MATHEMATICAL MORPHOLOGY: SKIZ and WSKIZ

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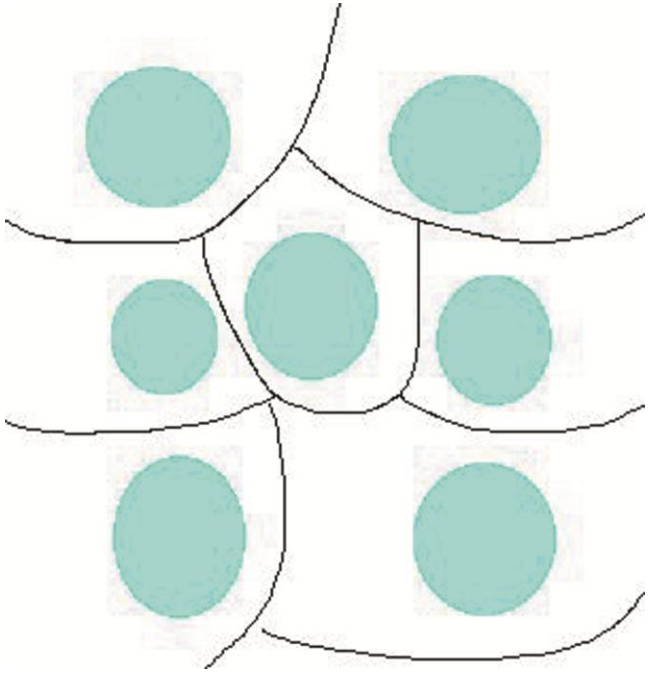
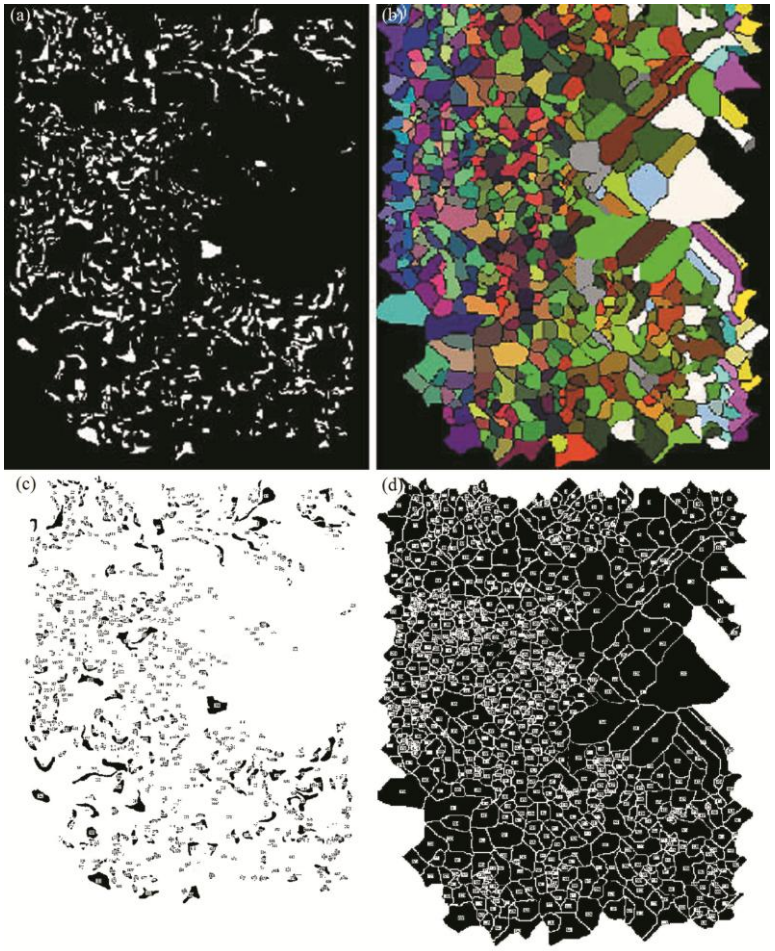
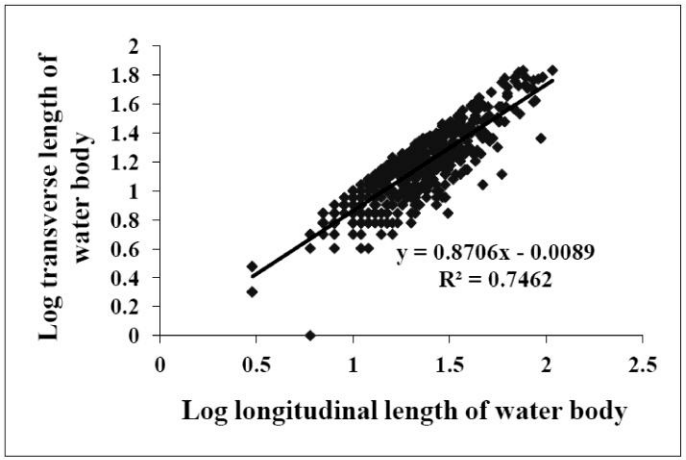
V. Spatiotemporal Visualization

