Need to make figure

python

*# Multi-panel figure menampilkan:*

- Panel A: Lokasi cekungan Bandung dalam konteks regional (Jawa Barat)

- Panel B: Digital Elevation Model (DEM) cekungan Bandung dengan major peaks labeled

- Panel C: 3D perspective view cekungan dengan orientasi monsoon

- Panel D: Cross-sectional profiles (N-S dan E-W)

**Figure 2: Detailed Topographic Analysis**

python

*# 6-panel figure terrain derivatives:*

- Panel A: Elevation zones (700-800m, 800-1000m, dst.)

- Panel B: Slope gradient (degrees)

- Panel C: Aspect (dengan wind rose overlay)

- Panel D: Topographic Position Index (TPI)

- Panel E: Terrain Ruggedness Index (TRI)

- Panel F: Flow accumulation & watershed boundaries

**2. PRECIPITATION CLIMATOLOGY FIGURES**

**Figure 3: GPM IMERG Data Overview**

python

*# Validation dan karakteristik data:*

- Panel A: Spatial coverage GPM grid points vs BMKG stations

- Panel B: Time series comparison GPM vs BMKG (2014-2024)

- Panel C: Bias correction assessment

- Panel D: Correlation scatter plots by elevation zones

**Figure 4: 11-Year Precipitation Climatology**

python

*# Annual precipitation patterns:*

- Panel A: Mean annual precipitation (2014-2024)

- Panel B: Coefficient of Variation (CV)

- Panel C: Wet season (DJF) climatology

- Panel D: Dry season (JJA) climatology

**Figure 5: Seasonal & Temporal Patterns**

python

*# Temporal variability:*

- Panel A: Monthly precipitation climatology (box plots)

- Panel B: Diurnal cycle by elevation zones

- Panel C: Inter-annual variability (2014-2024)

- Panel D: ENSO correlation analysis

**3. EXTREME PRECIPITATION ANALYSIS**

**Figure 6: Extreme Indices Spatial Distribution**

python

*# ETCCDI indices maps:*

- Panel A: R95p (very wet day precipitation)

- Panel B: RX1day (annual maximum daily precipitation)

- Panel C: R20mm (heavy precipitation days)

- Panel D: R50mm (very heavy precipitation days)

**Figure 7: Extreme Event Frequency & Intensity**

python

*# Temporal analysis:*

- Panel A: Annual frequency of extreme events

- Panel B: Intensity trends (mm/decade)

- Panel C: Seasonal distribution of extremes

- Panel D: Return period analysis

**Figure 8: Case Study Events**

python

*# Major extreme events (2016, 2020, 2022):*

- Panel A: Event rainfall distribution maps

- Panel B: Time series of event evolution

- Panel C: Synoptic patterns (ERA5 analysis)

- Panel D: Flood impact correlation

**4. OROGRAPHIC ENHANCEMENT ANALYSIS**

**Figure 9: Windward-Leeward Analysis**

python

*# Orographic effects:*

- Panel A: Monsoon wind directions & frequency

- Panel B: Windward vs leeward slope identification

- Panel C: Precipitation enhancement ratio maps

- Panel D: Cross-sectional precipitation profiles

**Figure 10: Elevation-Precipitation Relationship**

python

*# Quantitative analysis:*

- Panel A: Scatter plot elevation vs precipitation

- Panel B: Regression analysis by seasons

- Panel C: Enhancement factor by elevation zones

- Panel D: Comparison with literature (Zhengzhou case)

**Figure 11: Basin Convergence Effects**

python

*# Atmospheric dynamics:*

- Panel A: Moisture flux convergence patterns

- Panel B: Valley wind circulation (conceptual model)

- Panel C: Convection initiation zones

- Panel D: Precipitation efficiency maps

**5. SPATIAL PATTERN ANALYSIS**

**Figure 12: Hotspot Analysis**

python

*# Spatial clustering:*

- Panel A: Getis-Ord Gi\* hotspot analysis

- Panel B: Cluster-outlier analysis (Anselin Local Moran's I)

