National Center of Climate and
Drought crisis Management

وزارت راه و شهرسازی
سازمان هواشناسی کشور
مرکز ملی اقلیم و مدیریت بحران خشکسالی

بسم‌الله‌الرحمن الرحيم

CRISIS MANAGEMENT UNDER EL NIÑO CONDITIONS

Scenario-Based Outlook for Autumn – Early Winter 2026/27
Southwest Asia with focus on Iran’s topographic and climatic diversity

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Training Workshop | 2026

Core Principles Guiding This Assessment

1. Probabilistic, not deterministic

El Niño raises probabilities but does not guarantee outcomes. Concurrent IOD, MJO, QBO and NAO can enhance, lessen or redistribute impacts.

2. Weak direct ENSO–winter rain link

Long-term correlations between Niño 3.4 and winter precipitation over large parts of Southwest Asia are only weak to moderate.

3. Indirect pathway via IOD + MJO timing

Positive IOD often provides the clearer moisture pathway. On 1–4 week scales the MJO frequently controls multi-day heavy rainfall episodes.

4. Topography converts rain into hazard

Zagros → flash floods; lowlands → inundation; Caspian and interior zones often respond differently to the same large-scale signal.

Current Boundary Conditions (SEP 2026)

+2.0 to +2.6°C

Niño 3.4 (Jul–Aug-Sep)

Near 100%

Persistence into DJF 2026/27

Positive IOD

SON forecast ~ +0.5°C

Very Strong

Expected peak intensity

What this means

- Favorable large-scale setting for autumn moisture
- Positive IOD historically supports enhanced moisture transport
- Still only a probability shift – not a guarantee of heavy rain
- Winter precipitation remains weakly constrained by ENSO alone

