1. Familiarize with the environment using NSHARP, favorable parameters:
   - Long, skinny CAPE (< 1000 J/kg)
   - Moist vertical profile (Low/Mid RH > 70%)
   - Above average PWs (> 75th percentile)
   - Deep warm cloud layer (> 10 kft)
   - Slow “LCL-EL (Cloud Layer)” wind (< 10 kt)
   - Slow Corfidi Up/Down shear vectors (< 15 kt)

2. Familiarize with the antecedent soil conditions and topography
   a. Become familiar with 1-, 3-, and 6-hr FFG values across your CWA
   b. Consider topography and urban areas
   c. Look at FLASH soil moisture to see recently saturated areas; where FFG may be too high

3. Choose your optimal precip source
   a. Find nearest radar and assess Melting Layer to determine confidence in DP QPE
   b. Assess first-guess QPE biases: BIAS/#G-R
      - Legacy biases in STP, DP biases in MPE Misc menu
      - BIAS: > 1: QPE under-estimating, < 1: QPE over-estimating
      - #G-R: num. of gauge-radar pairs used to calculate bias → more pairs = more confidence
   c. Assess QPE biases at gauges: Compare QPE with observations at close to moderate ranges
      - Identify the precip source with the highest instantaneous precip rates
      - Compare 1-hr QPE to METARs (PXXXX = XX.XX inches)
        - NOTE: Time-match QPEs and obs, zoom all the way in before sampling!
      - Compare storm-total QPE to Mesonet gauges (note when Mesonets reset!)
   d. Precip source options
      - DHR (Legacy): use when you want Legacy estimates, single Z-R
      - DPR (DP): good near the radar, use when you want Dual-Pol estimates, high spatial res
      - HPE (DP mosaic): use for DP + mosaic (consider DPR when there’s beam blockage)
      - BHPE (DP mosaic w/ biases applied): use when you want DP and when biases help
      - MRMS (mosaic): unique precip type and Z-R calculations (no DP), high temporal res

4. Analyze heavy rainfall and streamflow signatures in radar, FFMP, and FLASH

<table>
<thead>
<tr>
<th>Dual-Pol product</th>
<th>Values</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z</td>
<td>50-60 dBZ</td>
<td>Enhanced reflectivity/rainfall</td>
</tr>
<tr>
<td>ZDR</td>
<td>2.0-5.0 dB</td>
<td>Bigger drop size</td>
</tr>
<tr>
<td>CC</td>
<td>&gt; 0.96</td>
<td>Uniform precip type</td>
</tr>
<tr>
<td>KDP</td>
<td>&gt; 1.0 deg/km*</td>
<td>Increasing liquid water content</td>
</tr>
</tbody>
</table>

*KDP > 4.0 deg/km could indicate water-coated hail, so be wary of rain rates in these areas (use ZDR and CC to diagnose hail)

   a. Use FFMP to diagnose basin threat, coverage, and timing
      - Set-up with “All & Only Small Basins” Layer and “Ratio” product (use County Layer to filter basins)
        - Ratio > 100% to identify areas of flash flooding (w/ consideration of biases found in #3)
        - Diff > 0 in. to assess severity of flash flooding
      - Look at 1-, 3-, and 6-hour durations (for both short-term and training potential)
      - Use All-hour basin trend graph to identify timing, storm training, and optimal durations for analysis
   b. Use FLASH to assess flood threat, precip anomaly → MRMS QPE-to-FFG Ratio, MRMS Precip Return Period
   c. Use FLASH to analyze streamflow and rivers → CREST Unit Streamflow, SAC-SMA Unit Streamflow

5. Issue Flash Flood Warnings with proper criteria and routinely reassess
   a. Duration: no less than 3 hours
   b. Polygon size: small buffer around current threat, extend for threat evolution & couple basins for runoff
   c. Text includes:
      - How much rain has fallen, how much more is expected over the warning duration, cities impacted, reports included, and 1-2 Call-to-Action statements
**CREST Max Unit Streamflow**

<table>
<thead>
<tr>
<th>Streamflow (cfs mi⁻²)</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 100 cfs mi⁻²</td>
<td>Monitor area for increasing FF potential</td>
</tr>
<tr>
<td>100-200 cfs mi⁻²</td>
<td>Monitor closely; initial threshold for warning consideration</td>
</tr>
<tr>
<td>200-1000 cfs mi⁻²</td>
<td>Higher confidence in warning issuance and impending FF impacts</td>
</tr>
<tr>
<td>&gt; 1000 cfs mi⁻²</td>
<td>Likely a significant FF event</td>
</tr>
</tbody>
</table>

**Loading the FFMP Basin Trend Graph:**

1. Right-click on basin name in FFMP Basin Table
2. FFMP text legend “editable”, Click menu in FFMP table set to “Basin Trend”, right-click on basin in D2D

**Time:**
- Rate — hours before current time (<0)
- QPE/Guid — durations (i.e. -3.0 = 3-hr duration)