To visualize point-data into polygonal data

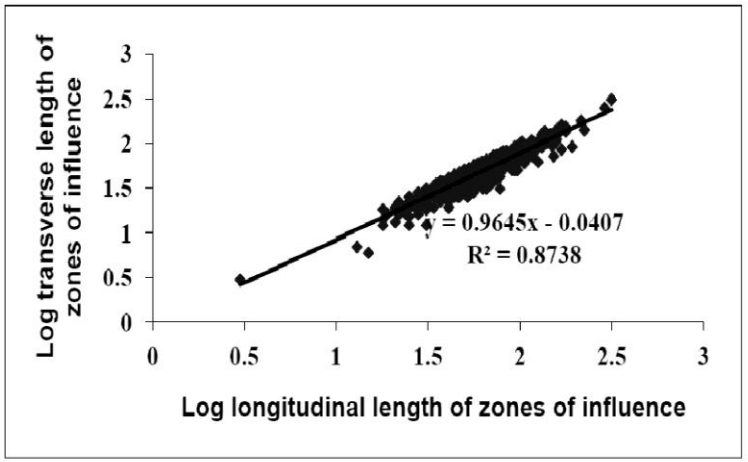
Weighted Skeletonization by Influence Zones (WSKIZ)



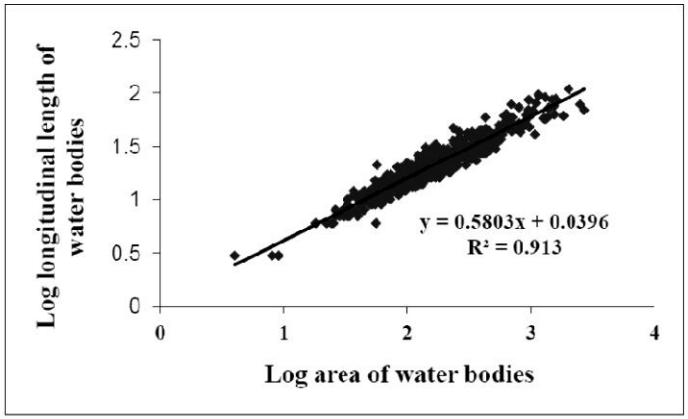

(a)
(b)
(c)
(d)


Log transverse length of water body
Log longitudinal length of water body
y = 0.8706x - 0.0089
R² = 0.7462

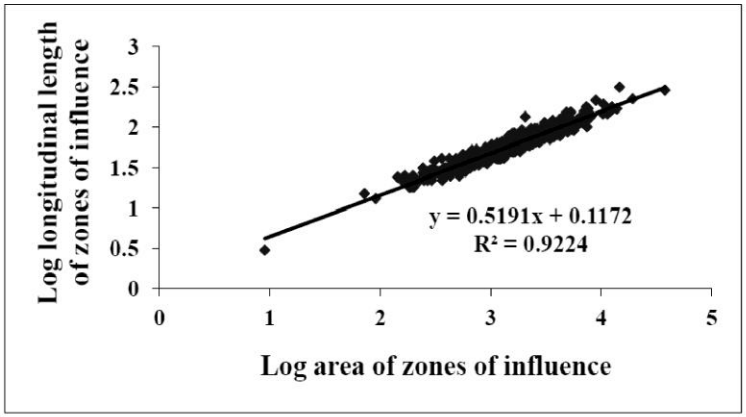
(a)


Log transverse length of zones of influence
Log longitudinal length of zones of influence
y = 0.9645x - 0.0407
R² = 0.8738