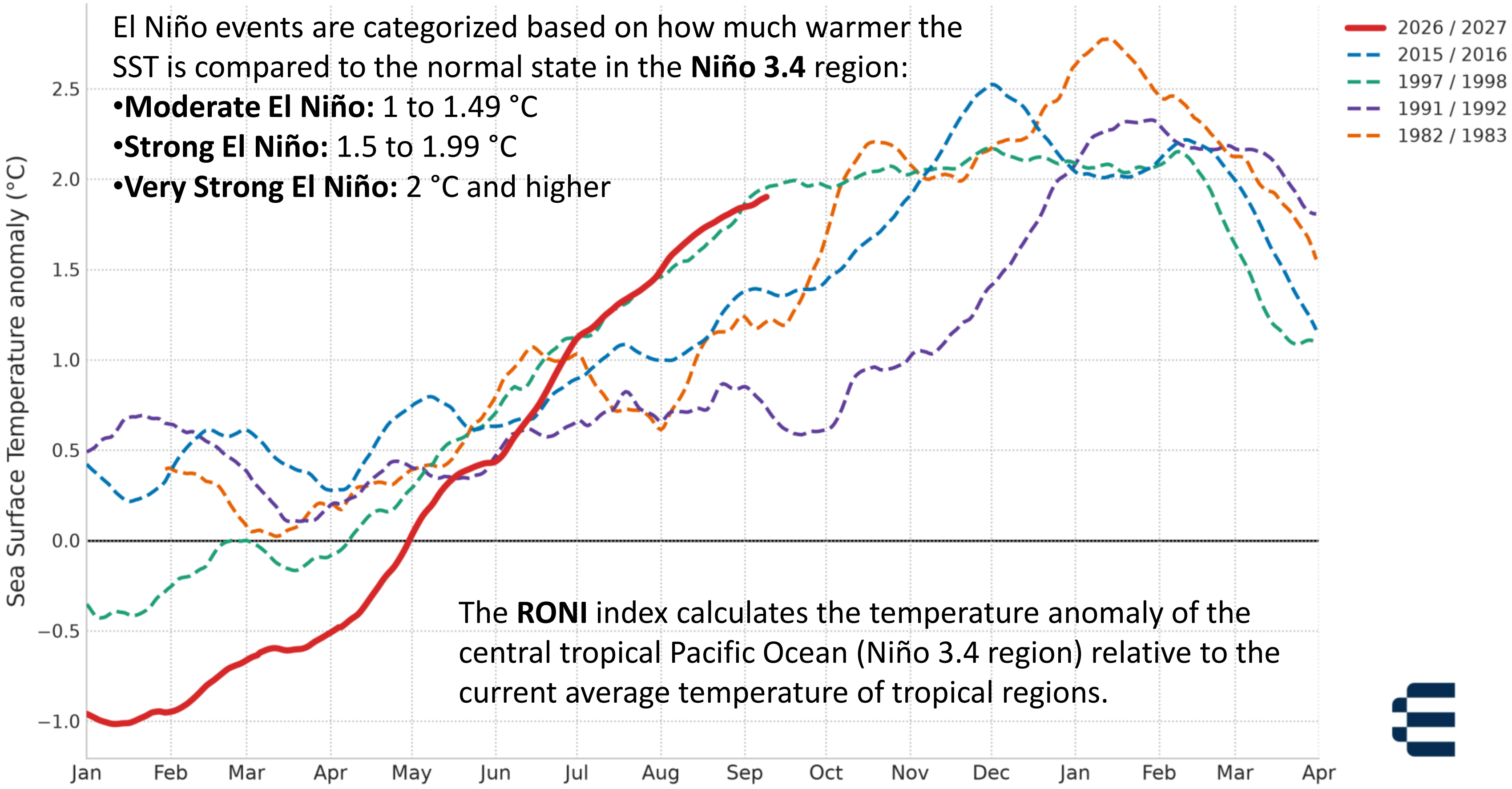
What still decides the outcome

- MJO phase and amplitude (timing of heavy-rain episodes)
- Position and strength of the subtropical jet
- Concurrent extratropical (NAO/AO) pattern
- Antecedent soil moisture and local topography
- Daily and weekly forecast evolution

WMO El Niño/La Niña Update August 2026; GSCU SON 2026

El Niño strength tracker

