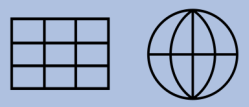
Inputs

Primary Field

Gridded data set (ϕ_p) where feature of interest is visible (eg. IVT for ARs)

Grid Properties

- Grid distance, area, & volume
- Coastlines



Feature Properties

Parameters and values constraining shape, scale, location, etc.

Segmentation

Smoothing

Space-Scale Selection

Removes variability for spatial scales much less than feature scale (L)

$$\phi_s = \phi_p(x, y, \dots) \times \frac{1}{2\pi\sigma} e^{-(x^2+y^2+\cdots)/2\sigma}$$

$$\sigma = f(grid, L)$$

Shape Extraction

Local shape determined by SI at each point:

$$SI = \frac{2}{\pi}\tan^{-1}\left[\frac{k_2 + k_1}{k_2 - k_1}\right]$$

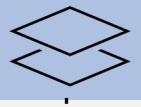
where k_1 and k_2 are eigenvalues for Hessian of smoothed field (ϕ_s)

Filtering

Secondary Field

(optional input)

Second gridded data set used to further constrain and filter objects (eg. Precip for ARs)



Feature Property Calculation

Area, Length, Statistics of Intensity (mean, max, min) calculated for each object

Filtering

Extracted objects are filtered to remove small or weak objects

Tracking

Object Tracking

Point of interest (eg centroid, point of maximum intensity, leading edge, etc.) tracked through time. Closest object within pre-defined radius (r) in subsequent time step ($t = n + 1$) considered as same object in motion. Object's tracking ends when no objects detected within r at $t = n + 1$

Further Filtering

Ephemeral objects with tracks lasting shorter than the minimum duration are further filtered

Outputs

Output 1*

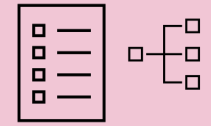
Object Mask

Labeled mask of detected objects returned on same grid as the input grid

Output 2*

Object Properties

Numbered list of objects corresponding to labeled mask, and the properties and statistics associated with each object



**NetCDF Output Files*