Global model ensembles

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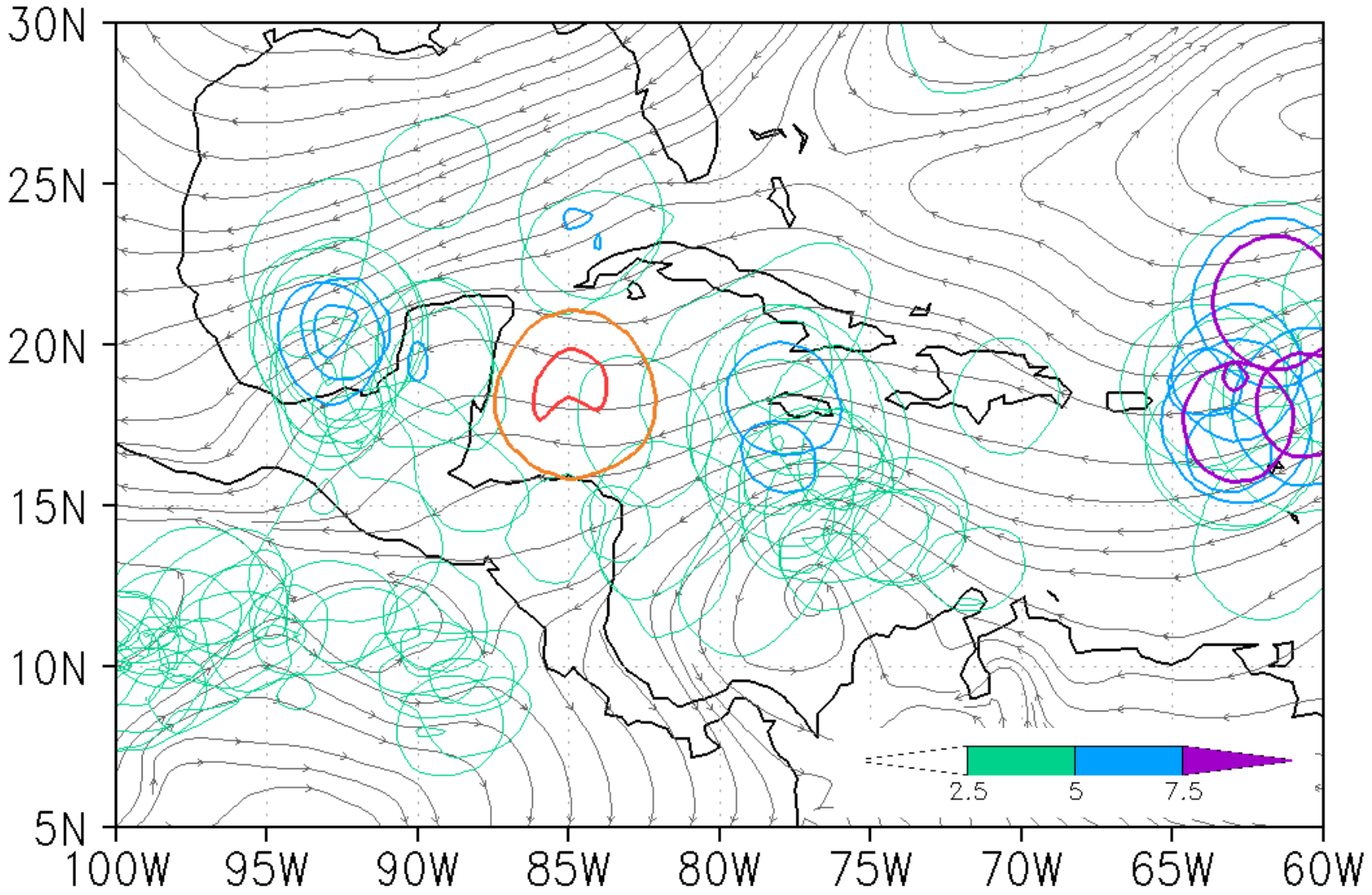
- Offer a longer-term outlook (0-10 days) on the potential for a tropical disturbance to develop.
  - Scatter of forecasts depicting critical values of
    - Area-averaged vorticity (or circulation)
    - Geopotential thickness anomaly
    - Okubo-Weiss parameter
  - Probabilities of exceedance of critical values of
    - Vertical wind shear
    - Lower-tropospheric relative humidity
    - Upper level divergence / lower-level convergence
- What are the characteristics of error in ensemble forecasts, and what are their physical sources?

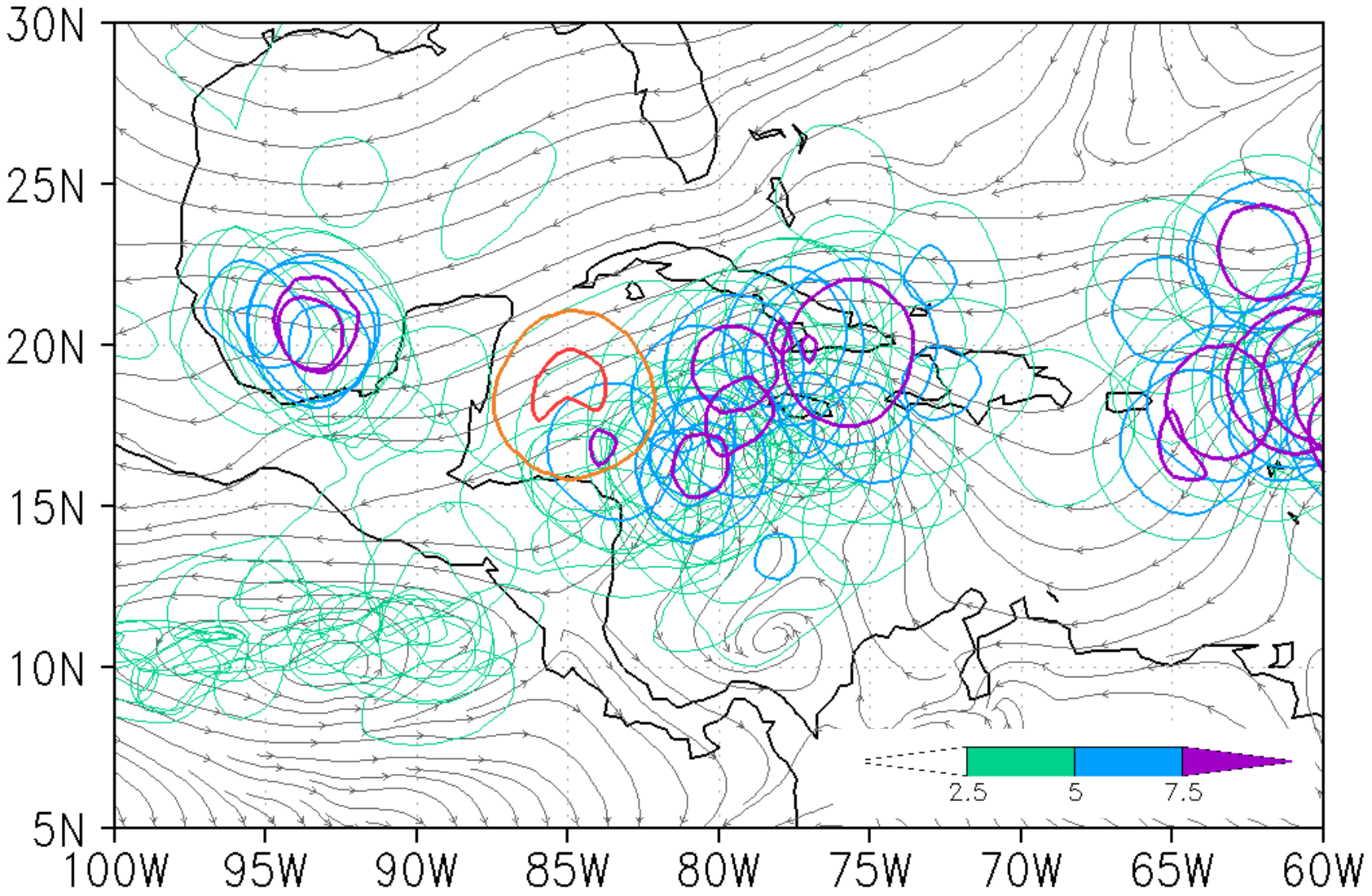
Example: Genesis of Karl (AL13; PGI44L)

- Genesis occurred just before 00 UTC, 15 Sep

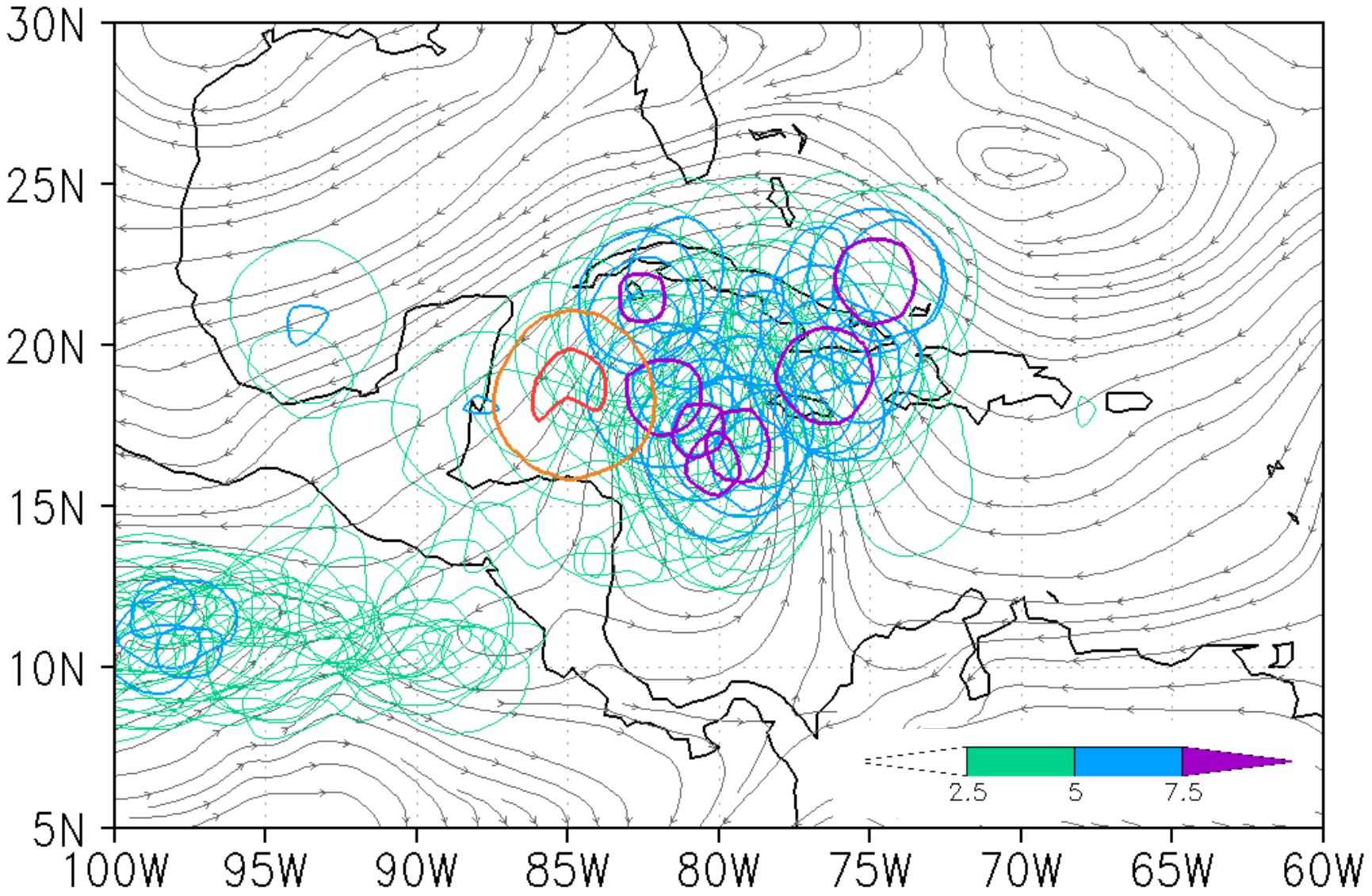
- Next two “loops”
  - 9- through 0- day ECMWF ensemble forecasts of area-averaged relative vorticity valid at genesis time
  - Same but displayed as PDFs