Sea surface temperature anomalies in the central equatorial Pacific for the 30 days period to 09 September 2026, relative to the tropical average



El Niño events are categorized based on how much warmer the SST is compared to the normal state in the **Niño 3.4** region:

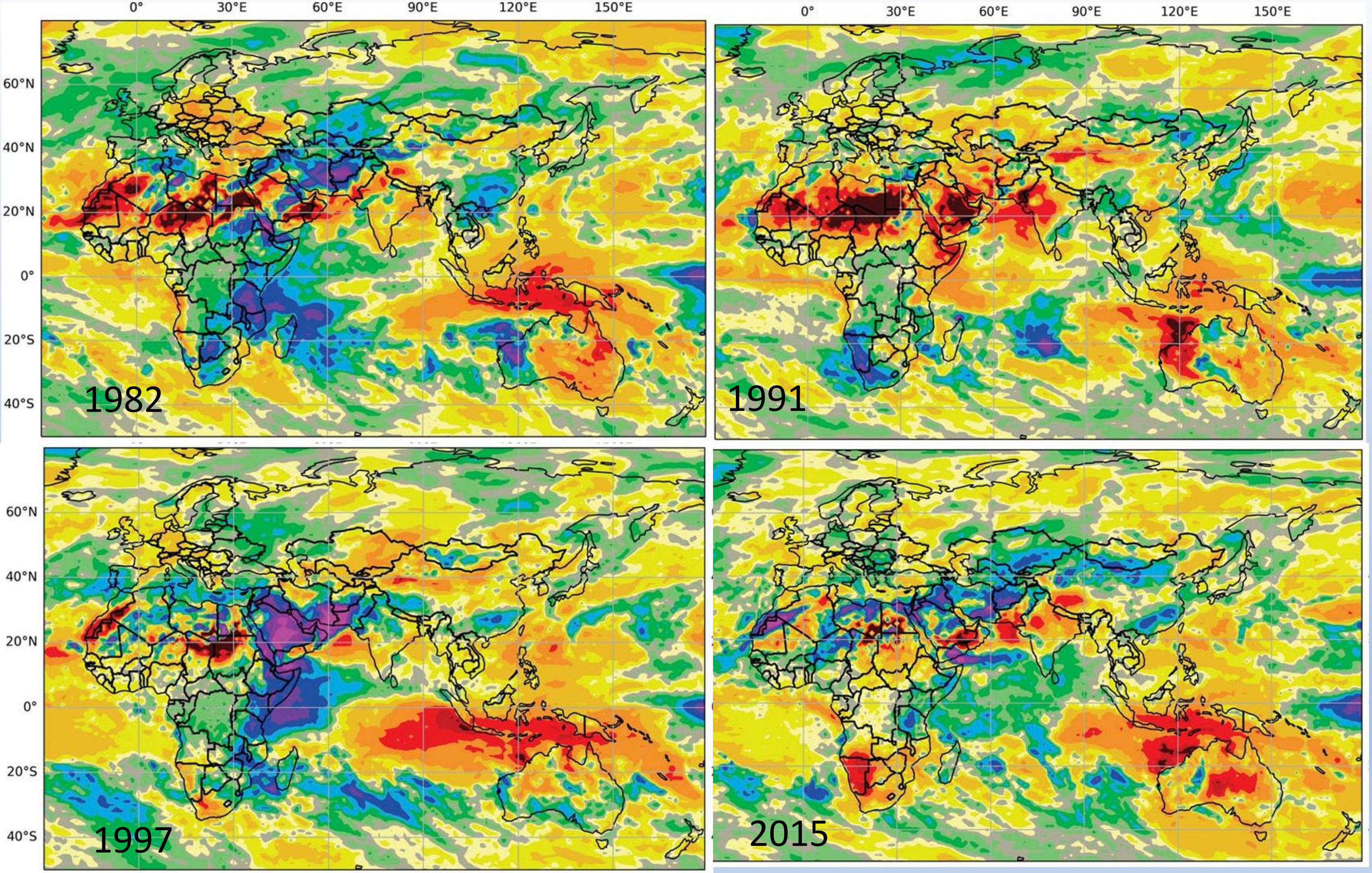
- **Moderate El Niño:** 1 to 1.49 °C
- **Strong El Niño:** 1.5 to 1.99 °C
- **Very Strong El Niño:** 2 °C and higher

