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

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**Parametric hurricane wind model flow chart**

**Step 1:**
- **Input Data:**
  - Storm Center (lon, lat)
  - Max Wind Speed
  - Min Central Pressure
  - Radius at Max Wind
  - Radius at 34kt Wind
  - Storm Speed

- **Holland’s Wind Profile Algorithm**

- **Output:**
  - Scaling Parameters A & B
  - Environmental Pressure

**Step 2:**
- **Input Data:**
  - Grid Points
  - Storm Center (lon, lat)
  - Max Wind Speed
  - Min Central Pressure
  - Radius at Max Wind
  - Radius at 34kt Wind
  - Storm Speed
  - Storm Motion U Component
  - Storm Motion V Component
  - Environmental Pressure
  - Scaling Parameter B

- **Compute distances of each grid point from the storm center**

- **Compute tangential wind and radial wind with inflow angle based on Holland’s Wind Profile Algorithm**

- **Compute U, V and wind direction from tangential wind, radial wind, and UV components of storm motion**

- **Output:**
  - Wind Speed and Direction for each grid point
“Fitz” Holland B

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

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

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

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

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.