[Reprinted from BULLETIN OF THE AMERICAN METEOROLOGICAL SOCIETY,
Vol. 28, No. 9, November, 1947, pp. 399–404.]
Printed in U. S. A.

Notes on the Origin and Structure of Philippine Typhoons

REV. CHARLES E. DEPPERMANN, S.J.

Manila Observatory *

ABSTRACT

References to previous papers by the author show that his ideas on typhoon origin and structure contain the following main elements:

(*a*) Strong surface convergence of two or more humid air streams.
(*b*) Strong upward convection in a rather narrow ring near typhoon center, giving a warm inner core, and conditions favoring a modified Rankine vortex.
(*c*) The formation of an upper front, roughly funnel-shaped.
(*d*) Possible divergence aloft, especially a fast upper current to dispose of the rising core air and partially at least controlling the pressure gradient and size of the convection ring.

These ideas are subjected to approximate mathematical treatment, giving satisfactory magnitudes for pressure gradients and proper shape of pressure curve.

A short discussion is given of what are considered the most essential elements determining typhoon origin and structure.

INTRODUCTION AND RESUMÉ OF PREVIOUS IDEAS OF THE AUTHOR

THE ELEMENTS in typhoon formation as conceived by the author in his previous monographs, can be briefly summarized as follows:—(Reference data at end of article)

(1) Surface convergence, at a considerable angle, of two or more air streams over a considerable area, with preexisting tendency towards counterclockwise motion. *Cf.* References 1b, 2b, 3b, 4a, 5b, 6a, to monographs of the author, at end of this paper.

(2) Strong upward convection of abundant moist air, in a rather narrow ring near the typhoon center, giving a warm inner core and conditions favoring the formation of a Rankine vortex. *Cf.* References 1a, 1b, 1c, 3a, 4a, 5b, 5d, 5e, 5g, 7a, 7b, 8a.

(3) The formation of an upper front, roughly funnel-shaped, with warm rising air inside and cooler air outside. *Cf.* References 2a, 2b, 4a, 5a, 5f, 5h, 5i, 6b, 7b.

(4) Possible divergence aloft, especially arising from a fast upper current disposing of the rising air of the core and partially at least controlling the pressure gradient and size of the convection ring. *Cf.* References 1c, 4a, 4d, 5c, and 7a.

MATHEMATICAL DEVELOPMENT

An attempt will now be made to subject these ideas to more exact mathematical treatment.

(*1*) *Upward Convection Ring and Rankine Vortex.*—If R denote the outer radius of the violent upward convection ring at the 1.5-km level, r its inner radius, V_z the vertical velocity, d' the density, then the mass of air pouring upward per hour through the ring at 1.5 km altitude will be $\pi(R^2 - r^2) \cdot V_z \cdot d'$. It is assumed that this rising column is formed

* Present address, c/o St. Louis University, St. Louis, Mo.