The **RONI** index calculates the temperature anomaly of the central tropical Pacific Ocean (Niño 3.4 region) relative to the current average temperature of tropical regions.

Source: Earth Sciences New Zealand | Relative Oceanic Nino 3.4 Index, using daily OISST v2.1 data to 09 September 2026

Super Elninio years % of NP for SON

(1991-2020)



Driver Chain and Topographic Modulation

El Niño

Boundary condition

IOD

Moisture pathway

MJO

Timing of heavy rain

Topography

Flash flood or inundation

Zagros Mountains

Flash floods, rapid river rises

Orographic enhancement; steep valleys convert moderate rain into high-impact runoff.

SW Lowlands / Khuzestan

Widespread inundation (low probability)

Flat terrain and slow drainage; same rainfall produces broader, longer-lasting flooding.

Caspian & Alborz

Different moisture regime

Often different teleconnection signal strength compared with the Zagros side.

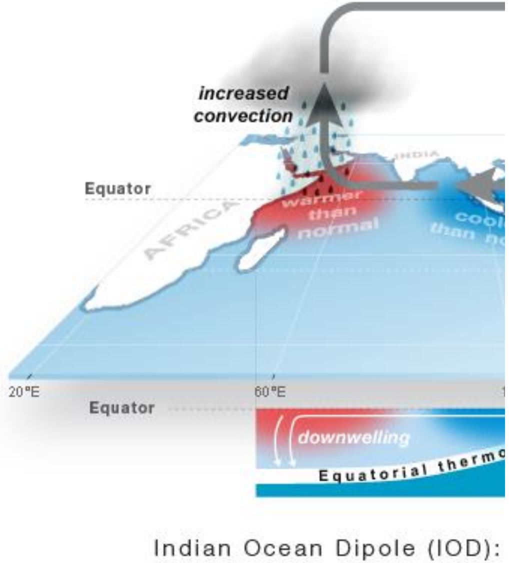
Interior Plateaus- the Central Basin

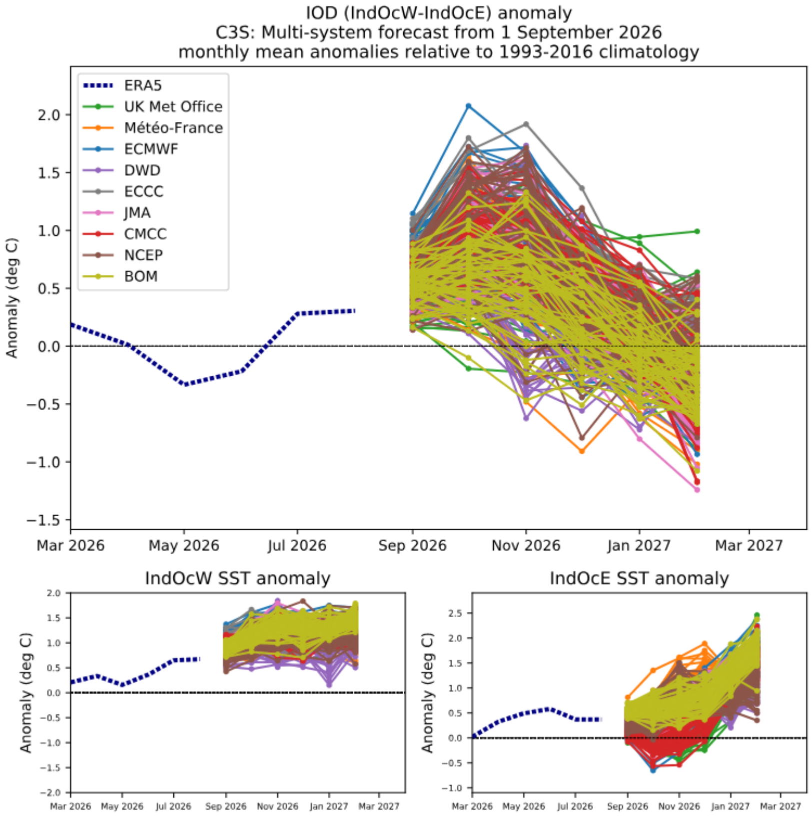
Localised convection

Generally weaker direct ENSO link; hazards more intermittent and limited.

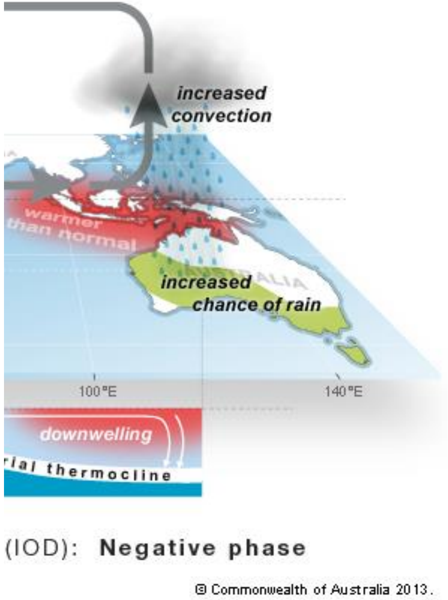
IRIMO climatology and hydrological-meteorological assessments

Indian Ocean Dipole-IOD





IOD (IndOcW-IndOcE) anomaly
C3S: Multi-system forecast from 1 September 2026
monthly mean anomalies relative to 1993-2016 climatology

