



Weathering the Storm in Warfare

May 2025

Agenda

Tomorrow.io at a glance

Weather & Defense

Use Cases

Tomorrow.io at a Glance

Powering Global Resilience with Weather Intelligence

2016

Founded
in Boston, MA

150+

Employees
across global offices

250+

Enterprise & government
customers worldwide

1M+

of app
downloads

100K+

Developers building
on our platform

Trusted By



Uber



DELTA



Trusted by the Top Brass



“Tomorrow.io to Rebuild NOAA’s Weather Data Models in the Cloud.”

“Tomorrow.io and NOAA Enter Cooperative Research and Development Agreement.”

POLITICO



“United States Air Force Awards \$19.3M to Tomorrow.io for First Satellites.”

CNN



“Tomorrow.io Informs WMO on Cutting-Edge Precipitation Measurements and Applications from Space.”

MIT
Technology
Review



DEFENSE
INNOVATION UNIT

“DIU Selects Tomorrow.io for U.S. Military Weather Modeling Project.”

“Tomorrow.io to Support FAA Project for Urban Mobility.”

MIT
Technology
Review

Nussbaum

[intact]

Microsoft



nationalgrid



Azul

IndiGrid

DELTA

SB Energy

Shipt

PATRIOTS

evergy

USTA - US OPEN



Uber

aws

Google Cloud

BILL & MELINDA
GATES foundation

LIVE
NATION

jetBlue

zomato

ITS ConGlobal

PROCORE

BLACK|SKY

2023

We Did It



CURRENT PLAN

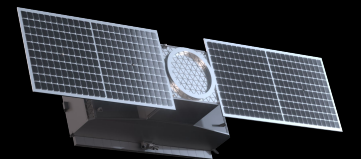
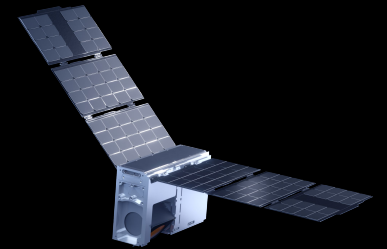
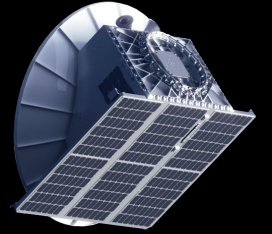
Tomorrow.io Gen-1 Constellation