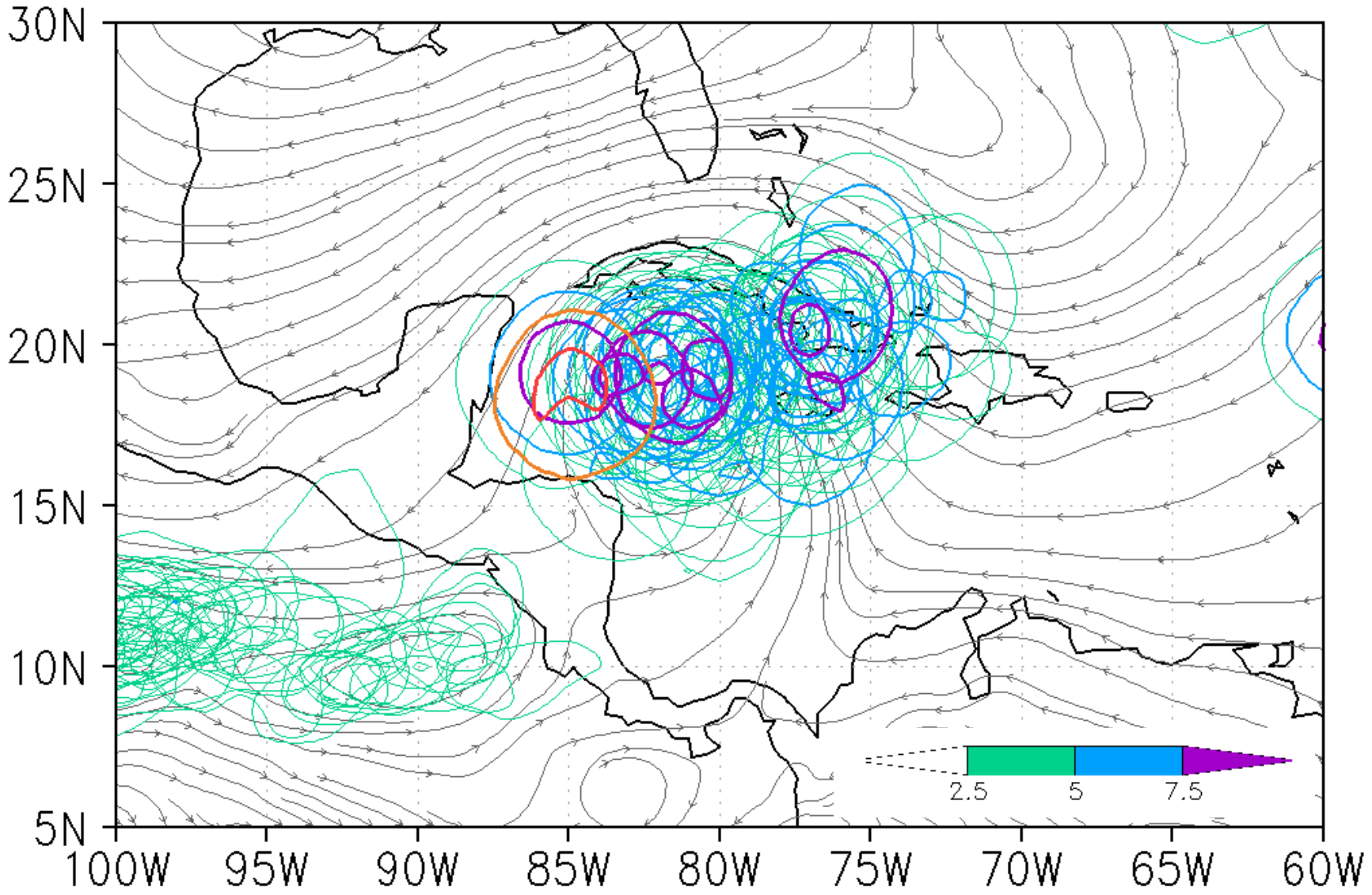
9-day forecast for 00 UTC 15 Sep



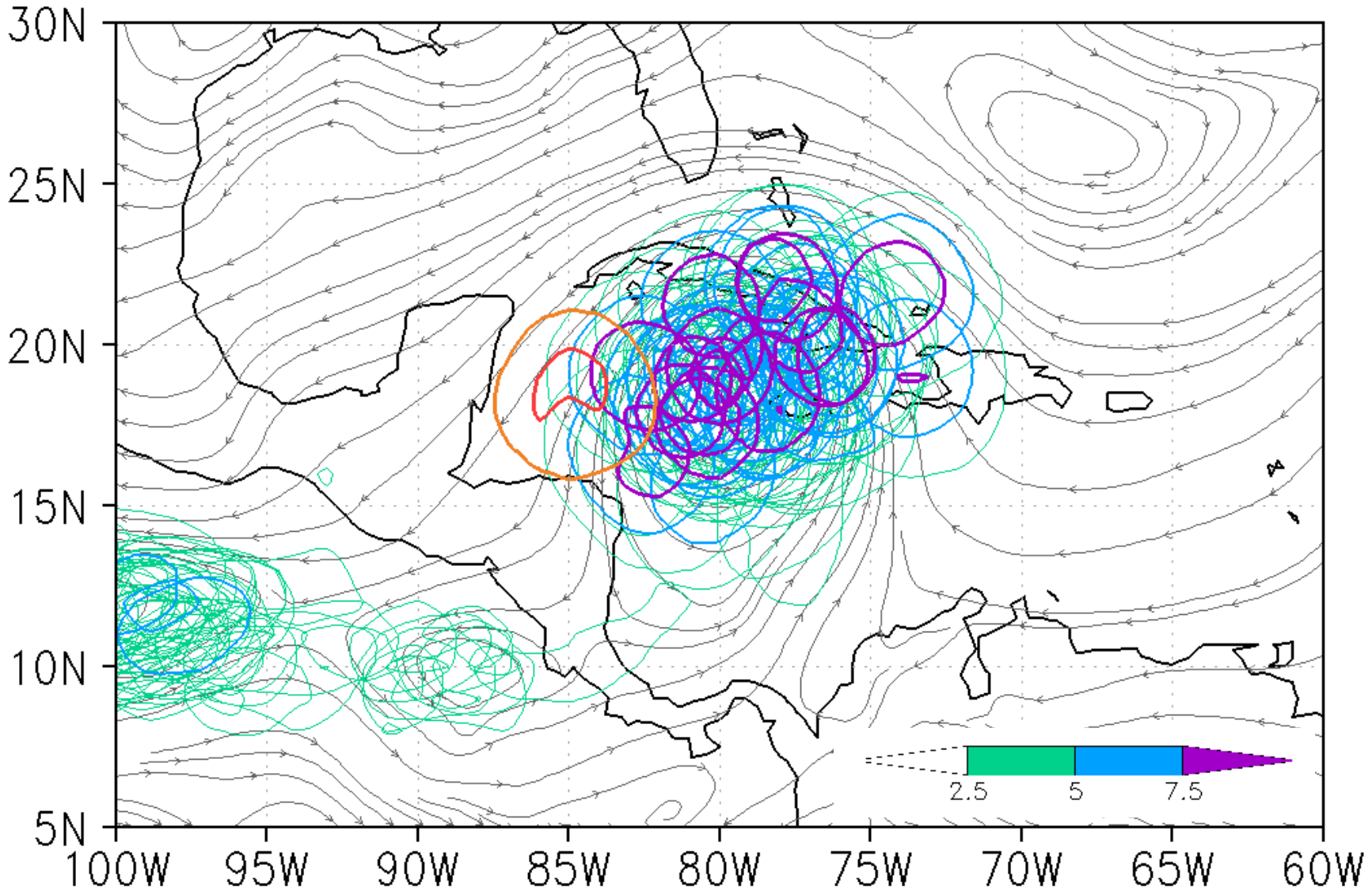
8-day forecast for 00 UTC 15 Sep



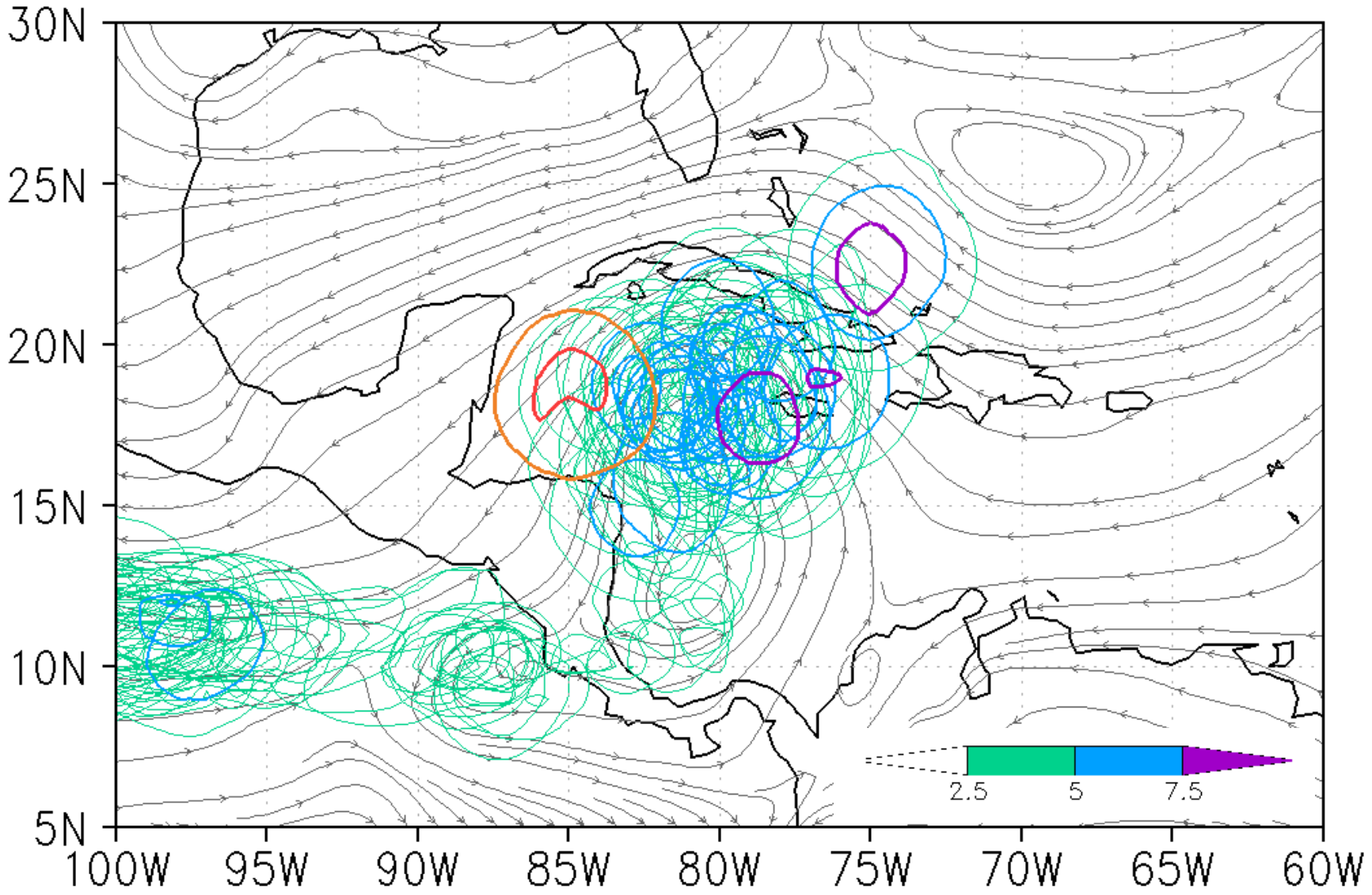
7-day forecast for 00 UTC 15 Sep



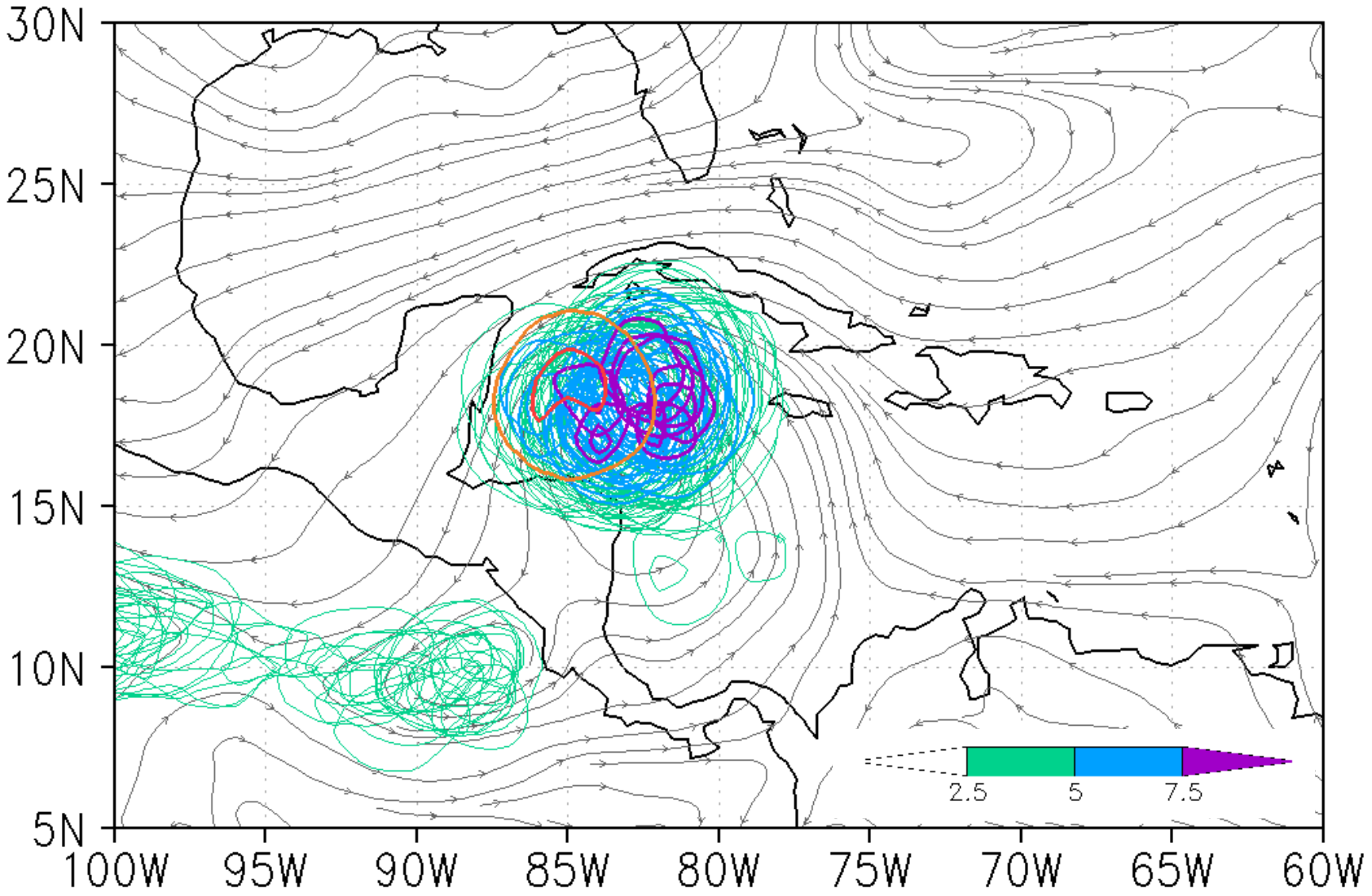
6-day forecast for 00 UTC 15 Sep



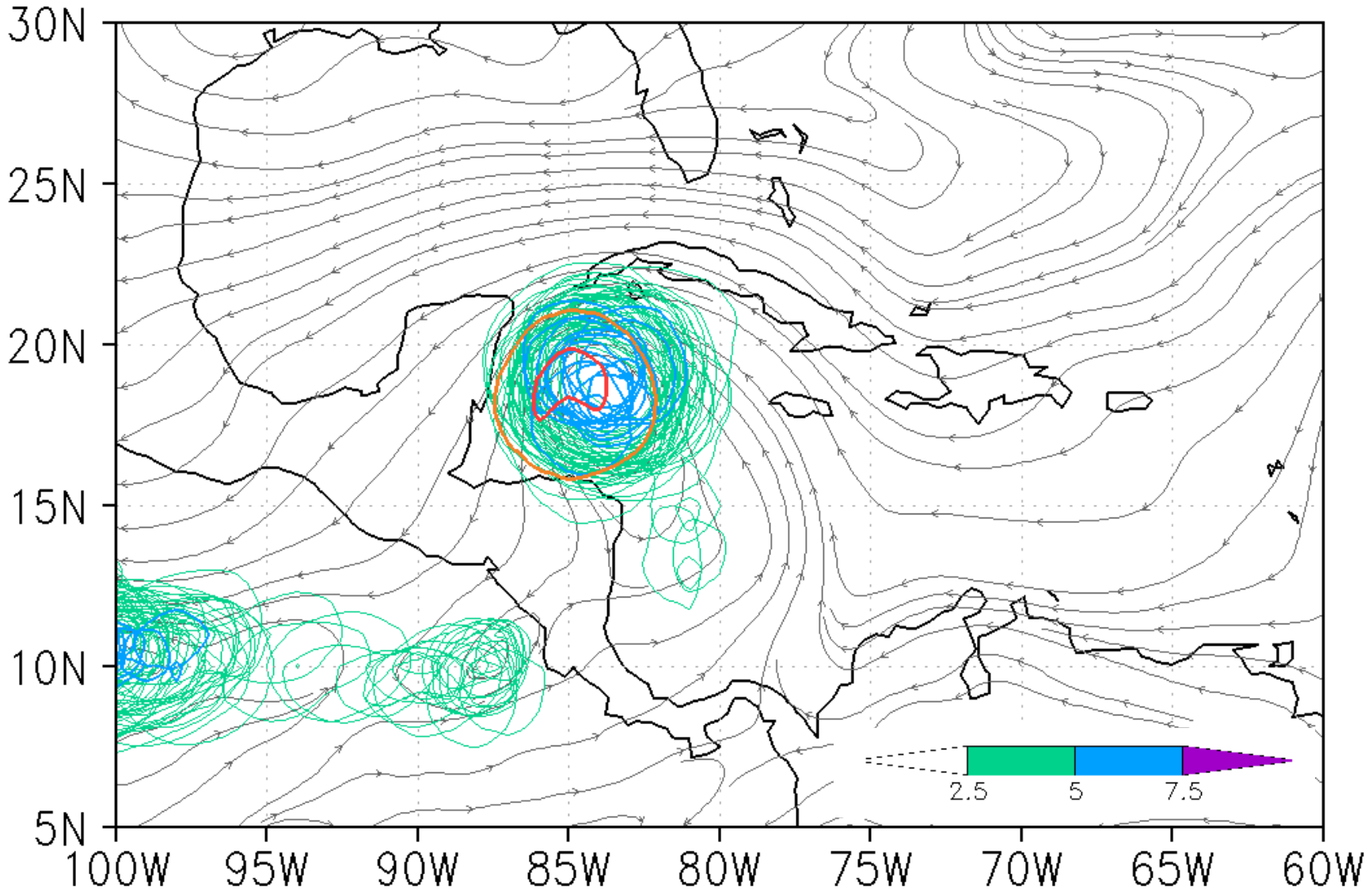
5-day forecast for 00 UTC 15 Sep



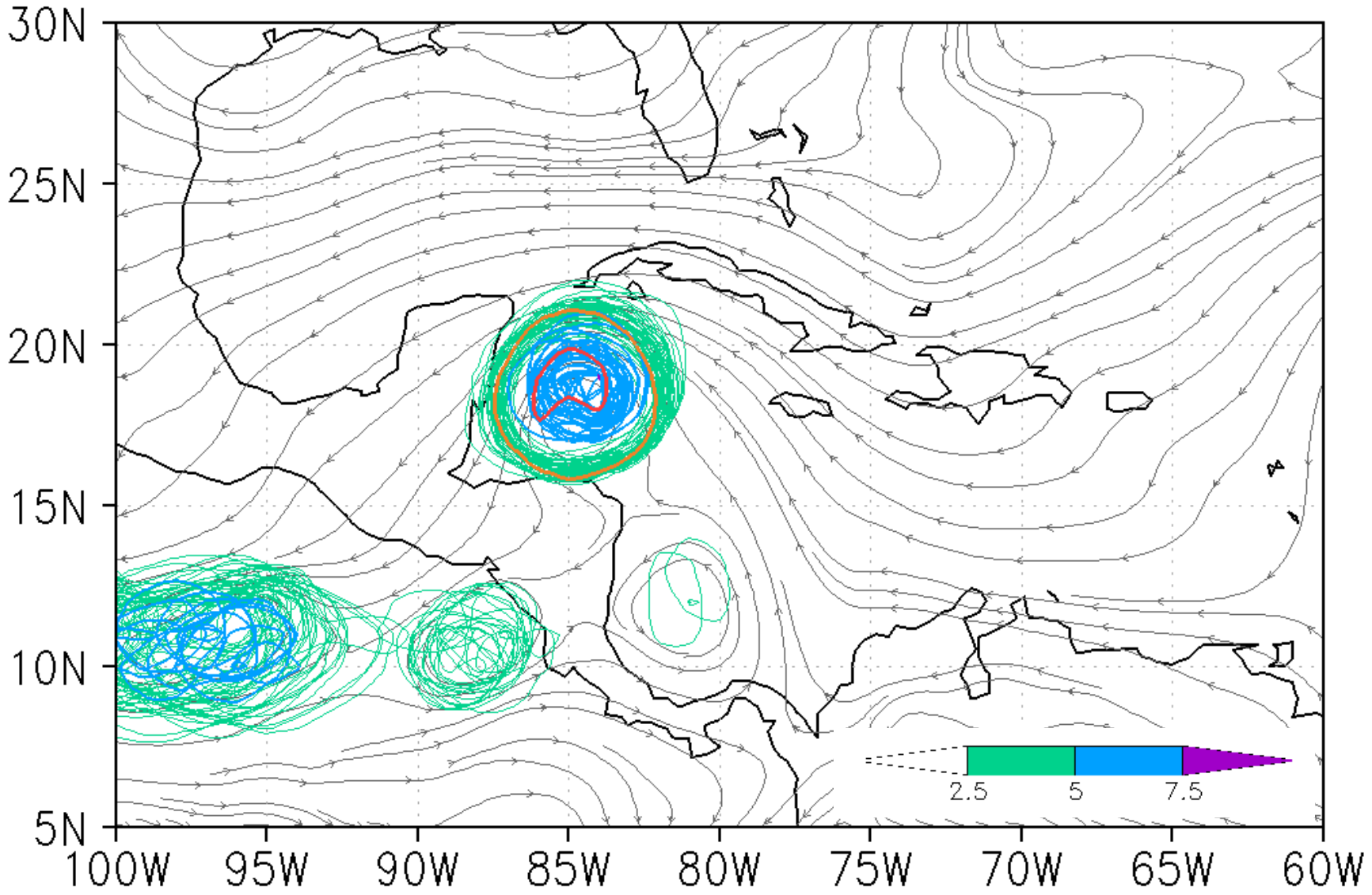