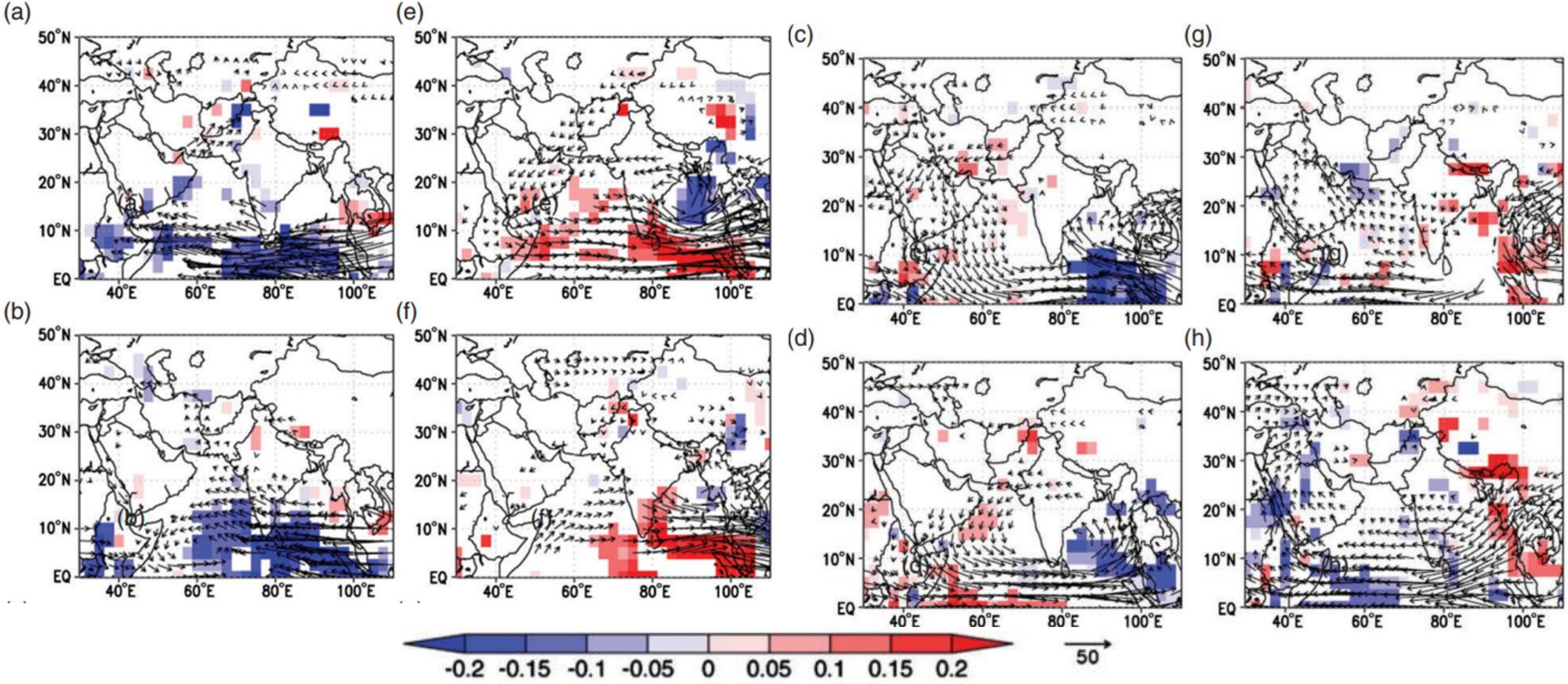


ENSO → Walker circulation → TWEIO → Diabatic heating → Rossby wave in IO → Changes in SWJ → Western Disturbances → CSWA Rain

MJO Impact on Iran Precipitation (183 Stations):

☐ Phases 1–2 & 7–8 (Wet): Enhance Western Indian Ocean moisture flux into southern Iran.

☐ Phases 3–6 (Dry): Induce northerly winds, leading to drier conditions.



Refrence: Pourasghar, DOI: 10.1002/asl2.531

Forecast Scales and Historical Context

What each scale can deliver

Seasonal (3 months)

Probability shift and scenario framework only. Strategic preparedness.

Weekly / Sub-seasonal

MJO windows; elevated-risk periods 1–3 weeks ahead.

Daily / Short-range

Actual timing and location of heavy rain and flash-flood potential.

Documented heavy-rain episodes

1997 Oct–Nov

Zagros & SW – intense multi-day rains, rapid rises

2002 November

Zagros–Khuzestan – heavy convection, local floods

2009 Oct–Nov

Southwest – above-normal totals, lowland flooding

2015 November

Western provinces – short heavy rain, active MJO

2018 Oct–Nov

Parts of SW Asia – enhanced autumn rains

IRIMO archives; illustrative cases, not predictions

Three Working Scenarios for Autumn–Early Winter

A

Enhanced Moisture

Highest flash-flood and inundation risk in western & southwestern basins

Condition: Positive IOD fully develops + recurrent active MJO phases + Favourable Extratropical Pattern Negative (-NAO/AO)

