9TH INDIA INTERNATIONAL WATER WEEK 2026 · MINISTRY OF JAL SHAKTI, GOVERNMENT OF INDIA
THEMATIC FORUM TF-12 · CLIMATE CHANGE: ERRATIC PRECIPITATION · 14:15 TO 15:45 HRS

Geospatial AI for Monitoring and Predicting Erratic Precipitation Patterns under Climate Change

Implications for Reservoir Operations and Water Security in Peninsular India

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600,000
sq km drained by the Krishna and Godavari basins

10 million
hectares of irrigation dependent farmland

4.2 to 6.8
days, growth in mean mid-monsoon dry spell

15%
worsening in basin groundwater deficit

Source: Author analysis of GPM IMERG archive 2000 to 2024 and GRACE-FO terrestrial water storage, Krishna and Godavari basins. Mann-Kendall non-parametric trend test.

24 September 2026 · Bharat Mandapam, New Delhi

Reservoir rules calibrated on a history that no longer holds

The Krishna and Godavari systems drain 600,000 sq km of Peninsular India and support over 10 million hectares of irrigated farmland. Four reservoirs form the water security spine of Telangana: Nagarjuna Sagar, Srisailam, Sriramsagar, Pochampad. Their operating rules were built for historical averages, and the averages have moved: **operators now face spillway emergencies if storage is held high, and critical under-storage if drawdown is conservative.**

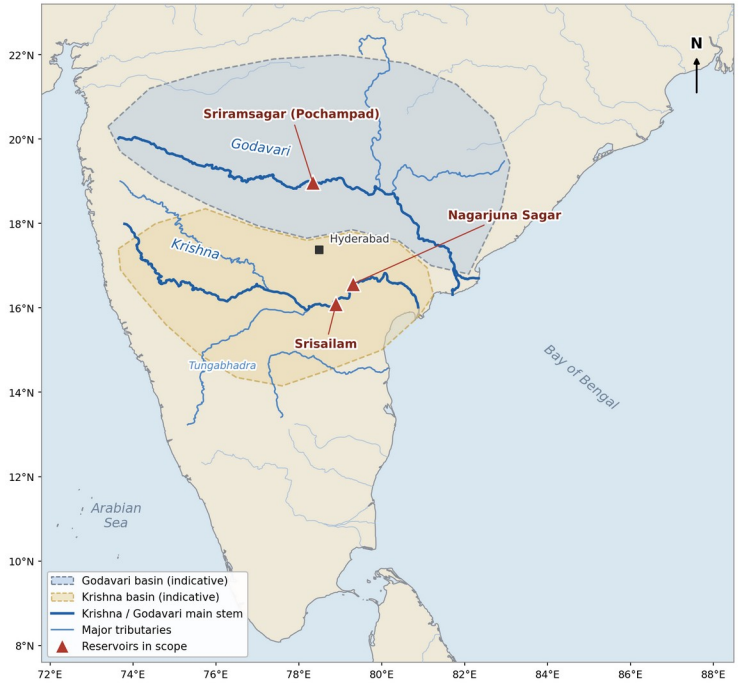


Fig. 1. Study area: the Krishna and Godavari river basins with the reservoirs in scope. Rivers and coastline: Natural Earth 10m cartographic data; basin extents indicative.

