments
in Applied
Climatology**

W. C. JACOBS

AUGUST 1947

METEOROLOGICAL MONOGRAPHS

Volume I

AUGUST 1947

Number 1

WARTIME DEVELOPMENTS IN APPLIED CLIMATOLOGY

CONTENTS

	PAGE
Foreword.....	iii
Introduction.....	1
Types of weather problems in staff planning.....	3
Climatological techniques for military problems with reference to civilian application.....	4
Climatology for forecasters.....	33
The accumulating, processing, and filing of basic climatological data.....	35
Bases for a "synoptic" or "synchronous" climatology.....	38
Problems associated with the presentation of climatic information.....	44
Conclusions.....	52
References.....	52

PUBLISHED BY THE AMERICAN METEOROLOGICAL SOCIETY
5 JOY ST., BOSTON 8, MASS.

Copy Price \$1.00

FOREWORD

WAR is a practical business. It demands practical answers to practical questions. In time of war a scientist or technologist may be deprived of his peacetime heritage of scholarship for scholarship's sake. Accordingly, it has been stated that during the recent war expediency retarded important fundamental research. Perhaps this is true; but certainly in all technical fields, and particularly in meteorology, much was achieved in the realm of applied science. Those achievements so recently directed to the problem of making war can now be redirected toward highly important uses in a peacetime world.

Throughout the war, I was associated with the AAF Weather Service, which was charged with the mission of providing weather intelligence for all branches of the United States Army. Thus I had the opportunity to observe the immense strides that were made in the preparation and utilization of weather information. The weather intelligence that was put to immediate practical use fell into two categories: weather forecasts for operations, and special weather studies for strategic and planning purposes. This paper by Dr. Woodrow C. Jacobs deals only with the latter. The special weather study evolved under pressure of necessity as a standard factor in all military plans. Its development was gradual and, at first, even uncertain. We were asked to provide answers relating to a diversity of undertakings—undertakings as complex as a complete amphibious operation or as relatively simple as the design of a microscope for use at a remote point on the globe. Frequently the questions concerned areas on which little or no weather data were available; sometimes they involved the solution to theoretical problems that even today are challenging science. Always an answer, the best possible, was required. Invariably some degree of improvisation was necessary. Each of the many hundred special studies that we made was a problem in itself, some phase of which demanded unique methods of solution.

I can think of no one who is better qualified to present a comprehensive picture of the advances made in applied meteorology as a planning aid than Dr. Woodrow C. Jacobs. As head of the Special Studies Research Group within the AAF Weather Service, Dr. Jacobs directed, and in many instances personally participated in, the preparation of weather studies used by our armed forces throughout the world. Close cooperation and coordination with allied meteorologists and studies of intelligence on our enemy meteorological achievements convince me that the weather study as a practical tool was as highly developed and as widely used by our armed forces as by the armed forces of any of the warring nations. Therefore there is no doubt in my mind that Dr. Jacobs is indeed qualified to present the paper that follows. As to its merit, I am certain it speaks for itself.

DONALD N. YATES

Brig. General, U.S.A.

Chief, Air Weather Service

Wartime developments

IN APPLIED CLIMATOLOGY

By Woodrow C. Jacobs*

Hq. Air Weather Service, Washington, D. C.

INTRODUCTION

WORLD WAR II was the greatest "battle of wits" of all time. To an extent never before approached, it was a war of technician versus technician. Particularly is this true of the technical use of weather. Weather has always been a potent weapon in warfare. History tells us that battles and sometimes even wars have been lost because weather aligned itself with the enemy. In this war, the intelligent exploitation of some single weather factor often supplied the slight technical advantage which meant the difference between success or failure of an operation or campaign. But the attainment of that technical advantage meant continuous and detailed long-range planning which in turn meant that it was impossible for the military planner to wait for a short-range forecast before incorporating the important weather factor into his plans. Weather planning on an equally long-range basis was the only answer and, to the meteorologist,

that meant climatology. But not the climatology he knew in 1941.

During the war the demands made on the Army Air Forces Weather Service for climatological information to be used in strategic and tactical planning were exceedingly heavy and the requirements exacting. Although they were of almost endless variety, the final need in all cases was the same—the effect of weather on the military operation or activity. *In no case was there any real requirement for pure climatological information as such.*

The solutions of the more difficult problems demanded very close coordination between the meteorologist-climatologist and the military planner or designer. Sometimes the climatological approach to a particular problem was entirely theoretical, sometimes it was completely empirical; most frequently elements of both approaches were involved. However, in all cases, a thorough knowledge of the military requirements and specifications was required.

* Now at the U. S. Weather Bureau.

During the early part of the war there was a tendency for some of the operating units to make requests simply for forecasts, climatological data, or general climatological studies. Follow-ups by the AAF Weather Service indicated that in a large percentage of cases the information supplied to various agencies was grossly misused. Specifications for fuels, lubricants, clothing, etc., were outlined on the basis of mean temperature data from scattered stations within large areas; airfield runways were oriented as directed by wind data scaled from locally fictitious mean pressure charts which were originally prepared to present the general features of the atmospheric circulation at the gradient level over a continent or hemisphere; flyabilities of air routes were determined on the basis of general climatic surveys which often depicted only regional variations in temperature and rainfall. In other cases, the problem was posed specifically enough, but absurd limitations were placed upon the meteorologist with respect to the form or manner in which the solution was to be presented.

Although it was universally agreed that weather played a vital part in military operations, there was an exasperating tendency for the various branches of the armed forces to take a simplified view of the ease with which weather information could be incorporated into military plans. It is the writer's belief that the military planner was not primarily responsible for this attitude. Climatologists for over half a century had devoted their main efforts to producing simplified versions of the results of inherently complex weather phenomena. It was an age of climatology, an age of climatic classifications based on regional variations in the mean values of one or two climatic elements. Since the climatologist had led the way toward this simplified descriptive concept, it was only natural that the layman should follow.

But wartime requirements made it plain that climatology is not an easy subject. Its use embodies all of the complexities of meteorology and in addition, the added complexities of the applica-

tion. If climatology is regarded as the historical aspect of meteorology, or simply as the study of the normal state of the atmosphere, the necessity for considering the individual atmospheric processes in all their complexity is not removed. If, on the other hand, climatology is regarded as a study of weather and its effects on man and his environment, an entirely new system of complex variables must be added.

As a result of the "weather naïveté" of the military planner, the AAF Weather Service was placed in the difficult position of educating the military to the possibilities of the use of specific weather information and, simultaneously, of developing the techniques necessary for handling the new problems. The latter was necessary because it soon became apparent that the older, "classical" methods in climatology, consisting of the simple presentation of climatic averages or of the independent frequencies of occurrence of various weather elements, were hopelessly inadequate for the exacting military needs. The development of an entirely new field, "applied climatology" or "meteorological engineering," was required.

Each climatic investigation was, of necessity, tailored to meet the specific requirements of the problem of the moment. In spite of the 1,500 or more formal climatic reports and results of investigations published by the Weather Central Division in Washington by the end of the war, it was even then seldom possible to refer to the files and find a complete report or reports which would conform to the specifications of a new problem. The writer sets forth this experience as the best possible argument against assuming in the future that it is possible to prepare, in advance, climatic investigations according to some formal plan and expect them to come up to even a small fraction of the requirements of application. It would seem just as unreasonable to ask the professional meteorologist or climatologist to do this as it would be to expect members of other professions—engineers, lawyers, or doctors, for example—to serve the public through