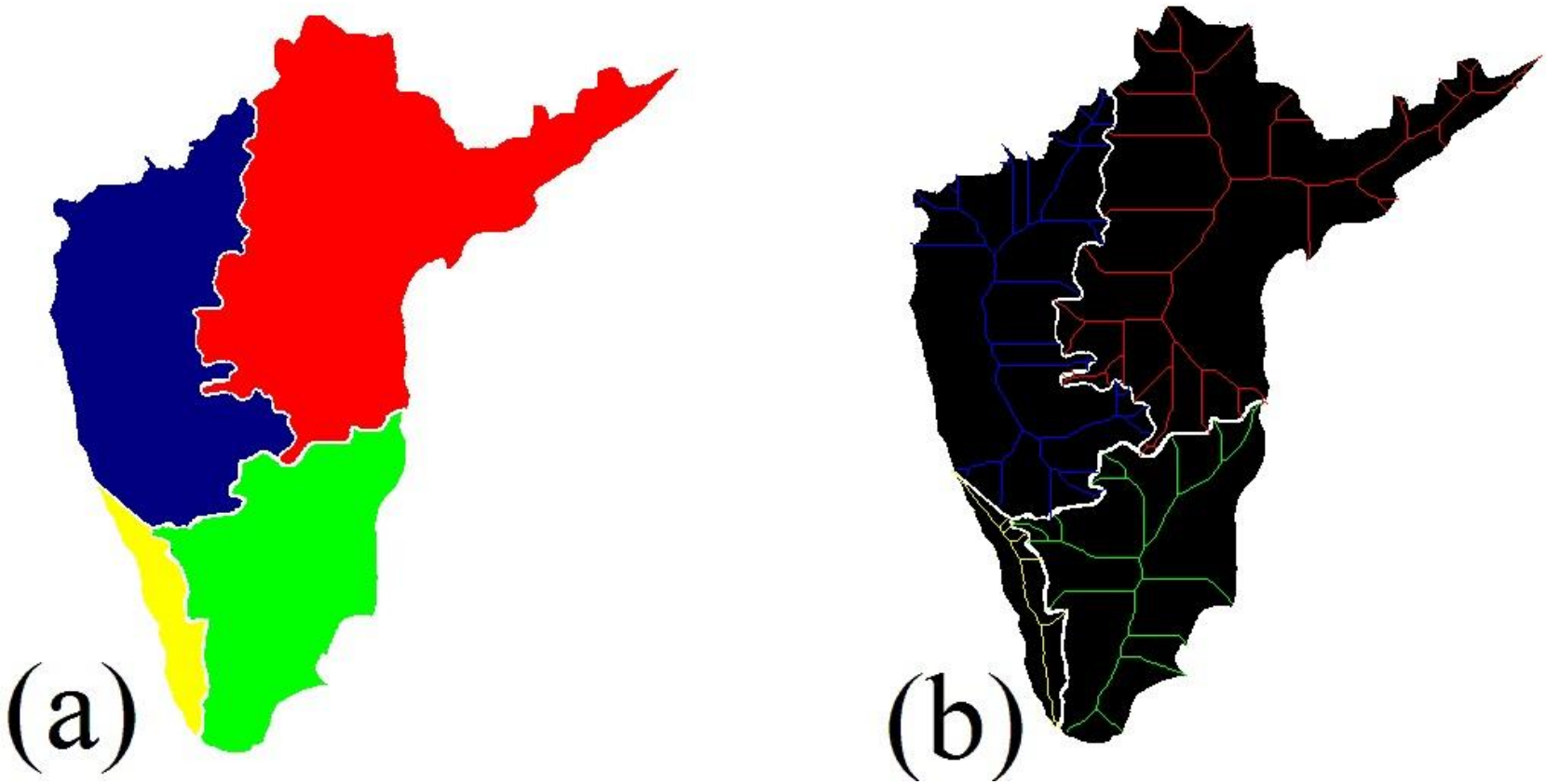
(b)

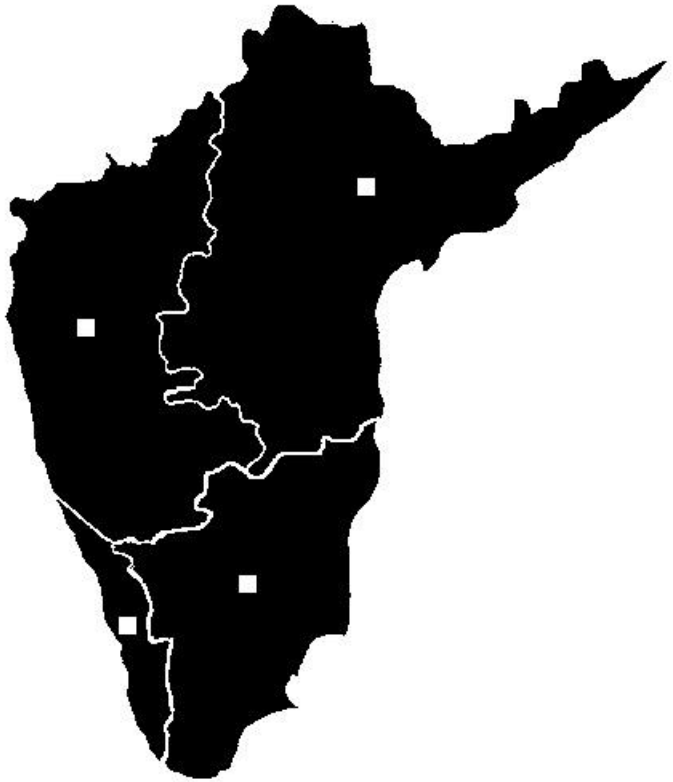

Log longitudinal length of water bodies
Log area of water bodies
y = 0.5803x + 0.0396
R² = 0.913

(c)


Log longitudinal length of zones of influence
Log area of zones of influence
y = 0.5191x + 0.1172
R² = 0.9224

(d)


(a)
(b)



Point-to-Polygon Conversion

(a) (b)

Fig. 2. (a) region considered is south India, and (b) gauge-station locations (A_1, A_2, A_3, A_4).

(a) (b) (c) (d)

Fig. 3. The variable strengths (in terms of propagation speeds are given as (a) $A_2 > A_4 > A_1 > A_3$, (b) $A_2 > A_1 > A_3 > A_4$, (c) $A_1 > A_3 > A_2 > A_4$, and (d) $A_1 > A_4 > A_2 > A_3$.