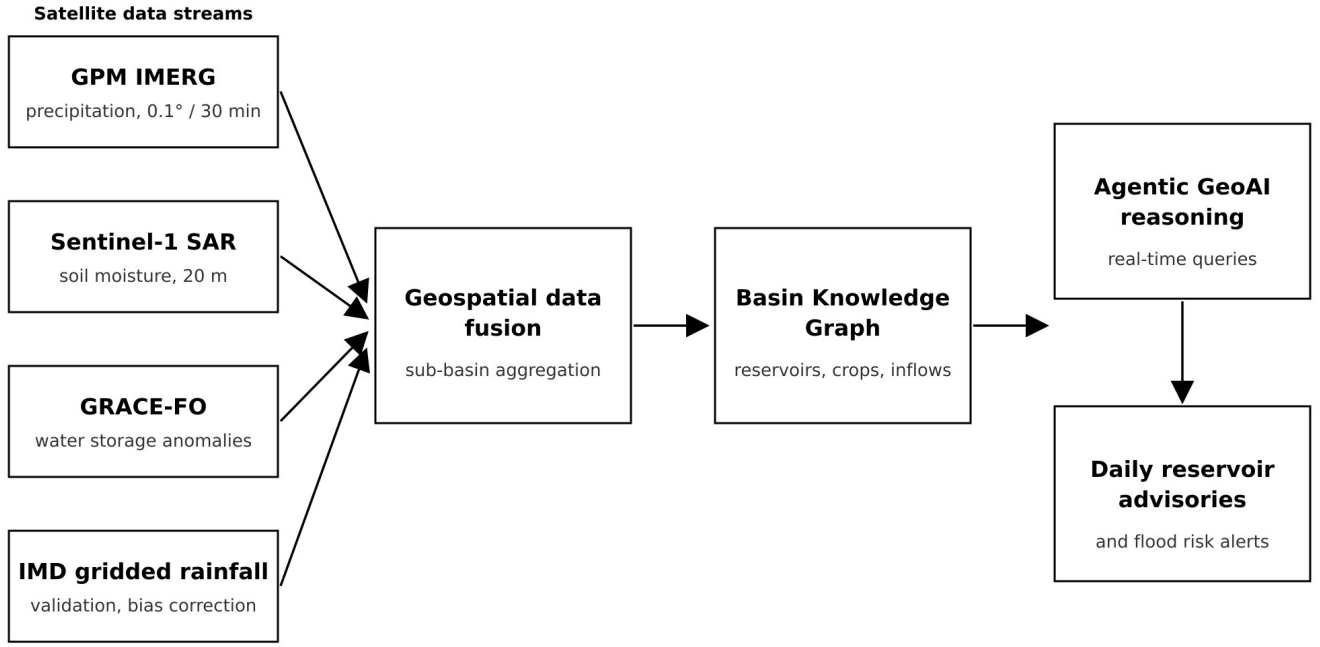


Fig. 2. Anvīkṣaṇa data integration architecture: satellite streams referenced against IMD gridded rainfall, fused into a basin Knowledge Graph queried by an Agentic GeoAI layer (IMERG validation: Prakash et al., 2016).

The Krishna basin is measurably more erratic

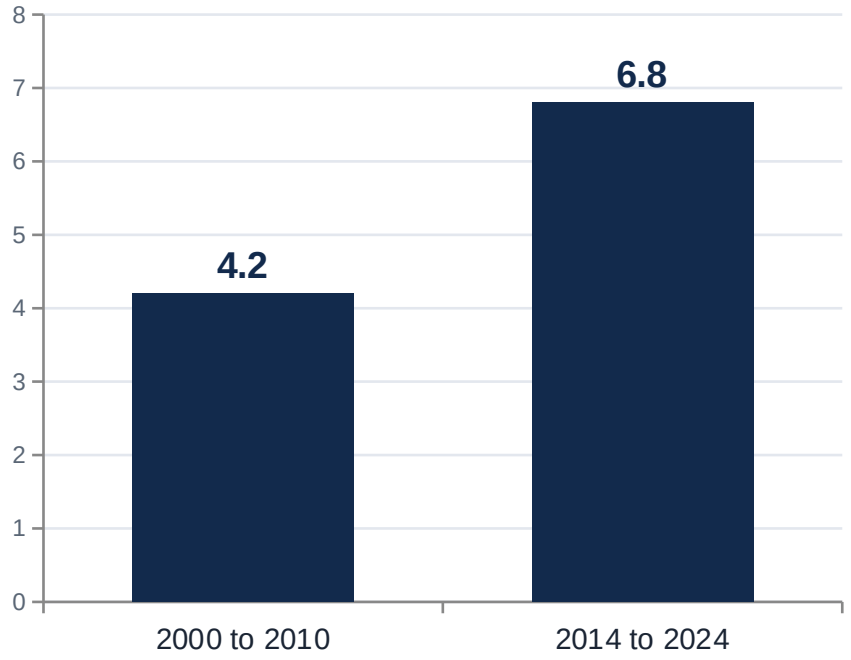


Fig. 3. Mean mid-monsoon dry spell duration (days), Telangana portion of the Krishna basin. Author analysis, GPM IMERG Late Run archive; Mann-Kendall test, $p < 0.01$.