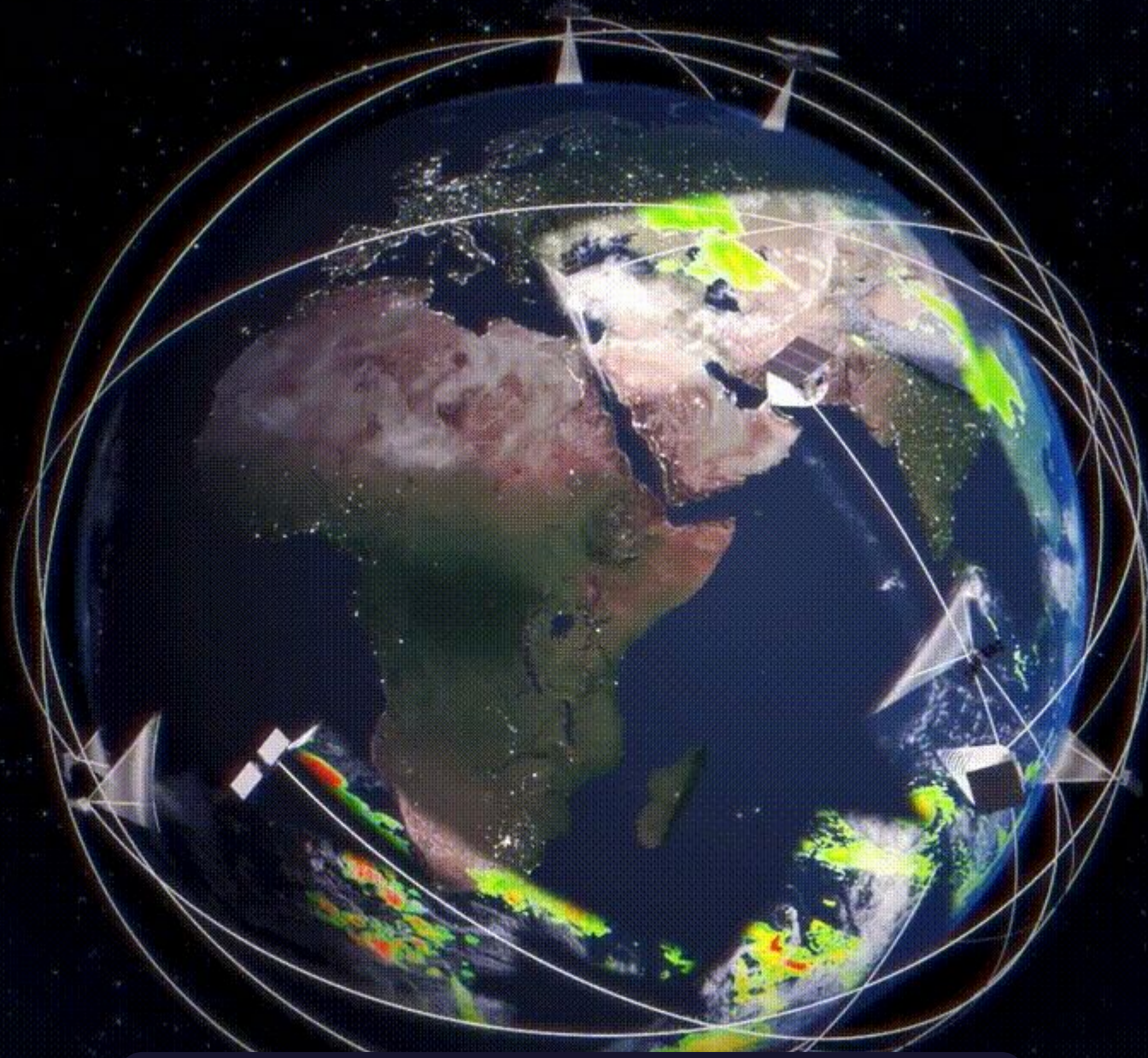
Goal: Hybrid constellation of 22 small Satellites In Low Earth Orbit

- 14+ Microwave Sounders **(7 currently on orbit)**
- 8 Precipitation Radars **(2 on Orbit!)**

Fully Deployed Constellation Capabilities

- Full Global Coverage
- <1 hour average revisit rate
- Vastly improving coverage of near real-time precipitation estimates and 3D atmospheric profiles
- Collects valuable data for precipitation nowcasts, rapid-refresh forecast models, tropical cyclone warnings, and flood alerts