$$Z(A_i) = \bigcup_{n} \left(\delta^{n}_{\lambda_i}(A_i) \cap A \right) \setminus \bigcup_{\forall j} \left(\delta^{n}_{\lambda_{j \neq i}}(A_j) \cap A \right)$$

$$Z(A) = \left(\bigcup_{i} \left(Z(A_i) \right) \right)^{C}$$

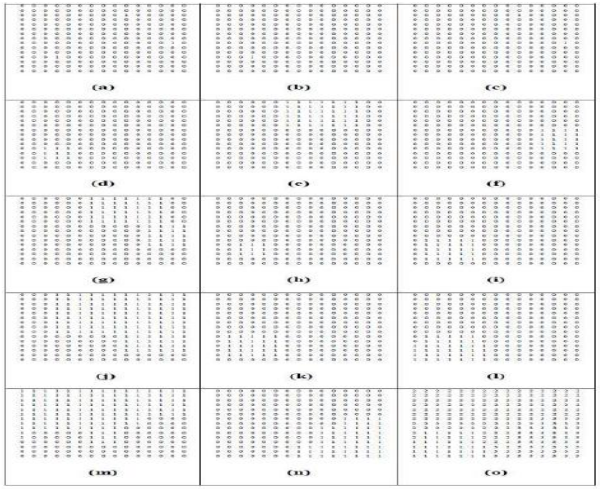


Fig. S1. (a) original map with three points (shown with 1s) for (A_1), (A_2), and (A_3), (b) i^{th} point $(A_i) = (A_1)$, (c) union of j^{th} points, $\bigcup_{\forall j} A_j = (A_2) \bigcup (A_3)$, (d) first cycle of dilation of i^{th} point by B (Square in shape) with the propagation speed of $\lambda = 1$, denoted by $\delta^{\square}(A_1)$, (e) first cycle of dilation of j^{th} point (A_2) by B with the propagation speed of $\lambda = 3$, $\delta^{\square}(A_2)$, (f) first cycle of dilation of i^{th} point (A_3) by B with the propagation speed of $\lambda = 2$, $\delta^{\square}(A_3)$, (g) union of $\delta^{\square}(A_1)$ and $\delta^{\square}(A_2)$, (h) $\delta^{\square\square}(A_1) \setminus \delta^{\square\square}(A_2) \bigcup \delta^{\square\square}(A_2)$, (i) $\delta^{\square\square}(A_3)$ (j) similarly for next iteration: $\delta^{\square\square}(A_1) \bigcup \delta^{\square\square}(A_2)$, (k) $\delta^{\square\square}(A_3) \setminus \delta^{\square\square}(A_1) \bigcup \delta^{\square\square}(A_2)$, (l) $Z(A_1) = \bigcup \left[\delta^{\lambda=1}(A_1) \setminus \delta^{\lambda=1}(A_2) \bigcup \delta^{\lambda=1}(A_3) \right]$, (m) similarly follow the steps from (b-l) by changing the i^{th} point from (A_1) to (A_2), and by treating (A_1) and (A_3) as i^{th} points; the $Z(A_2)$ is obtained, (n) obtained $Z(A_3)$, and (o) three zones $Z(A_1)$, $Z(A_2)$, and $Z(A_3)$ are shown with 1s, 2s, and 3s.