62% increase in mean dry spell duration; extreme event frequency up at $p < 0.01$

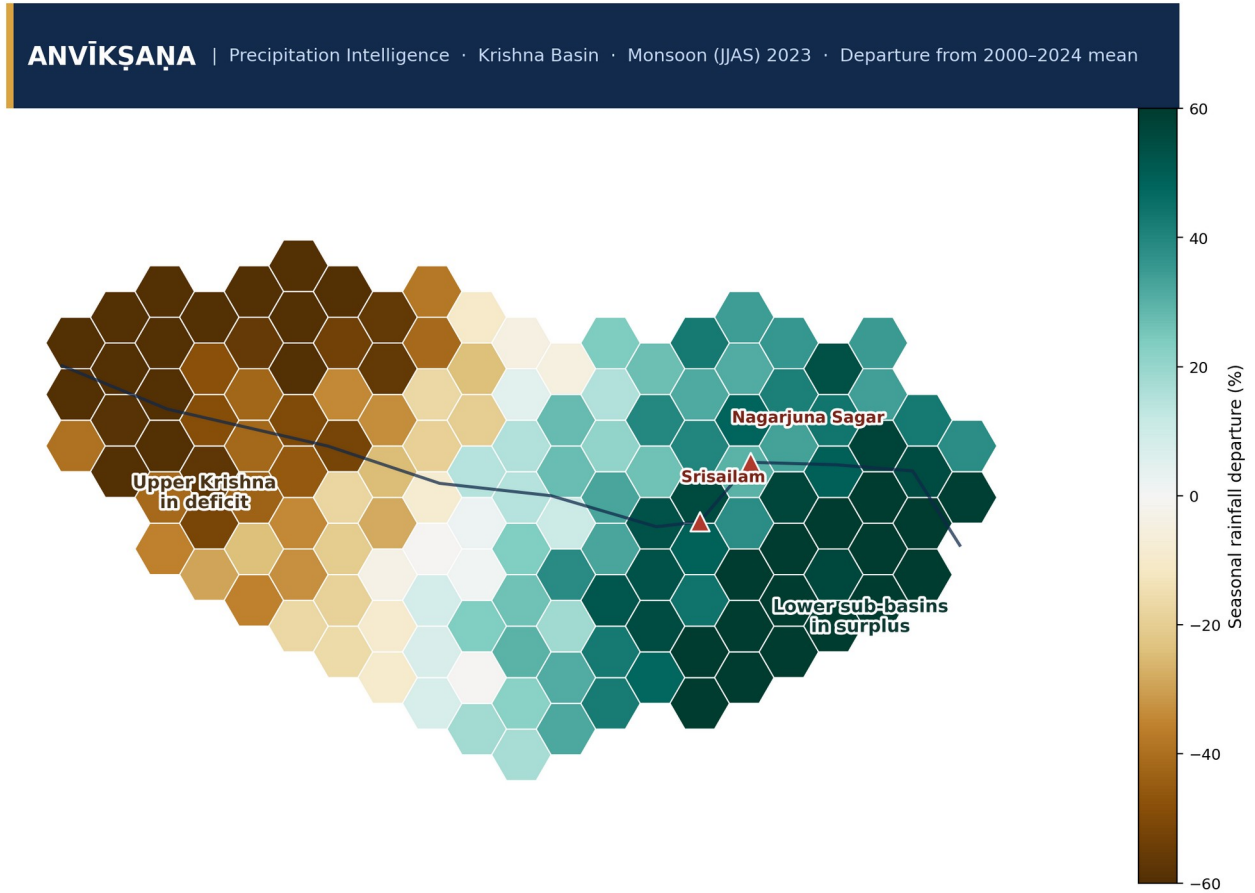


Fig. 4. Sub-basins diverge within the same season: one in deficit while another floods, heterogeneity that gauge network monitoring systematically misrepresents. Representative Anvīkṣaṇa sub-basin precipitation view; cell values illustrative.

What open satellite data can already deliver

Can a reservoir Elevation-Area-Capacity curve be derived from open satellite data alone, with no gauge readings?

Water spread area	ISRO Bhuvan, Know Your Water Body module, optical extent per date
Water level	DAHITI altimetry, target 17805, Sentinel-3A; 190 observations since 2016
Validation rule	Area must increase as level rises; 9 of 20 scenes passed, 11 rejected
Volume	Prismoidal formula between consecutive validated elevation-area pairs

RESULT EAC curve from 157.4 to 174.7 m elevation: 3,636 MCum incremental capacity (128.4 TMC). No gauge data used.