4-day forecast for 00 UTC 15 Sep



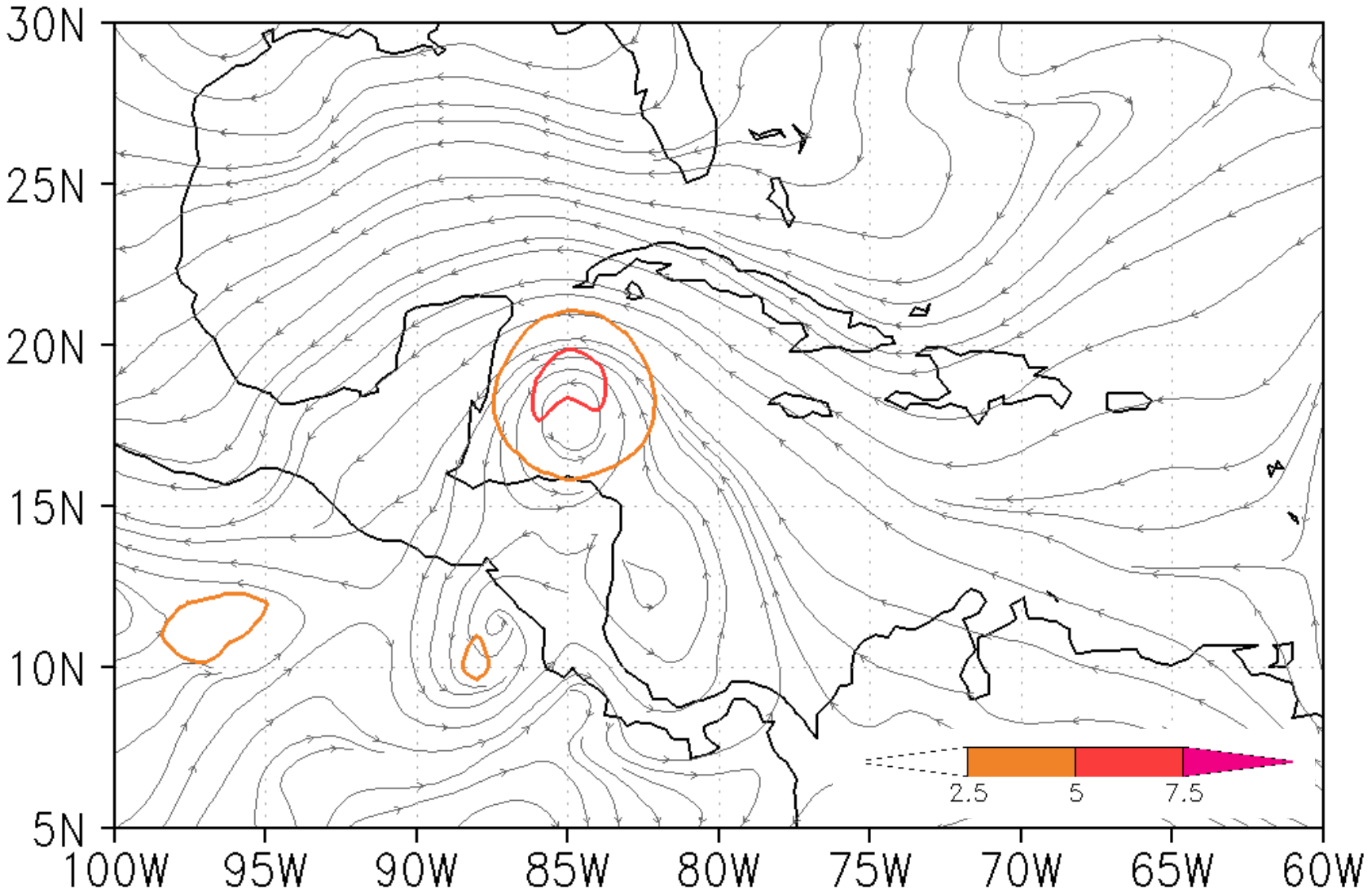
3-day forecast for 00 UTC 15 Sep



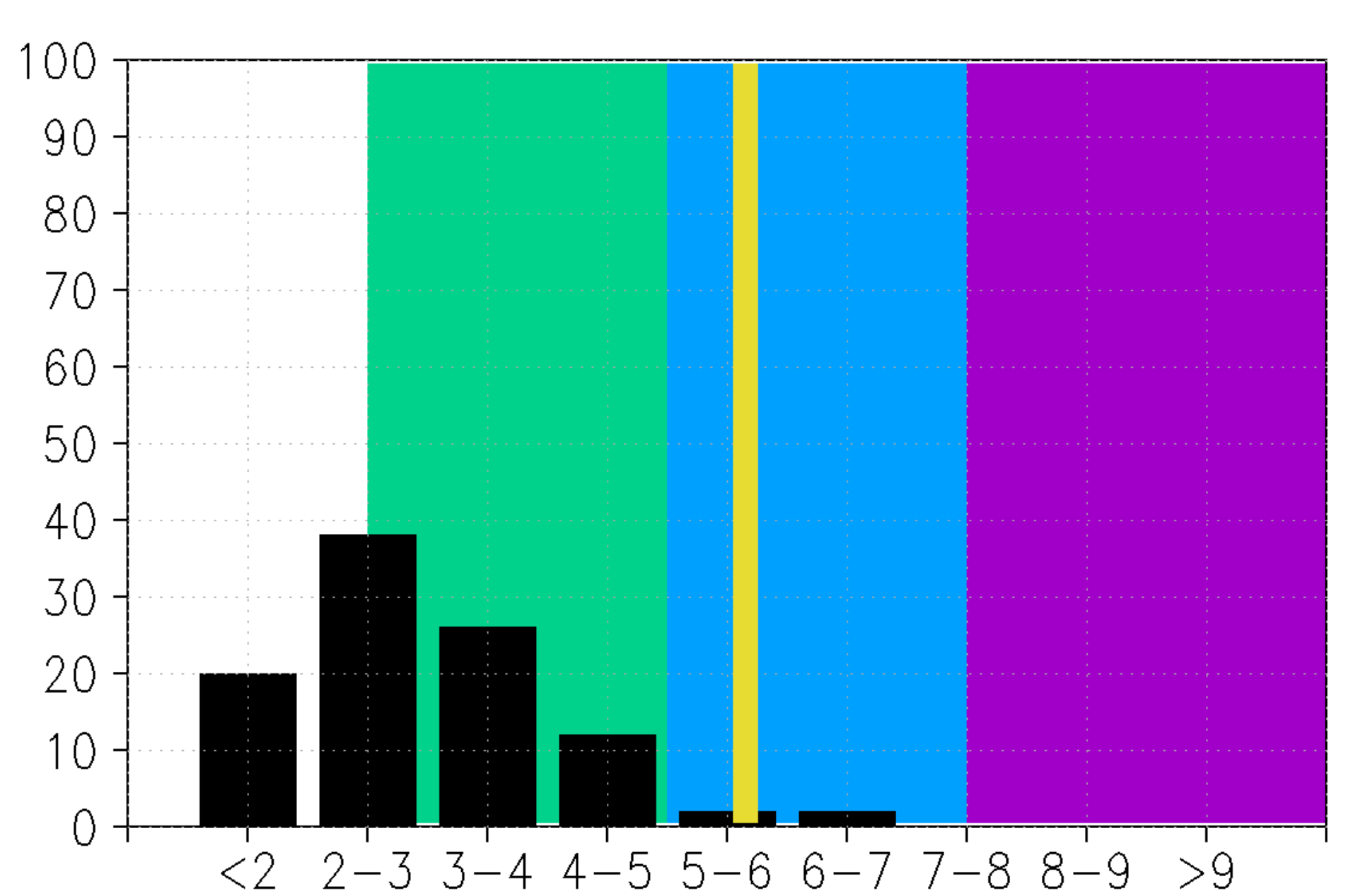
2-day forecast for 00 UTC 15 Sep



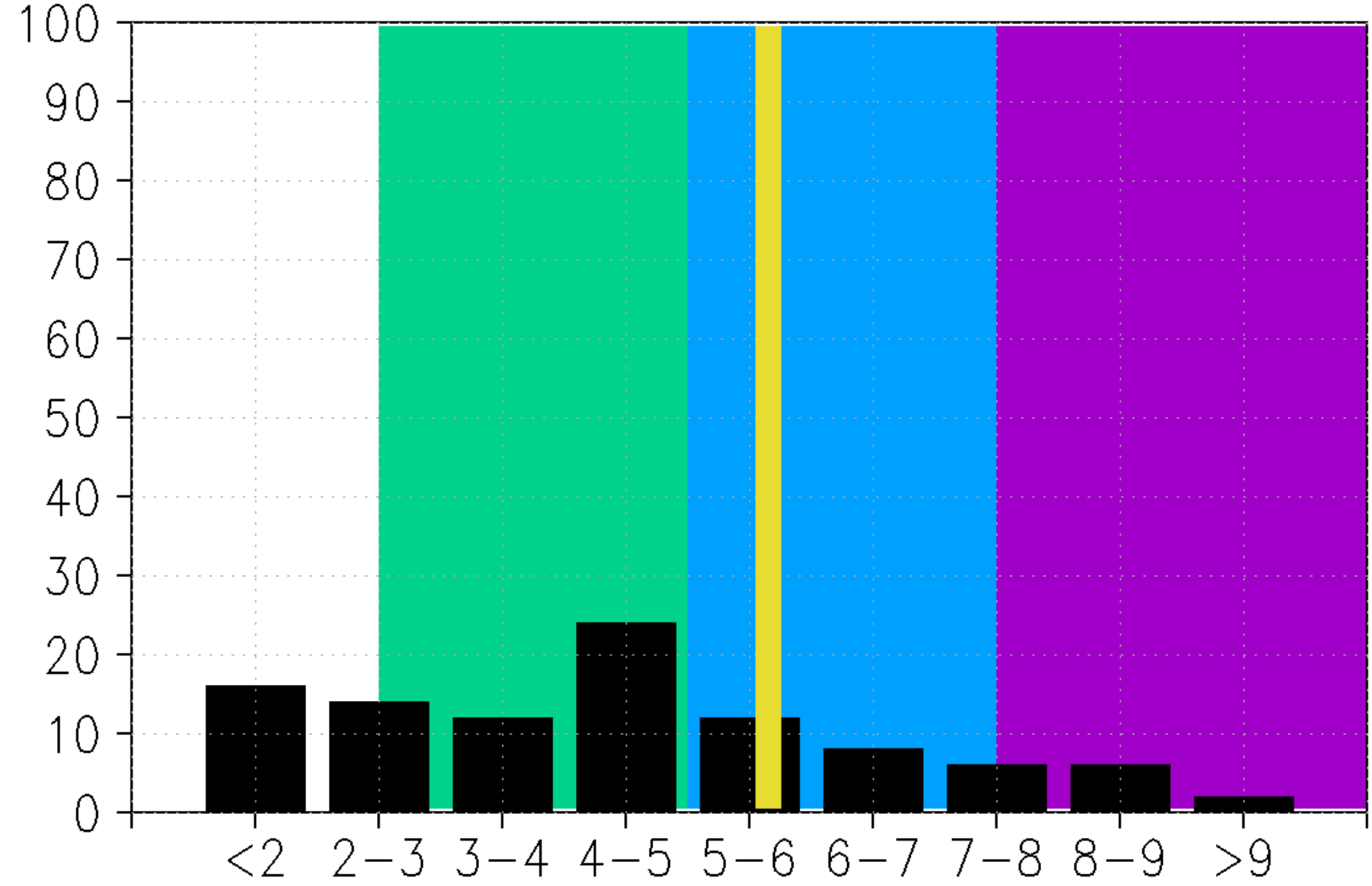
1-day forecast for 00 UTC 15 Sep



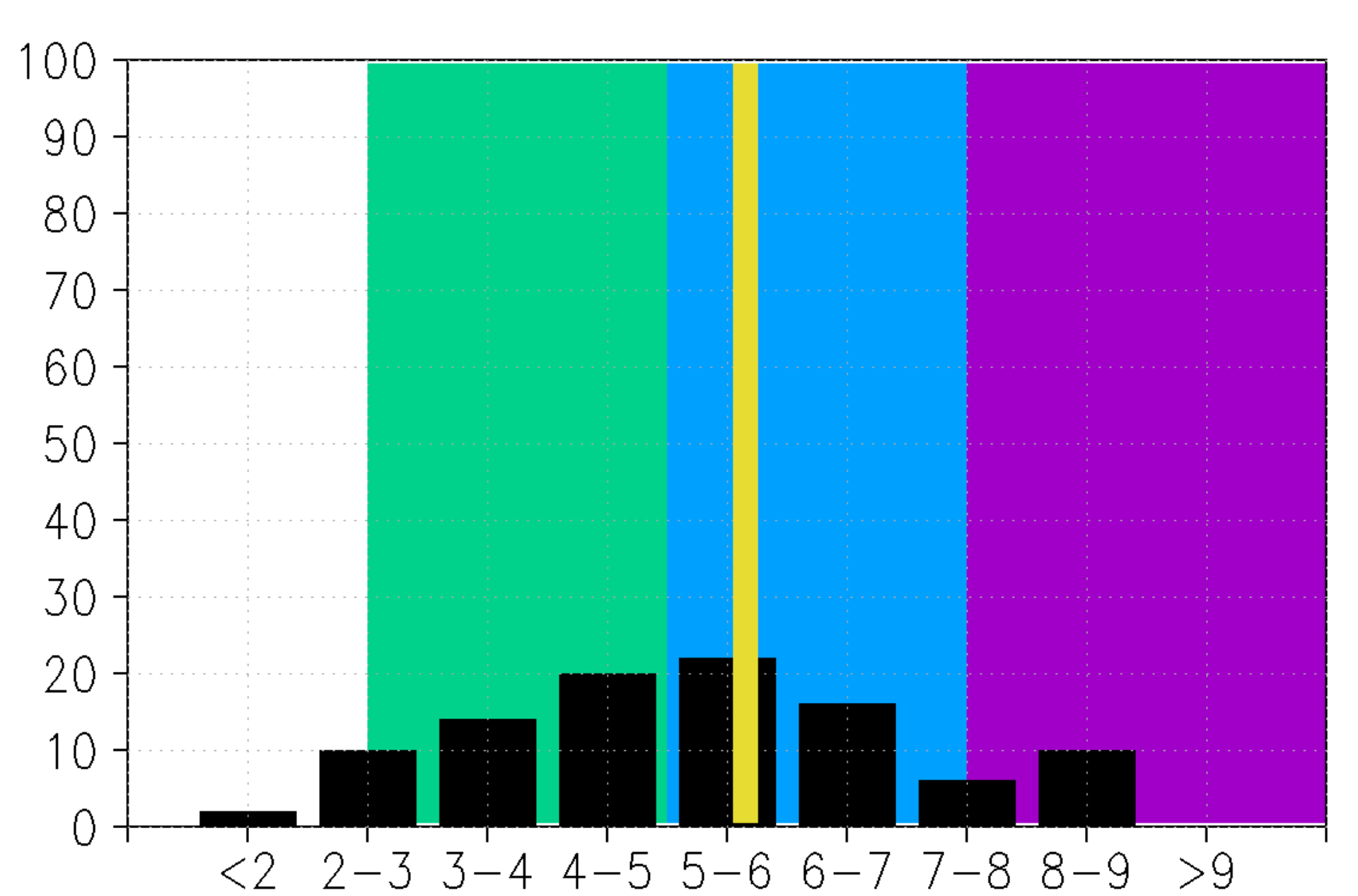
0-day forecast for 00 UTC 15 Sep



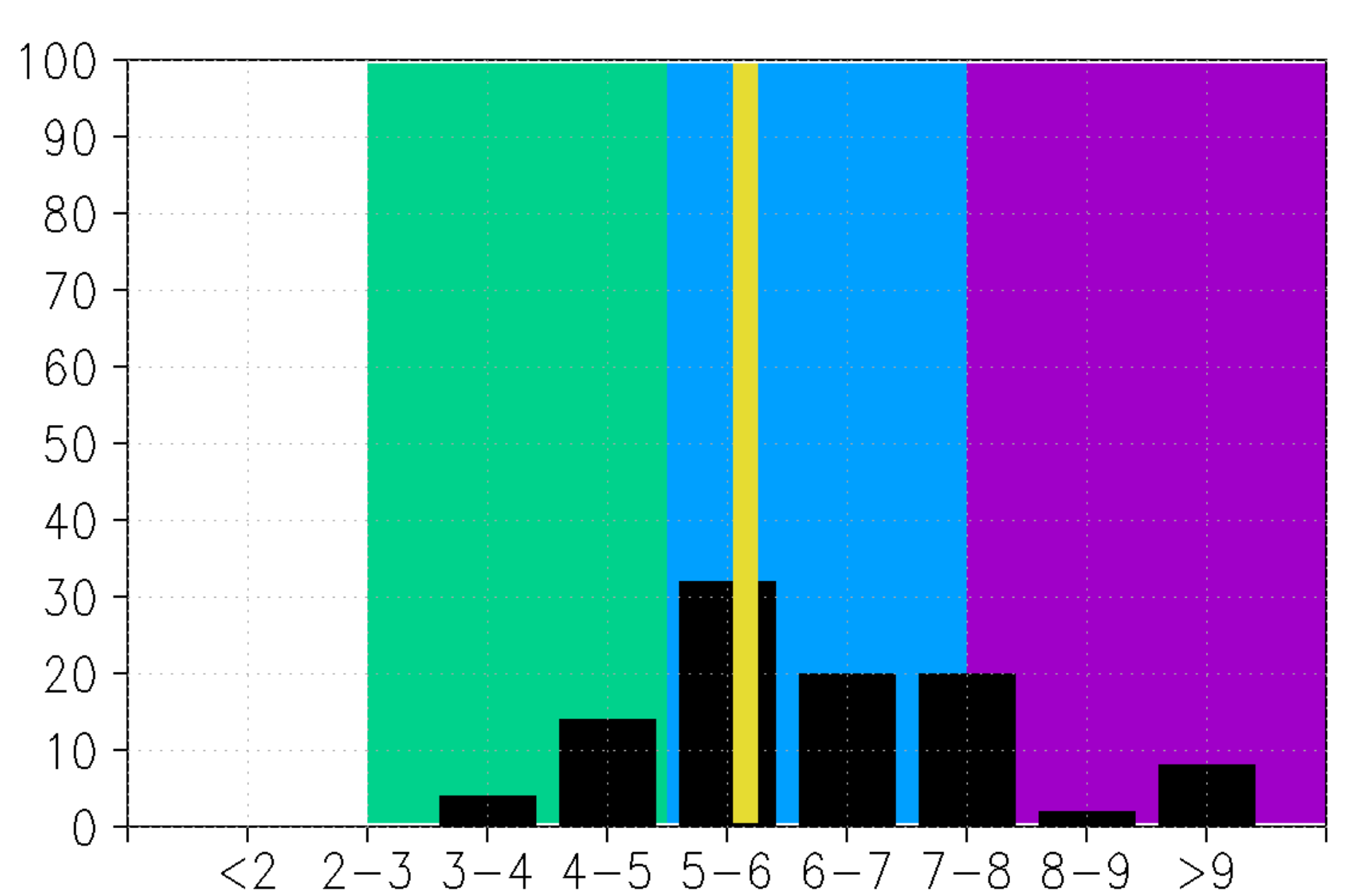