Point-to-Polygon Conversion

http://www.isibang.ac.in/~bsdsagar/AnimationOfPointPolygonConversion.wmv

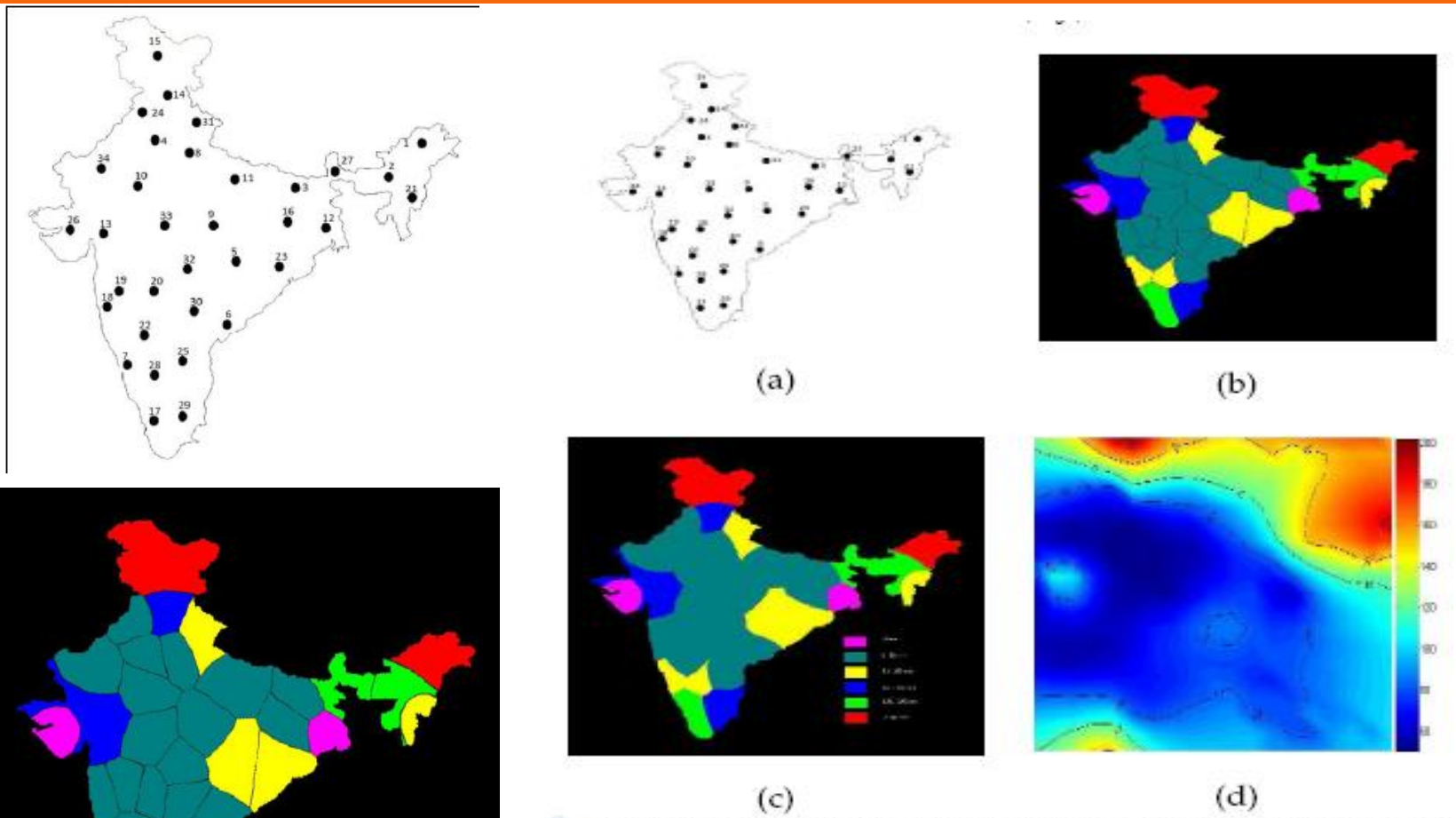
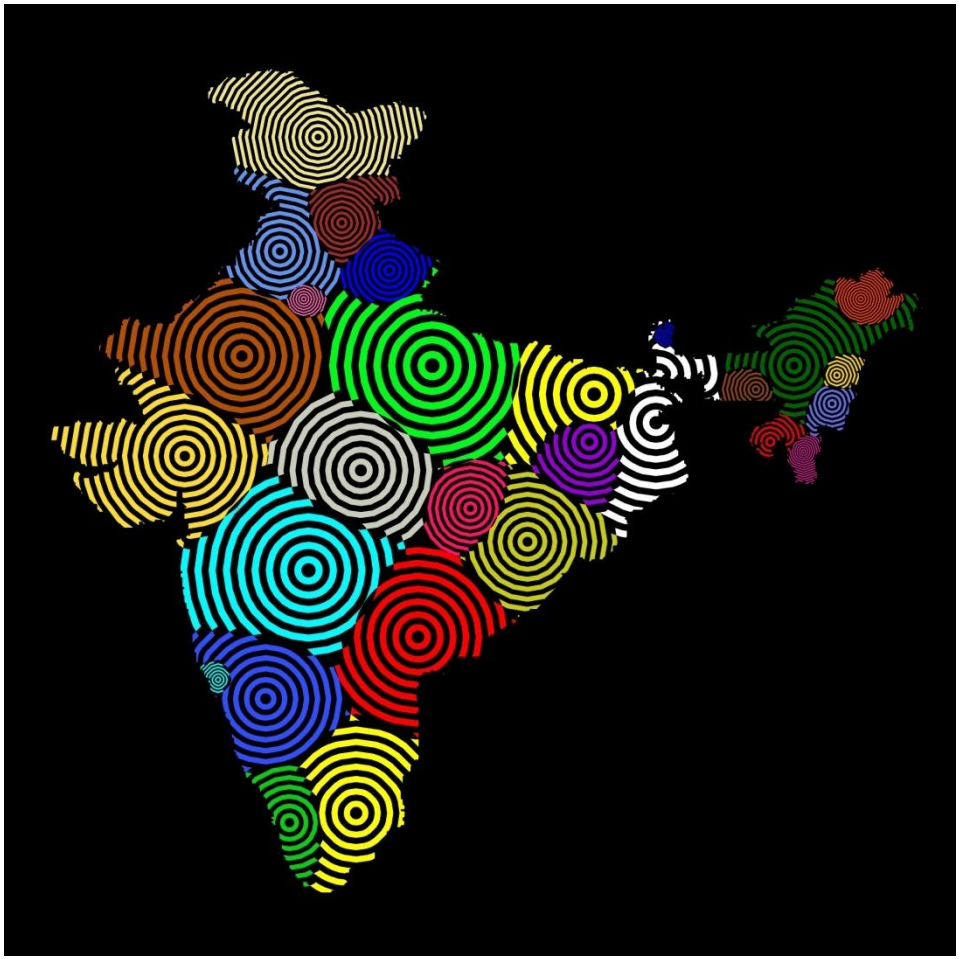
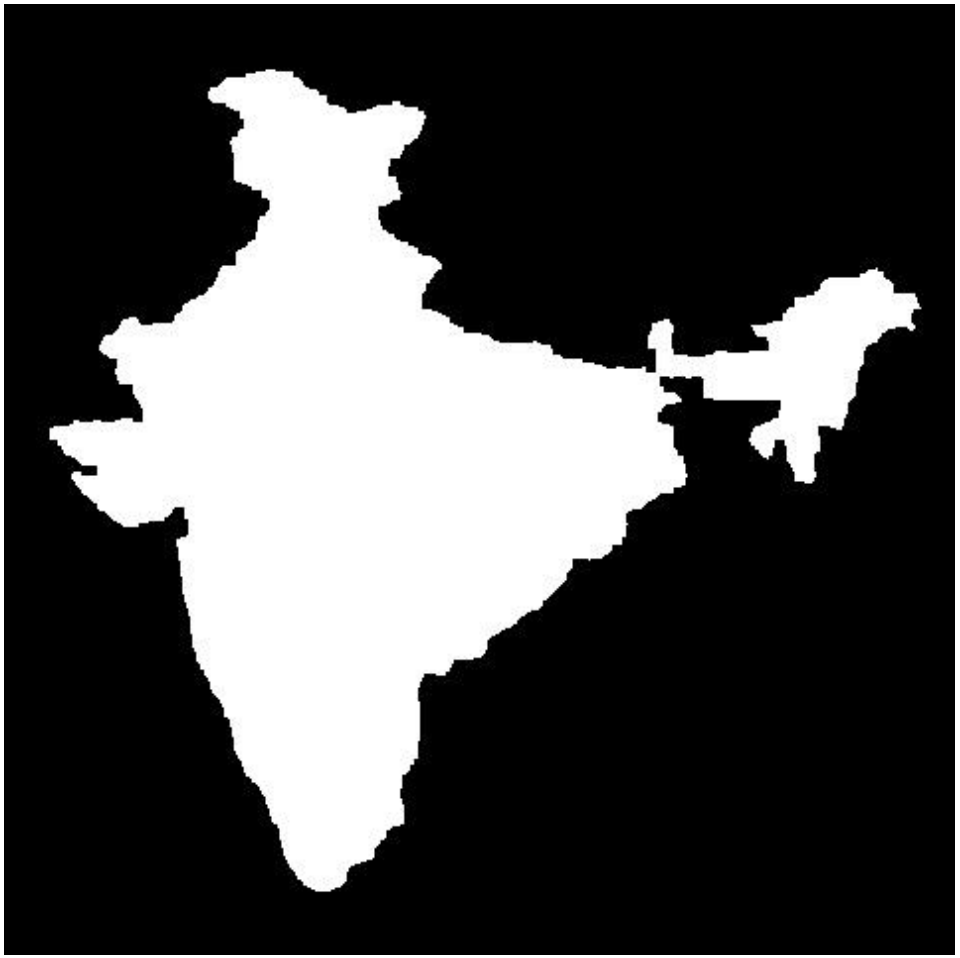