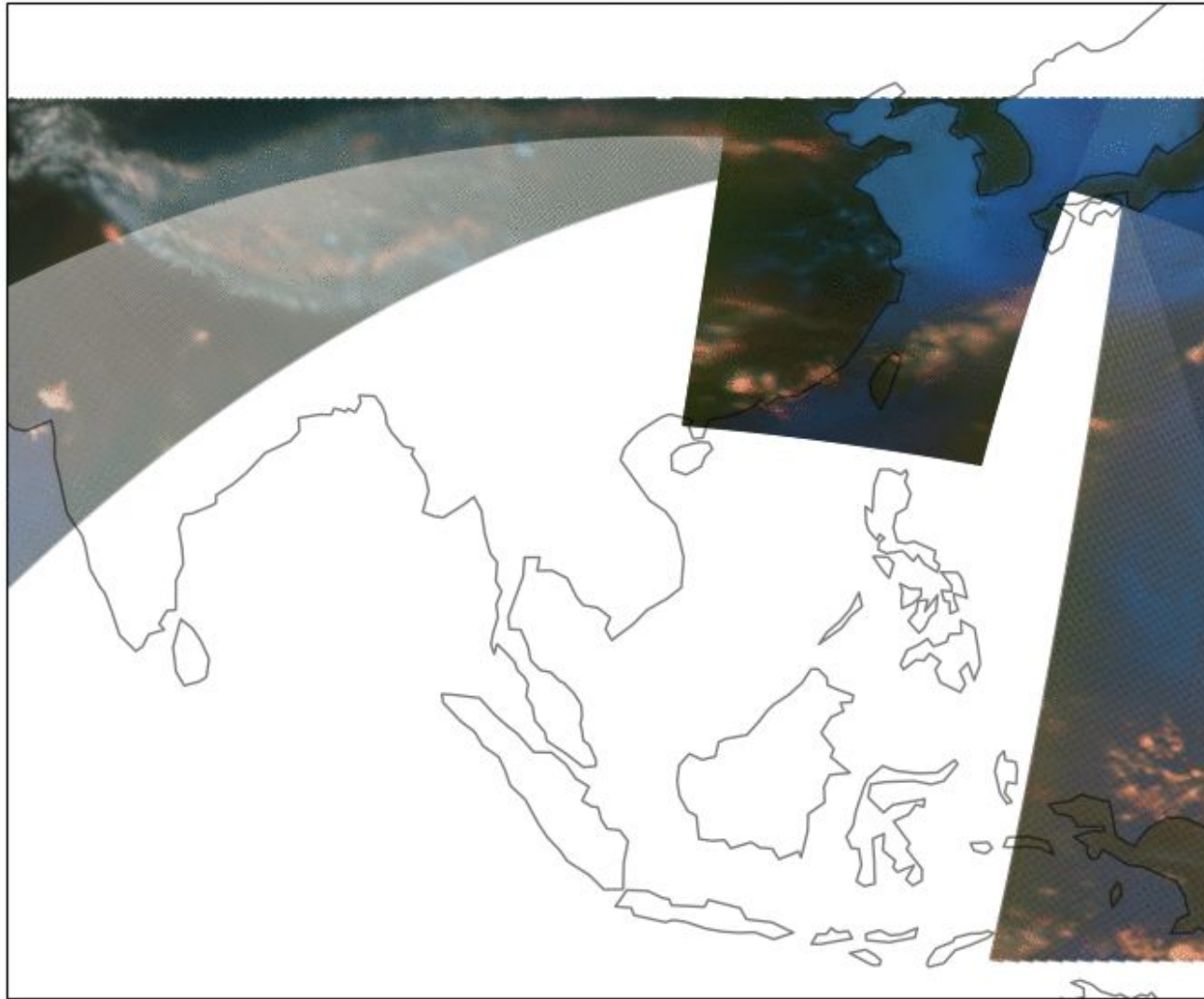




Creating Near-Real-Time
Global Coverage

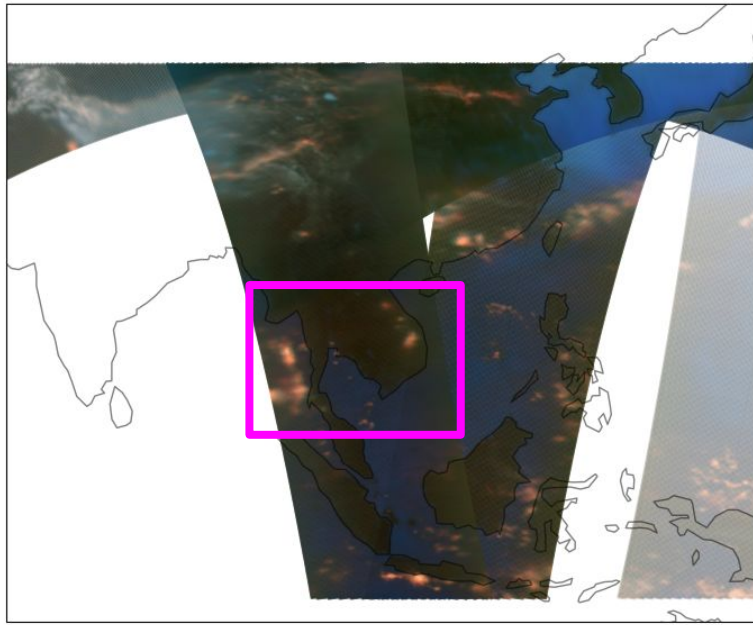
Sample 12 hours of TMS coverage over SE Asia