B

Average / Patchy

Near-normal or spatially uneven rainfall; localised convective hazards still possible

Condition: IOD near neutral or MJO remains weak/inactive

C

Delayed / Reduced

Lower-than-expected Rain; drought-watch will continue in interior zones

Condition: Suppressed MJO or unfavourable extratropical pattern

Compound Scenario: Warmer Autumn Rain → Water & Energy Stress

The compound risk-Even in a wet Autumn

- Above-normal temperatures in autumn–early-winter
- Probable reduced snow share, especially over the Zagros.
- River flows rise earlier, reservoirs currently have free capacity
- Uncertainty in mid-to-late winter and spring rainfall- difficult storage-management dilemma.
    - The need to secure water for the next dry summer ahead,
    - Probable cold outbreaks with possible gas shortages then shift load onto the electricity system.

WATER SIDE

- Earlier and rain-dominated inflows in Zagros basins
- Reservoirs have seasonal free capacity – can accept early water
- Risk: over-release or over-storage decisions if later winter/spring is dry
- Need: flexible rule curves + continuous update of residual seasonal rainfall probability

ENERGY SIDE

- Possible higher winter heating demand (cold outbreaks still occur under El Niño)
- Gas-supply stress can shift load to electricity
- Hydropower may benefit from early inflows but cannot be relied upon for the whole season
- Need: coordinated water–power operating rules and demand-side contingency plans

Compound risk framed from IRIMO climate monitoring + water/energy sector consultations

Managing the Compound Water–Energy Scenario

1. **Dynamic reservoir rule curves**

   Replace fixed seasonal targets with rules that are updated every 2–4 weeks using the updated weather signals probability (IOD + MJO + model outlooks).

2. **Snow–rain ratio monitoring**

   Look for temperature and freezing-level forecasts over the Zagros in every synoptic weather systems so that the expected rain/snow partition and timing of runoff are continuously revised- Weather NWP models are very good

3. **Joint water–power operating committee**

   Standing coordination unit (energy + water + meteorology) that meets weekly during the autumn–winter window to align storage, release and generation decisions.

4. **Demand-side and fuel contingency**

   Pre-agreed measures for possible gas shortfalls (priority users, temporary fuel switching, public messaging) so that electricity demand spikes do not cascade into wider system stress.

5. **Scenario-triggered readiness levels**

   Define clear thresholds (e.g., successive active MJO phases + above-normal temperature/Rainfall) that automatically raise or lower water-storage and energy-contingency postures.

Actions Already Under Way | Crisis-Management Priorities

Already implemented

1. **Multi-driver monitoring (ENSO, IOD, MJO, QBO, NAO) with weekly updates**
2. **Scenario-based monthly and seasonal outlooks to ministries**
3. **Targeted briefings for water, energy, agriculture, health and crisis bodies**
4. **Basin-scale probabilistic rainfall and SPI/SPEI products**
5. **MJO training for provincial meteorological staff**
6. **Strengthened protocols for rapid daily-warning transfer to field agencies**

Priority actions for crisis bodies

1. **Multi-scenario plans switchable within days between wet and dry orientations**
2. **Topography-aware provincial readiness (higher readiness in Zagros & SW)**
3. **Flash-flood protocols triggered by daily forecasts ahead of active-MJO windows**
4. **Practised Met Service ↔ Field Agency communication chain**
5. **Public messaging that states probabilities and the possibility of rapid change**
6. **Post event documentation for the next strong El Niño season**

Key Messages for Decision Makers

1. Very strong El Niño is present and will persist, but it is not a deterministic predictor of Cold season rainfall over Southwest Asia.
2. Positive IOD raises autumn moisture probability; MJO largely controls intra-seasonal timeframes.
3. Iran’s topography Plays a key role and may convert the same rainfall into a flash flood (Zagros) or broader inundation (lowlands).
4. Warmer autumn can reduce snow share, lead to early river flows and create a compound water–energy management dilemma.
5. Seasonal forecasts set scenarios; flood occurrence and storage decisions require weekly and daily forecast updates.
6. Tight Met Service ⟷ water/energy/field-agency cooperation is indispensable for safe management.

با تشکر از توجه شما

Thank you for your attention

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