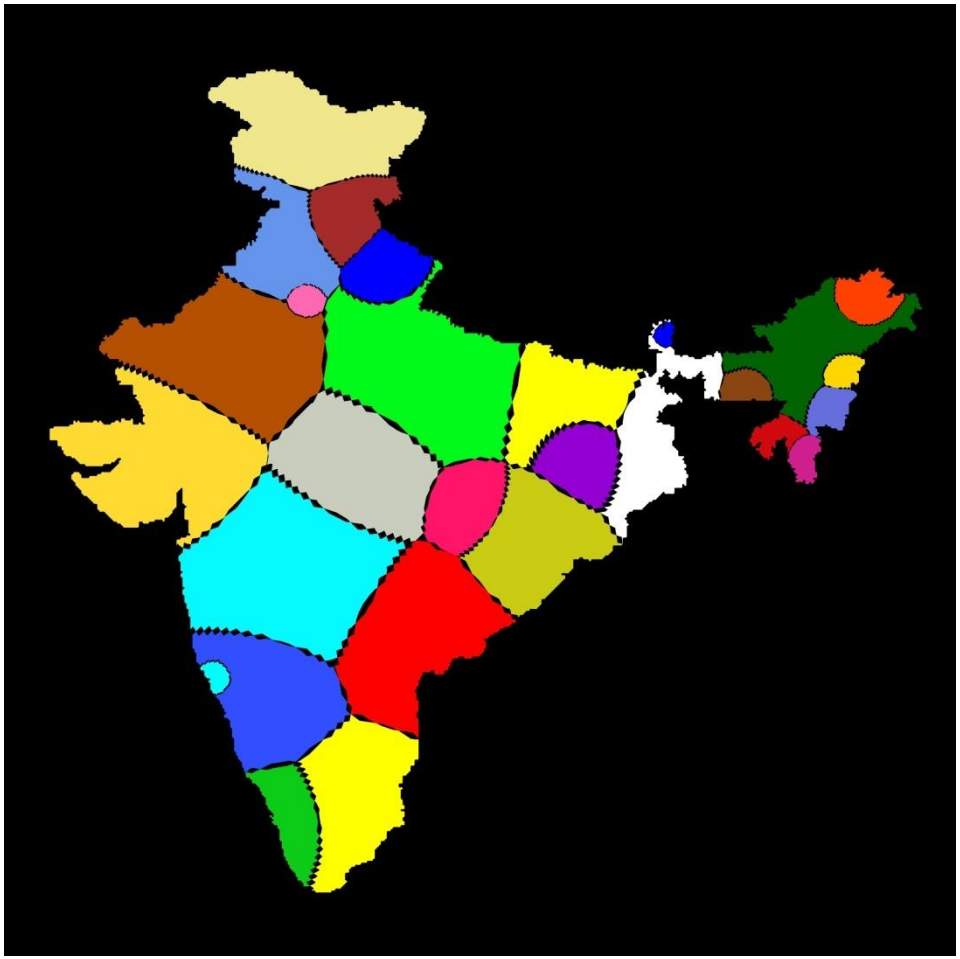
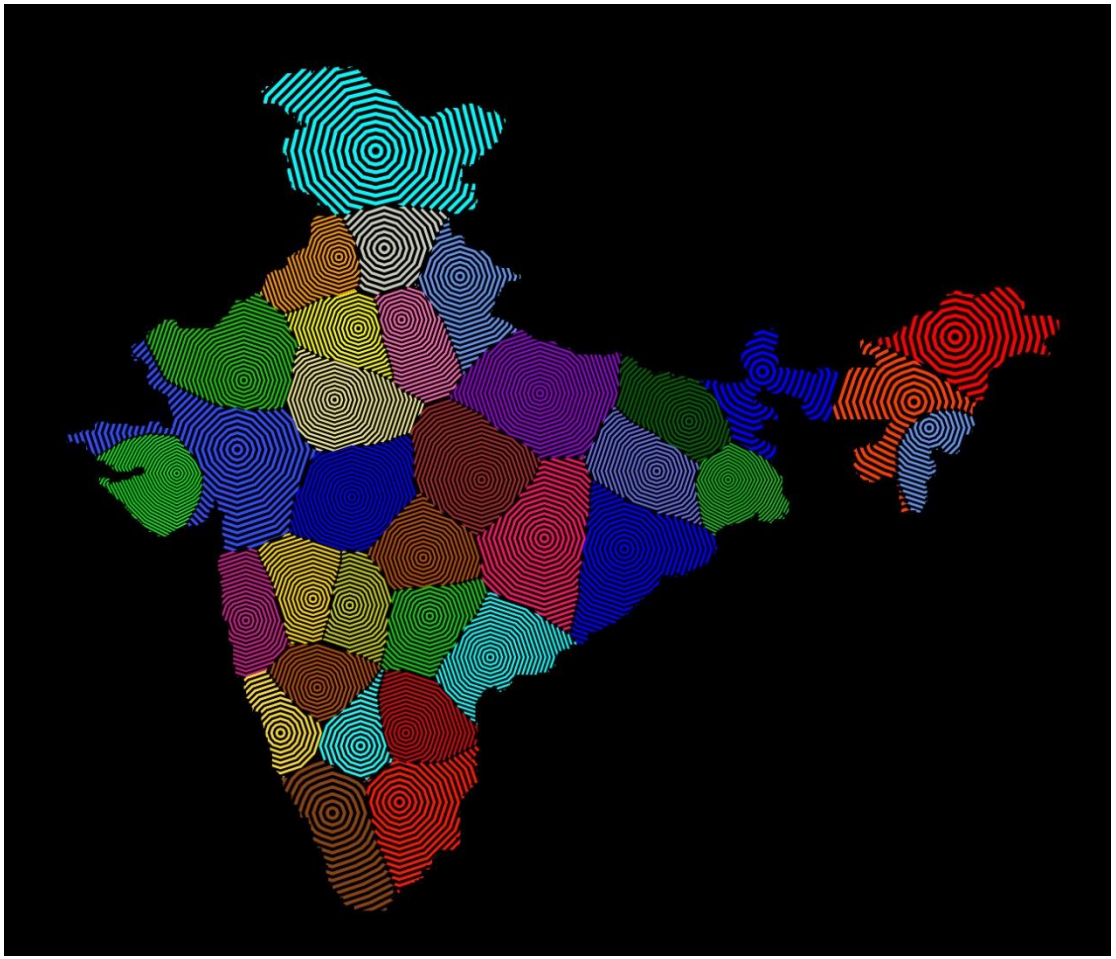