- Panel C: Spatial autocorrelation patterns

- Panel D: Geographic weighted regression results

**Figure 13: Precipitation Gradients**

python

*# Spatial variability:*

- Panel A: N-S precipitation gradients

- Panel B: E-W precipitation gradients

- Panel C: Radial gradients from basin center

- Panel D: Gradient comparison with other basins

**6. FLOOD THRESHOLD ANALYSIS**

**Figure 14: Rainfall-Flood Relationship**

python

*# Threshold determination:*

- Panel A: ROC curves for different thresholds

- Panel B: Optimal thresholds by elevation zones

- Panel C: Threshold exceedance frequency

- Panel D: False alarm vs hit rate analysis

**Figure 15: Zone-Specific Thresholds**

python

*# Multi-zone analysis:*

- Panel A: Valley floor thresholds (700-800m)

- Panel B: Lower slope thresholds (800-1000m)

- Panel C: Mid slope thresholds (1000-1500m)

- Panel D: Threshold uncertainty assessment

**Figure 16: Flood Risk Zonation**

python

*# Risk mapping:*

- Panel A: Current flood hazard zones

- Panel B: Precipitation-based risk zones

- Panel C: Combined topographic-precipitation risk

- Panel D: Urban area vulnerability overlay

**7. TREND & CHANGE ANALYSIS**

**Figure 17: Long-term Trends**

python

*# Temporal changes:*

- Panel A: Mann-Kendall trend maps

- Panel B: Magnitude of trends (mm/decade)

- Panel C: Change point detection results

- Panel D: Trend significance assessment

**Figure 18: Climate Variability Impact**

python

*# Large-scale connections:*

- Panel A: ENSO-precipitation correlations

- Panel B: IOD impact assessment

- Panel C: Monsoon strength correlation

- Panel D: Multi-year variability patterns

**8. VALIDATION & UNCERTAINTY**

**Figure 19: Model Validation**

python

*# Accuracy assessment:*

- Panel A: GPM vs BMKG validation scatter plots

- Panel B: Bias assessment by elevation

- Panel C: Seasonal validation performance

- Panel D: Extreme event validation

**Figure 20: Uncertainty Analysis**

python

*# Confidence assessment:*

- Panel A: Bootstrap confidence intervals

- Panel B: Sensitivity to threshold selection

- Panel C: Spatial uncertainty maps

- Panel D: Temporal uncertainty assessment

**9. SYNTHESIS & APPLICATION**

**Figure 21: Conceptual Model**

python

*# Process understanding:*

- Panel A: 3D conceptual diagram of orographic processes

- Panel B: Seasonal process differences

- Panel C: Scale interaction effects

- Panel D: Climate change implications

**Figure 22: Operational Products**

python

*# Practical applications:*

- Panel A: Early warning threshold maps

- Panel B: Seasonal forecast guidance

- Panel C: Urban planning recommendations

- Panel D: Monitoring network optimization

**TECHNICAL SPECIFICATIONS:**

**Figure Quality Standards:**

* **Resolution**: 300 DPI minimum untuk publikasi
* **Format**: Vector format (PDF/SVG) untuk maps, PNG untuk raster
* **Color scheme**: Scientific color palettes (matplotlib cmocean, ColorBrewer)
* **Projections**: UTM Zone 48S untuk detail maps, WGS84 untuk regional context

**Data Visualization Tools:**

python

*# Primary tools:*

- Python: matplotlib, seaborn, cartopy, geopandas

- ArcGIS Pro: untuk high-quality cartographic maps

- R: ggplot2 untuk statistical plots (optional)

- Adobe Illustrator: untuk final figure polishing (optional)

