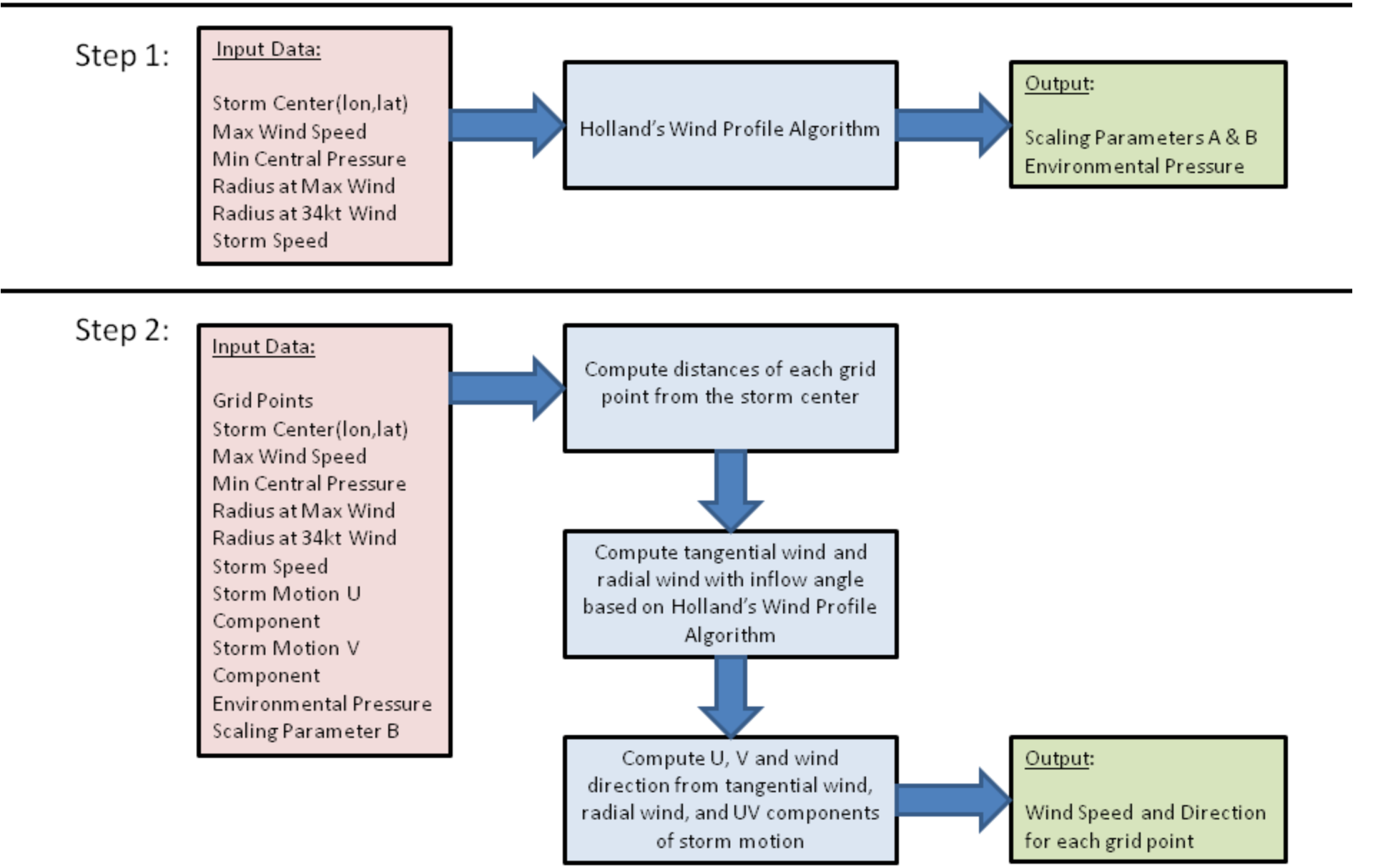
A parametric hurricane wind model for intensity, size, and speed specification

By Pat Fitzpatrick and Yee Lau
Geosystems Research Institute
Mississippi State University

Parametric hurricane wind model flow chart



“Fitz” Holland B

The hurricane winds are based on a variant of the *Holland* (1980) wind profile:

$$p(r, B, p_{env}, p_c, R_{\max}) = p_c + [p_{env} - p_c]e^{-Ar^{-B}}$$

$$V(r, B, f, p_{env}, p_c, R_{\max}) = \left[\frac{AB[p_{env} - p_c]e^{-Ar^{-B}}}{\rho r^B} + \left[\frac{rf}{2}\right]^2\right]^{0.5} - \left[\frac{rf}{2}\right]$$

$$V_{max}(B, p_{env}, p_c) = \left[\frac{B}{\rho e}\right]^{0.5}[p_{env} - p_c]^{0.5} \; ; \; A(R_{\max}, B) = R_{max}^B$$

where f is the Coriolis parameter, p_c is the storm central pressure, p_{env} is the environmental pressure (set to 1013 mb), and e is Euler’s number (the base of the natural logarithm, approximately 2.71828). A and B are scaling parameters which control the radial wind profile. This formulation includes storm motion in V. Given storm motion, V_{max}, R_{max}, p_{env}, and R34, the algorithm iterates for B and then calculates p_c.

Because these equations apply above the boundary layer, but V_{max} and V34 (34-kt winds at R34) are at 10-m height within the boundary layer, V_{max} and V34 are multiplied by 1.11 before the B iteration. On average, winds are 11% faster above the boundary layer (see http://www.nhc.noaa.gov/aboutwindprofile.shtml, and Powell and Black (1990)). However, little sensitivity in the B distribution was seen with this adjustment.