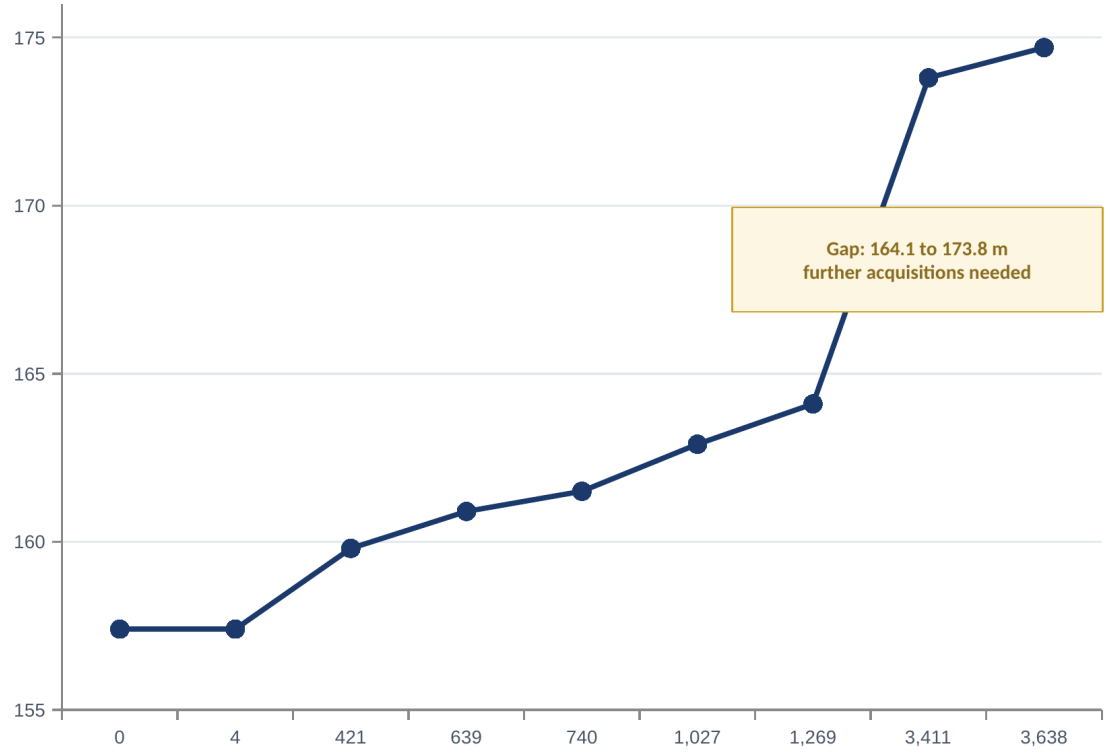


Fig. 5. Satellite derived Elevation-Area-Capacity curve, Nagarjuna Sagar reservoir. Water spread area from ISRO Bhuvan; water level from DAHITI target 17805, Sentinel-3A altimetry; capacity by prismoidal formula between validated pairs. Author analysis.

Nagarjuna Sagar is one of the largest masonry dams in the world. Its EAC curve underpins its operating rules and can now be refreshed between survey cycles.

Retrospective validation, 2019 to 2023

TABLE I

AGENTIC GEOAI ADVISORIES REPLAYED AGAINST RECORDED OPERATIONS, NAGARJUNA SAGAR

Season	Recorded event	Advisory trajectory
2019	Near-spillway emergency	Would have avoided the event
2020	Critical low storage	Would have avoided the event
2021	Near-spillway emergency	Would have avoided the event
2022	Near-spillway emergency	Would have avoided the event
2023	Critical low storage	Would have avoided the event

Method: advisories generated retrospectively against archived GPM IMERG, Sentinel-1 and GRACE-FO inputs for each season, then compared with the recorded operational decisions held by the Telangana Irrigation and CAD Department. Author analysis, Narayanam (2025).

3 near-spillway emergency operations

2 critical low-storage situations

These are not modelled scenarios. Each of the five is an event that occurred and is recorded in the operational history of the reservoir.

Give existing water infrastructure the intelligence layer it has lacked

01

Indian sovereign foundation

IMD gridded rainfall, CWC hydrological records and NRSC Bhuvan products are the reference layer: every satellite stream is bias corrected and validated against them. The design extends what India has already built.

02

Provenance and auditability

Every input to a release or drawdown decision carries its source, timestamp and confidence level through the Knowledge Graph. An advisory can be inspected end to end, from satellite observation to operator action.

03

Deployment readiness

Aligned to OGC open standards and ready for operational partnership with the Telangana Irrigation and CAD Department, integrating with existing Reservoir Management Information Systems rather than replacing them.

When an operator makes a release decision during an extreme event, that decision should be traceable from the satellite observation to the advisory.

Standards: OGC API Connected Systems · STAC · IEEE GRSS DMEW · Telangana Irrigation and CAD Department RMIS

Thank you

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