9-day forecast for 00 UTC 15 Sep



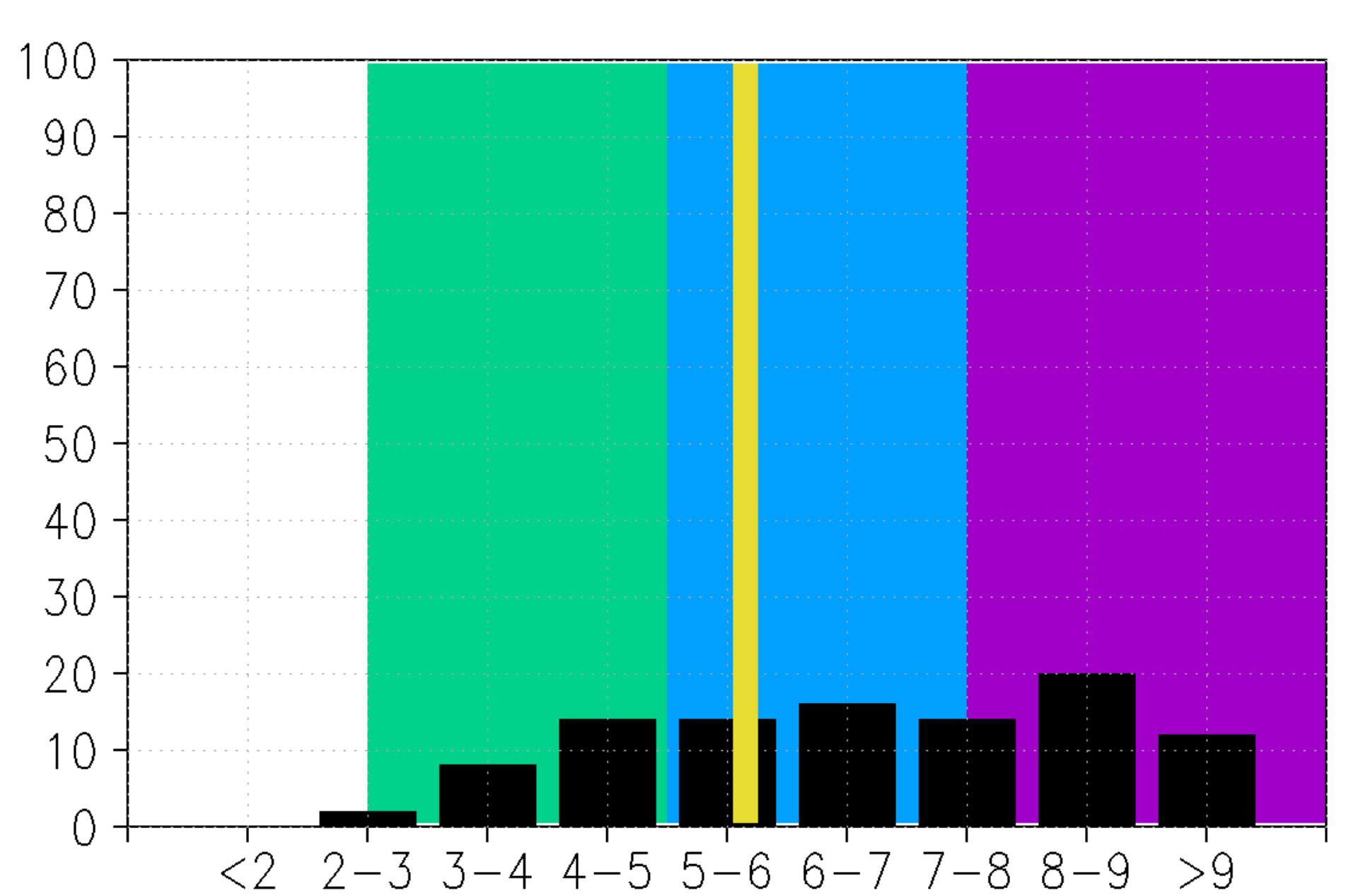
8-day forecast for 00 UTC 15 Sep



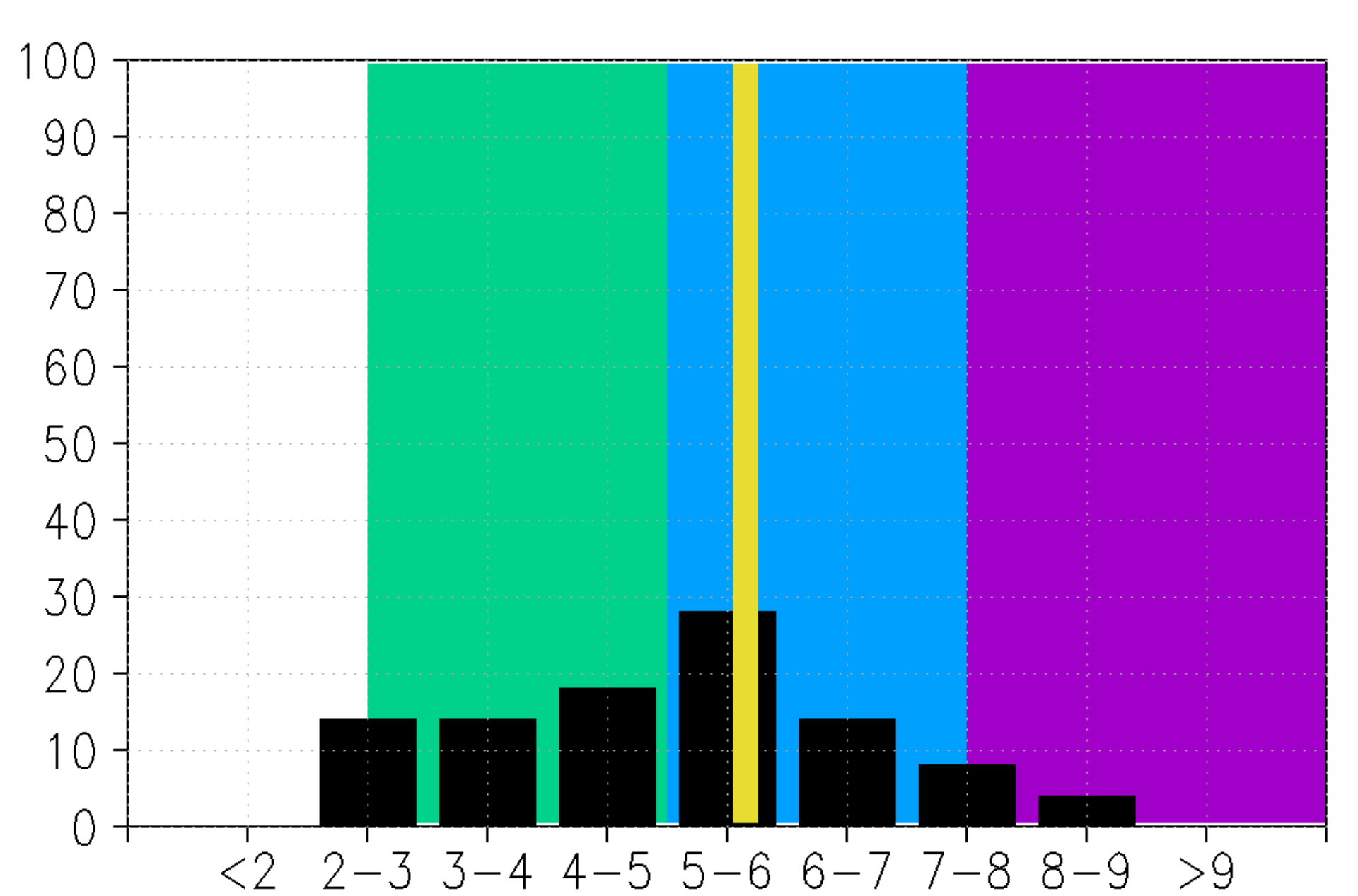
7-day forecast for 00 UTC 15 Sep



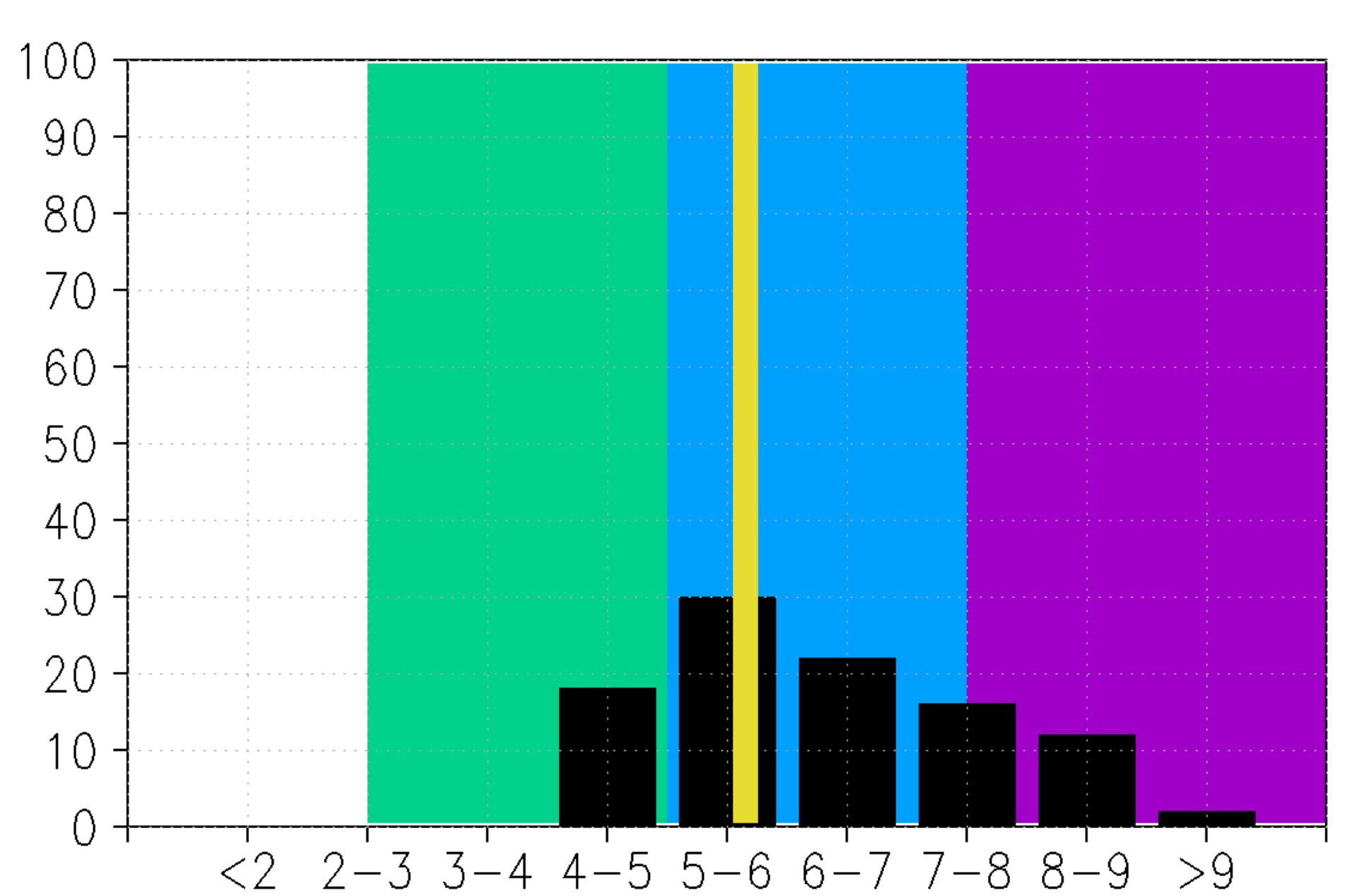
6-day forecast for 00 UTC 15 Sep



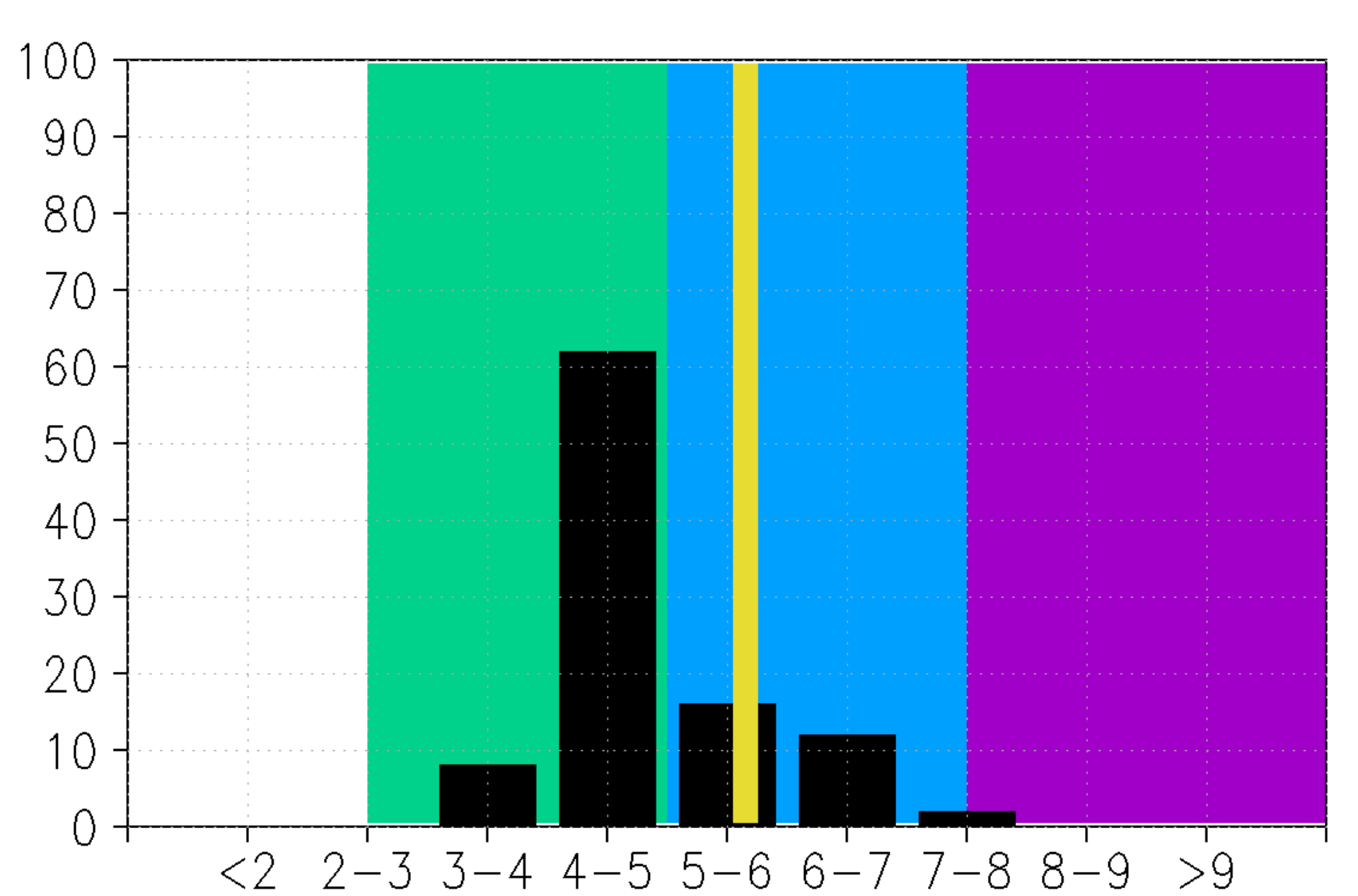
5-day forecast for 00 UTC 15 Sep



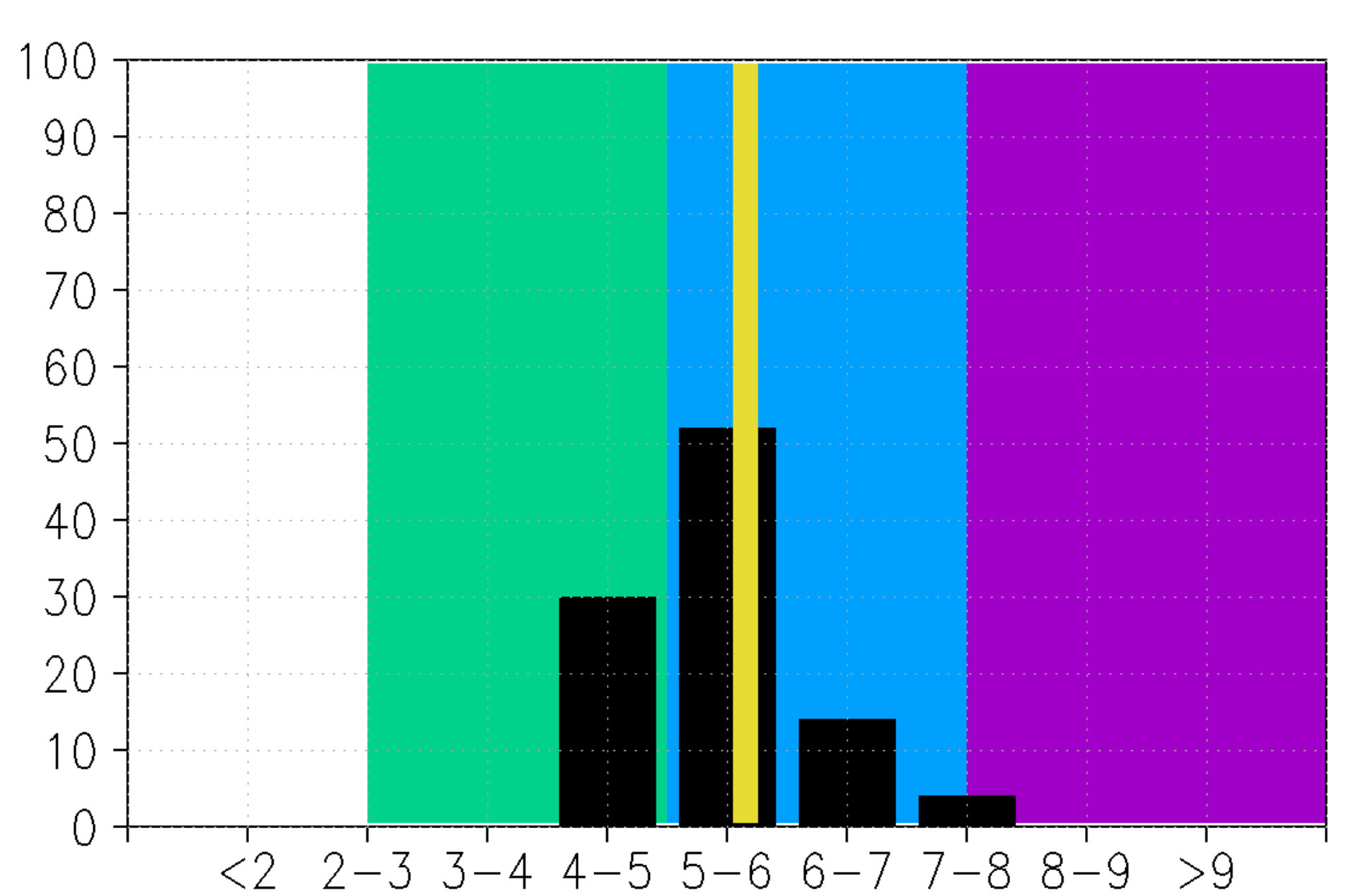
4-day forecast for 00 UTC 15 Sep