Fig. 4. (a) 34 points (locations) of rain-gauge stations spread over India indexed ($A_1 - A_{34}$), (b) Rainfall zonal map generated by having various possible propagation speeds, and the variable strengths in terms of propagation speeds are given according to ranks shown in Table 1, (c) broader zones obtained after merging the zones (Fig. 4b) obtained with similar propagation speeds, and (d) kriged map generated for 34 gauge station data.









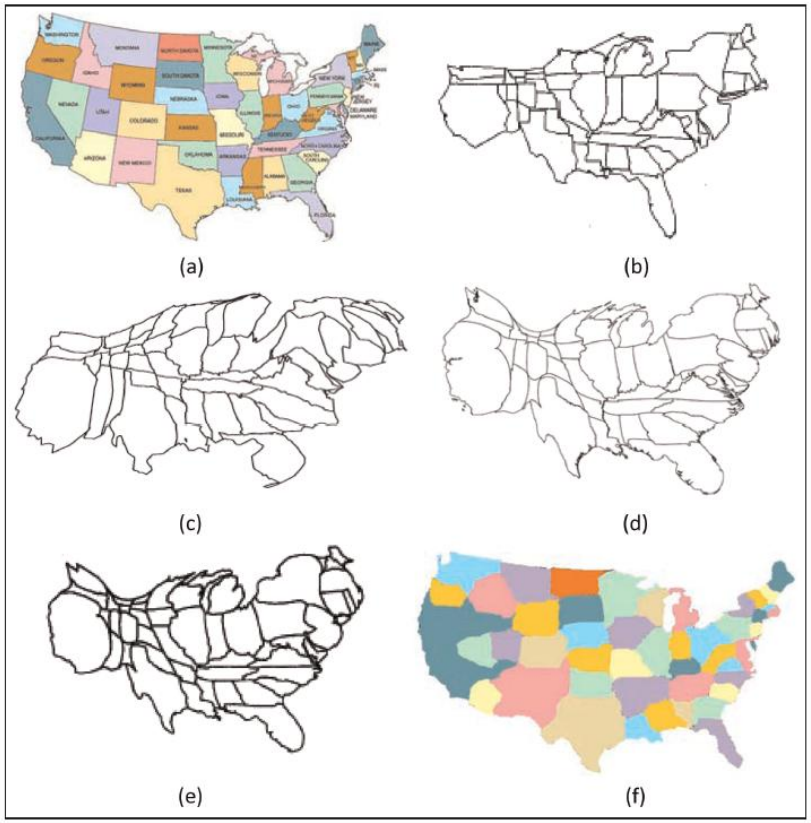
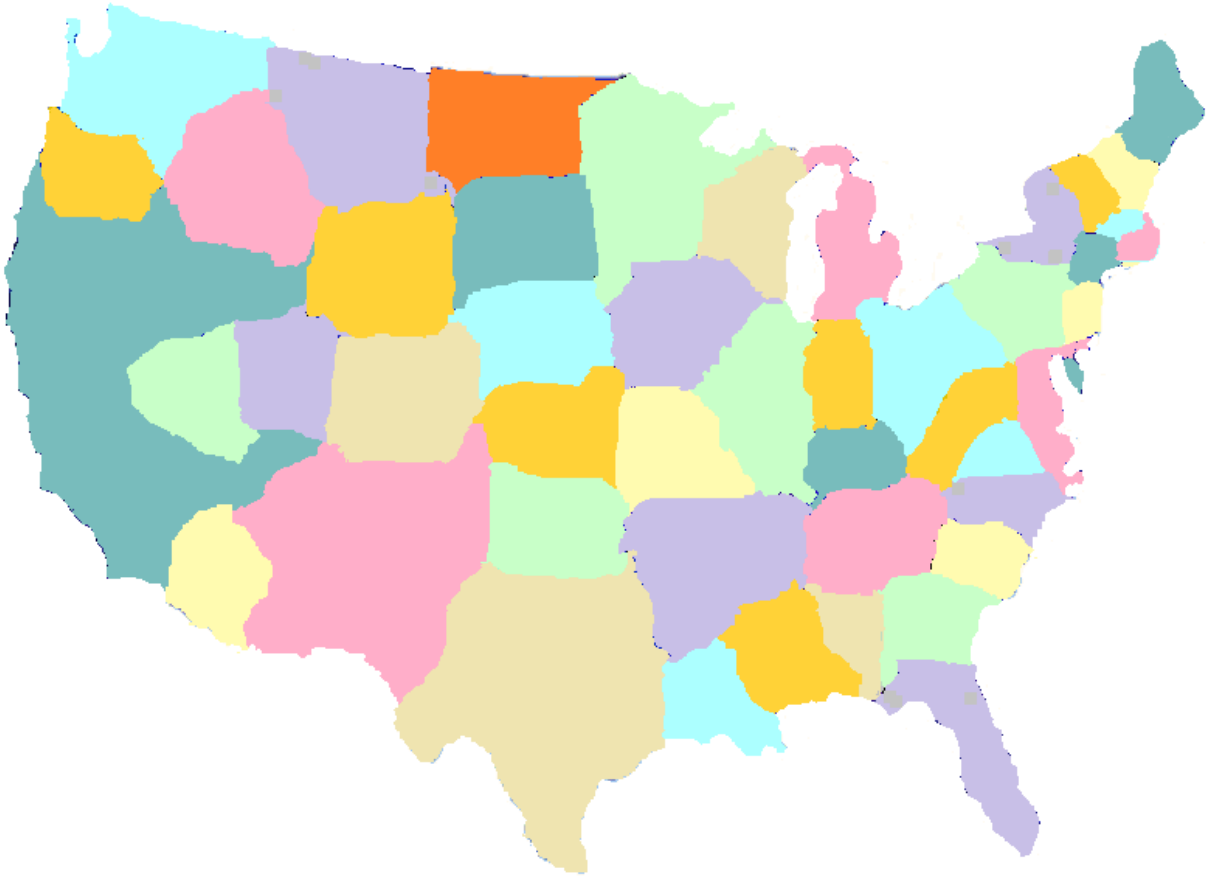


Figure 5. (a) Equal-area projection map of the United States. (b–e) Population cartograms generated for the United States based on (b) contiguous cartogram,[7] (c) Cartodraw,[8] (d) Gastner–Newman cartogram,[12] (e) area cartogram of the United States, with each county rescaled in proportion to its population,[17] and (f) morphology-based cartogram.
US population cartogram by Gusein-Zade and Tikunov (reproduced with permission from Gusein-Zade and Tikunov,[17] page 172, Figure 1, ©1993 American Congress on Surveying and Mapping).
The color coding given in (a) is similar to that of (f).



Thank You

Q & A