All TMS Observations 2025-05-07 0000Z-0300Z

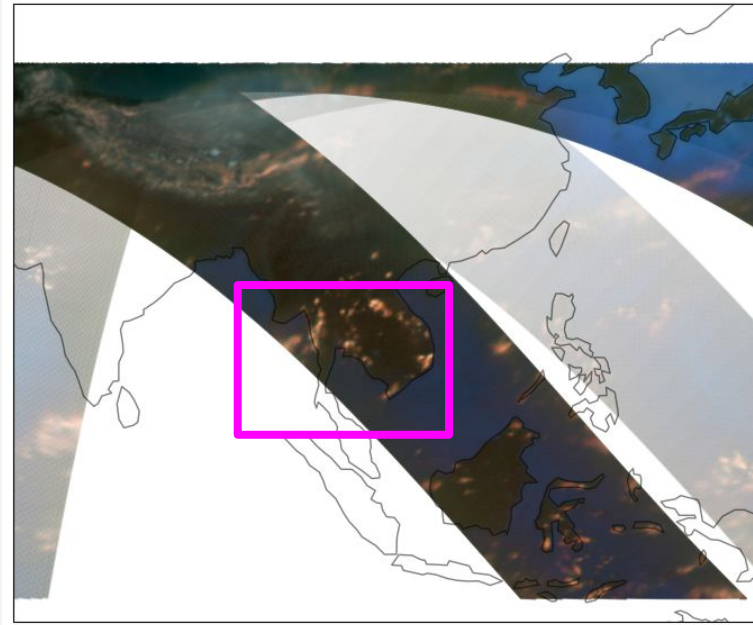


Why rapid revisit is needed for nowcasting

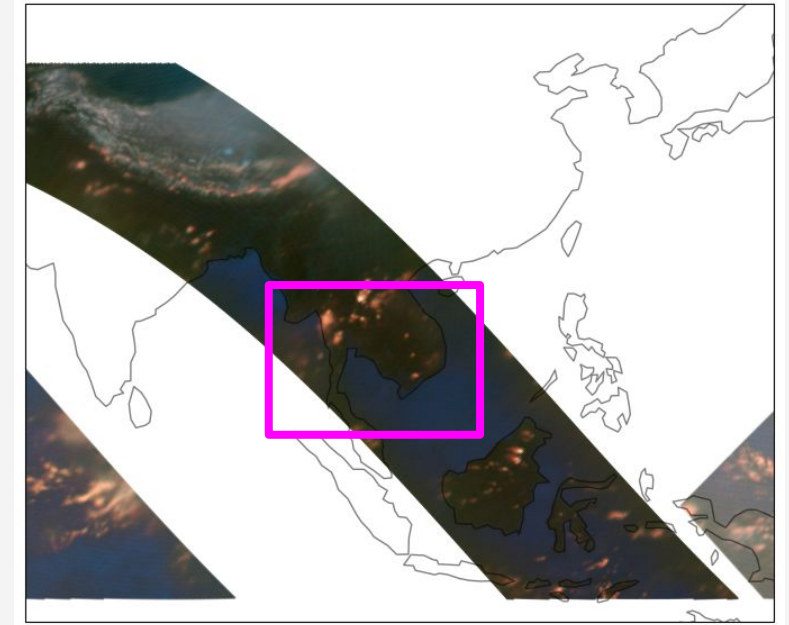
All TMS Observations 2025-05-07 0100Z-0400Z