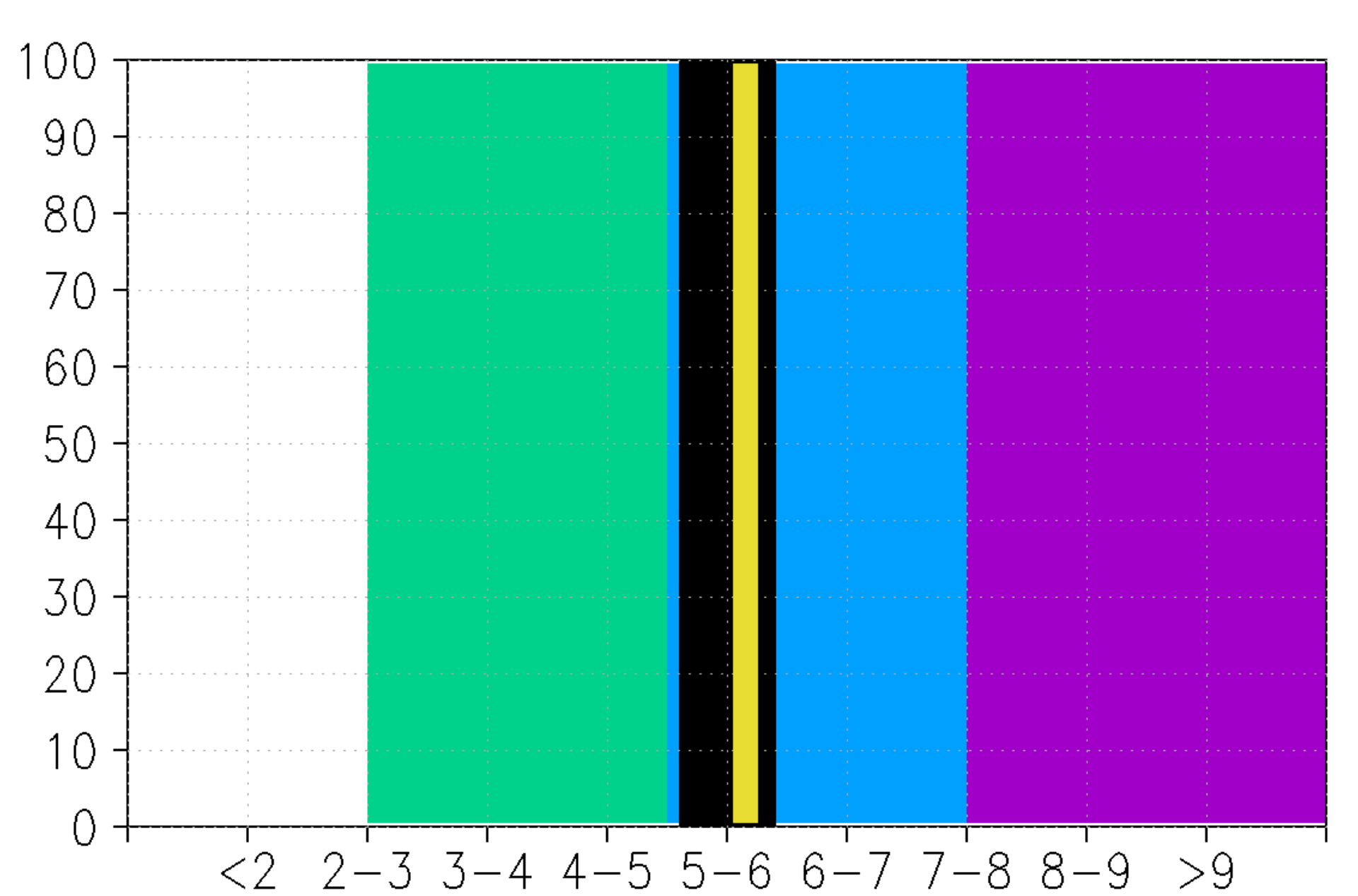
3-day forecast for 00 UTC 15 Sep



2-day forecast for 00 UTC 15 Sep

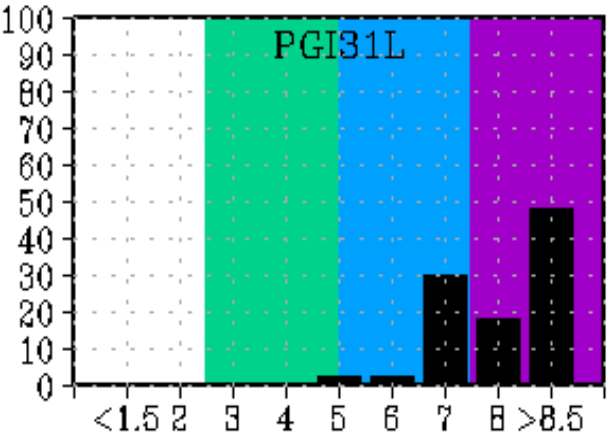


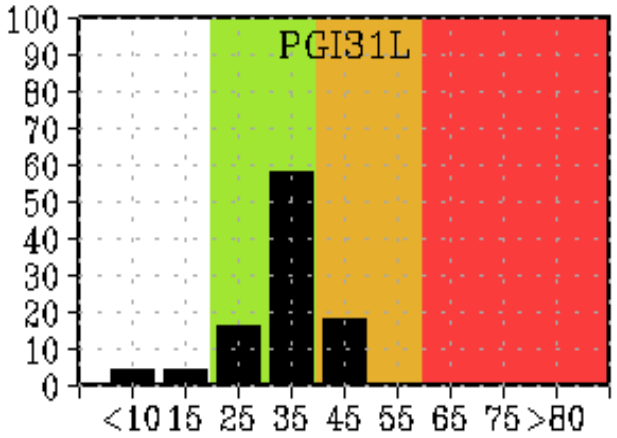
1-day forecast for 00 UTC 15 Sep

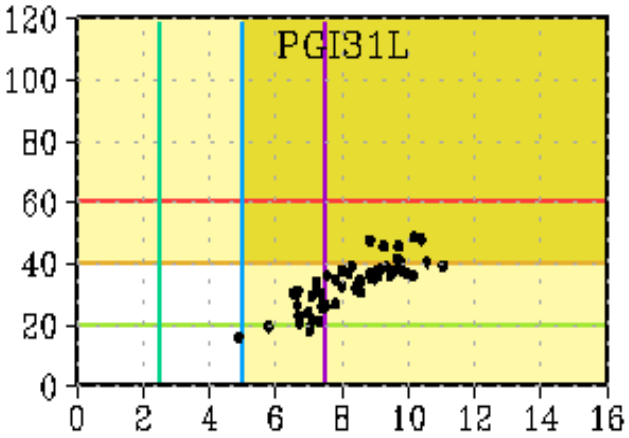


0-day forecast for 00 UTC 15 Sep

How to verify ensemble forecasts?