**Figure Numbering & Organization:**

Figure 1-2: Study Area & Topography

Figure 3-5: Data & Climatology

Figure 6-8: Extreme Events

Figure 9-11: Orographic Effects

Figure 12-13: Spatial Patterns

Figure 14-16: Flood Thresholds

Figure 17-18: Trends & Variability

Figure 19-20: Validation

Figure 21-22: Synthesis & Applications

PRIMARY (ArcGIS Pro Essential): - Figure 1: Study Area Overview - Figure 2: Topographic Analysis - Figure 4: Precipitation Climatology Maps - Figure 6: Extreme Indices Maps - Figure 8: Case Study Event Maps - Figure 9: Windward-Leeward Analysis - Figure 11: Basin Convergence (3D) - Figure 12: Hotspot Analysis - Figure 16: Risk Zonation Maps - Figure 17: Trend Maps - Figure 21: Conceptual Model (3D) - Figure 22: Operational Products

🎯 PRIMARY (Python Essential): - Figure 3: Data validation & comparison - Figure 5: Temporal patterns & time series - Figure 7: Trend analysis & statistics - Figure 10: Elevation-precipitation relationships - Figure 13: Gradient analysis - Figure 14: ROC curves & thresholds - Figure 15: Zone-specific analysis - Figure 18: Climate variability analysis - Figure 19: Model validation - Figure 20: Uncertainty analysis

**FIGURE PALING PRIORITAS**

**1. Spatial Distribution Map of Extreme Precipitation (2014-2024)**

Panel A: Mean annual extreme precipitation (R95p)

Panel B: Maximum daily precipitation (RX1day)

Panel C: Heavy precipitation days (R20mm)

Panel D: Topographic elevation + station locations

**Mengapa penting:**

* Menunjukkan hipotesis H₁ (spatial distribution hypothesis)
* Membuktikan orographic enhancement pattern
* Baseline untuk semua analisis selanjutnya

**2. Orographic Enhancement Analysis**

Panel A: Precipitation vs Elevation scatter plot

Panel B: Windward vs Leeward slope comparison

Panel C: Enhancement ratio map (observed/theoretical)

Panel D: Cross-section showing precipitation gradient

**Mengapa penting:**

* Core finding penelitian (H₂ - topographic enhancement hypothesis)
* Quantify 20-40% enhancement yang dihipotesiskan
* Comparable dengan hasil Zhao et al. (2020) dan Jin et al. (2024)

**3. Flood Threshold Analysis by Topographic Zones**

Panel A: ROC curves untuk setiap zona elevasi

Panel B: Threshold map dengan confidence intervals

Panel C: Validation dengan historical flood events

Panel D: Seasonal threshold variations

**Mengapa penting:**

* Aplikasi praktis utama (H₃ - threshold-flood relationship)
* Direct relevance untuk early warning system
* Validasi dengan data BNPB

**4. Temporal Pattern Analysis**

Panel A: Seasonal climatology (monthly means)

Panel B: Diurnal cycle composite

Panel C: ENSO relationship (El Niño vs La Niña)

Panel D: 11-year trend analysis

**Mengapa penting:**

* Membuktikan H₄ (temporal pattern hypothesis)
* Climate variability context (2014-2024 coverage)
* Operational forecasting relevance

**5. GPM IMERG Validation Against Ground Stations**

Panel A: Scatter plot GPM vs BMKG stations

Panel B: Bias analysis by elevation zones

Panel C: Extreme events detection performance

Panel D: Spatial correlation patterns

**Mengapa penting:**

* Kredibilitas scientific methodology
* Justify penggunaan satellite data
* Foundation untuk semua conclusions

**REKOMENDASI TEKNIS**

**Software & Workflow:**

* **Python**: xarray + cartopy untuk spatial maps
* **ArcGIS Pro**: High-quality cartographic output
* **Statistical plots**: seaborn + matplotlib dengan professional styling

**Design Principles:**

* **Consistent color scheme** untuk elevation (terrain colormap)
* **High DPI output** (300+ dpi) untuk publikasi
* **Clear annotations** dengan statistical significance markers
* **Multi-panel layouts** untuk efficient space usage