All TMS Observations 2025-05-07 0545Z-0845Z

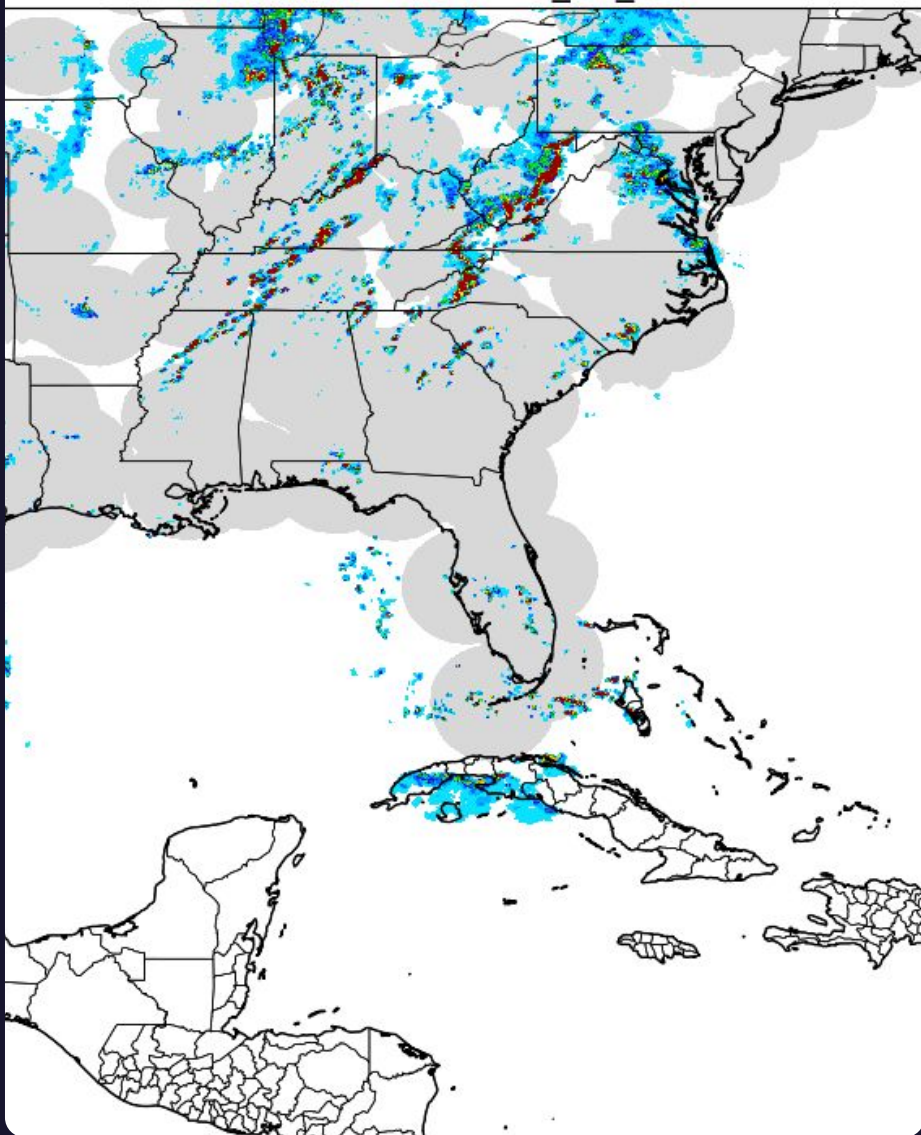


All TMS Observations 2025-05-07 0930Z-1230Z

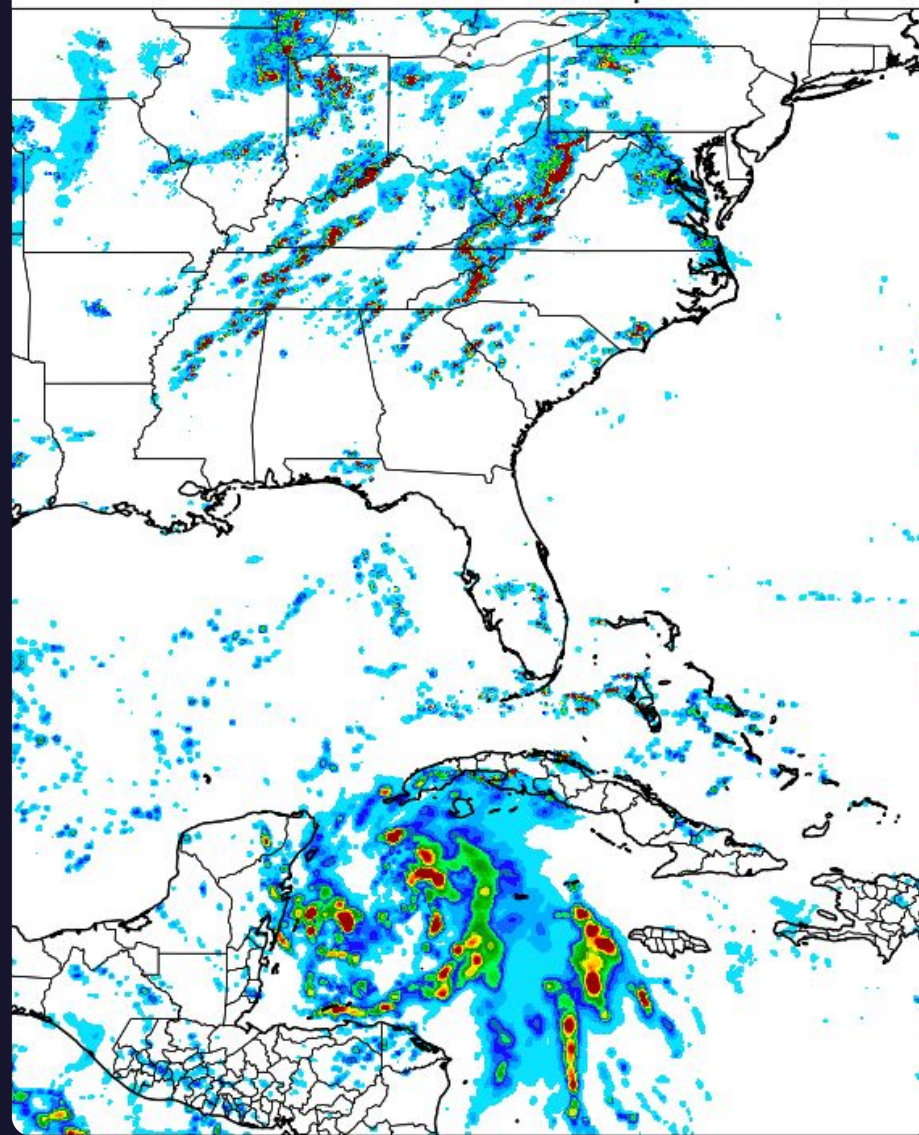


Convection initiates, grows, and decays on timescales shorter than satellites in a single orbital plane (such as FY-3 series) that provide twice-daily observations. TMS multiple orbital planes, including low-inclination orbits, provide this coverage.