- First, verify each ensemble member individually to determine whether they meet some threshold criteria for genesis.
- How to determine these criteria?

ECMWF Analysis Fields

- Twice-daily analysis fields available from http://tigge.ecmwf.int
- 0.25° resolution available
- Here, use 0.5° resolution to be consistent with resolution of ensemble output.
- Begun a qualitative examination
- Next: quantitative examination. Can the genesis process be reliably determined objectively from a model, based on quantitative threshold values?
- If so, use these values to estimate genesis locations and times (+/- 24h?) in ensemble.

Qualitative examination

- Cases with area-averaged 700-850 hPa relative vorticity exceeding 4.5 x 10^{-5} s^{-1} for at least 1 day
  - All depressions except Colin
  - Pouches 06L, 16L, 18L, 24L, 39L, 47L, 63L

- Secondary criteria
  - Warm core: thickness anomaly > 10(?) m
  - MSLP < 1012 hPa with closed contours
  - 10-m wind speed > 10 m/s
  - 925 hPa Z < 790 m
  - O-W > 2 x 10^{-9} s^{-2}

Next …

- Tricky cases:
  - PGI 22L / Colin
  - PGI 39L
  - PGI 63L
- How to deal with marginal cases?
- Quantitative evaluations, extend to more seasons, stratify by AEWs / other types
- Offer hypotheses for sources of spread and error
- Products in 2011?