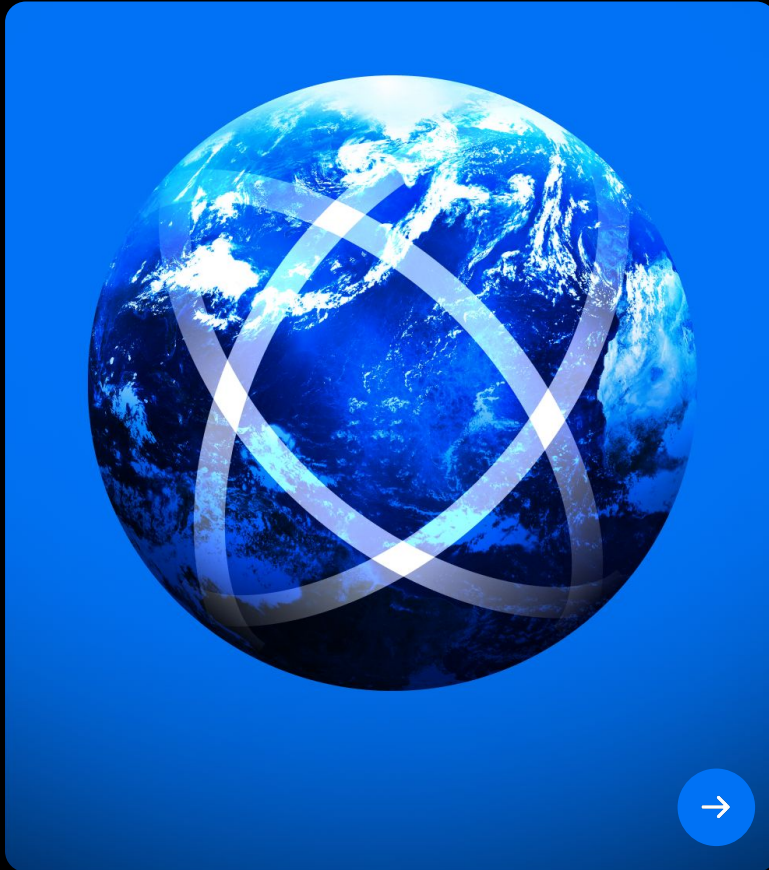
MRMS 20240924_18_30



Tomorrow.io Unified Precipitation

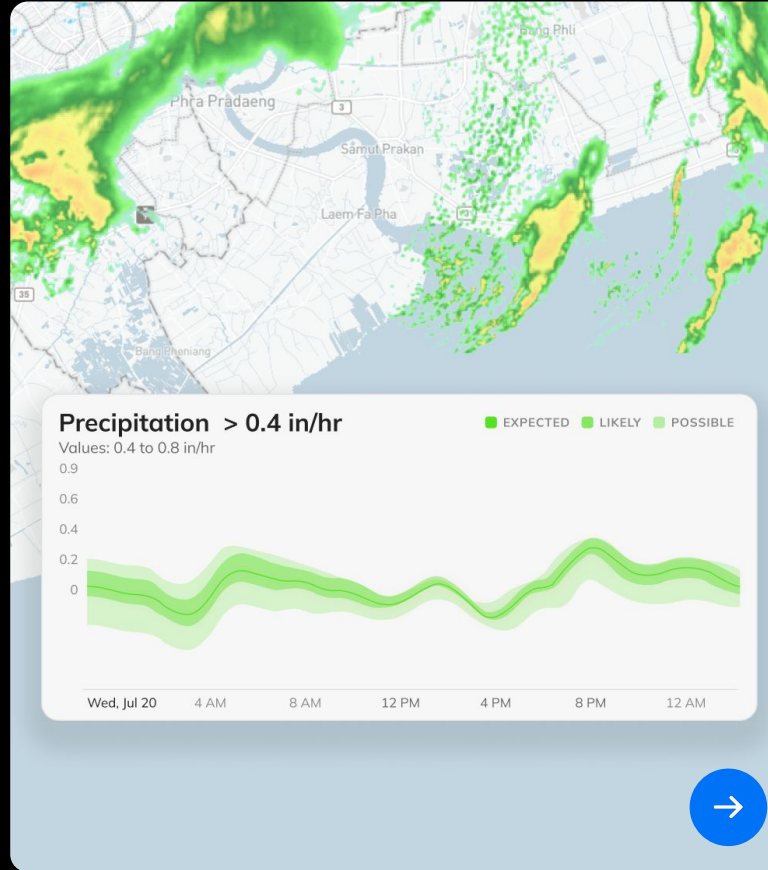


Tomorrow.io Weather Stack - Optimized for Defense Sector



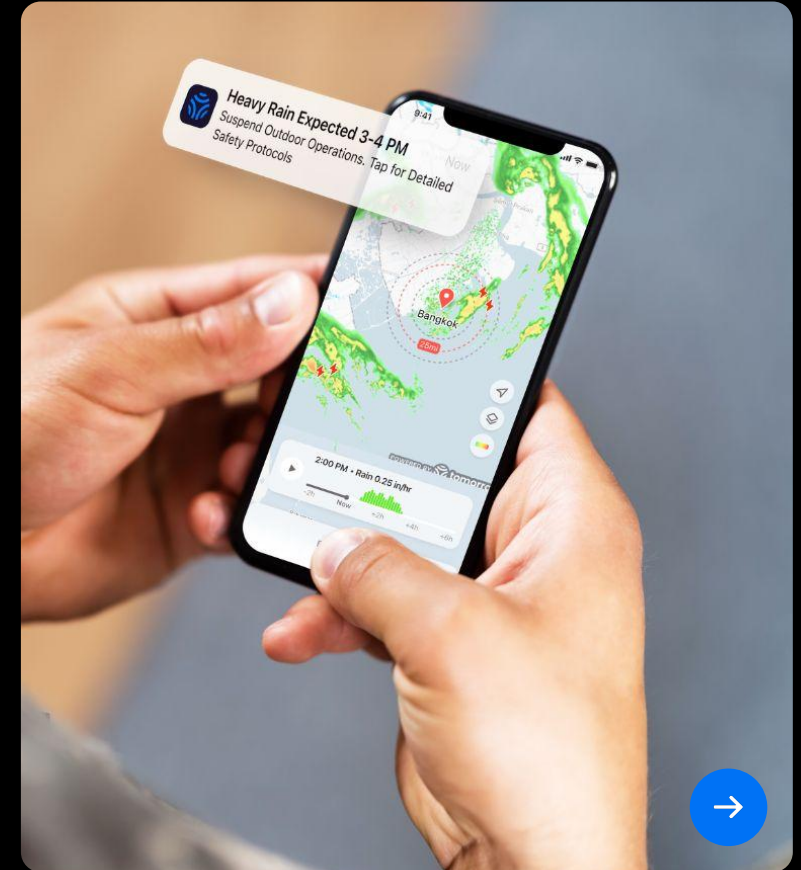
15-min integrated weather grid

Comprehensive Global Weather
Observations & Measurements



Sub-km accuracy

Proprietary **Weather Modeling**. Powered by
Physics, Supercharged with AI/ML



Instant GO/NO-GO

Weather Intelligence **SaaS/API**

Outdated Forecasts = Mission Risk

Weather forecasts today rely on sub optimized government infrastructure and
lack the quality of information necessary for **decision support**

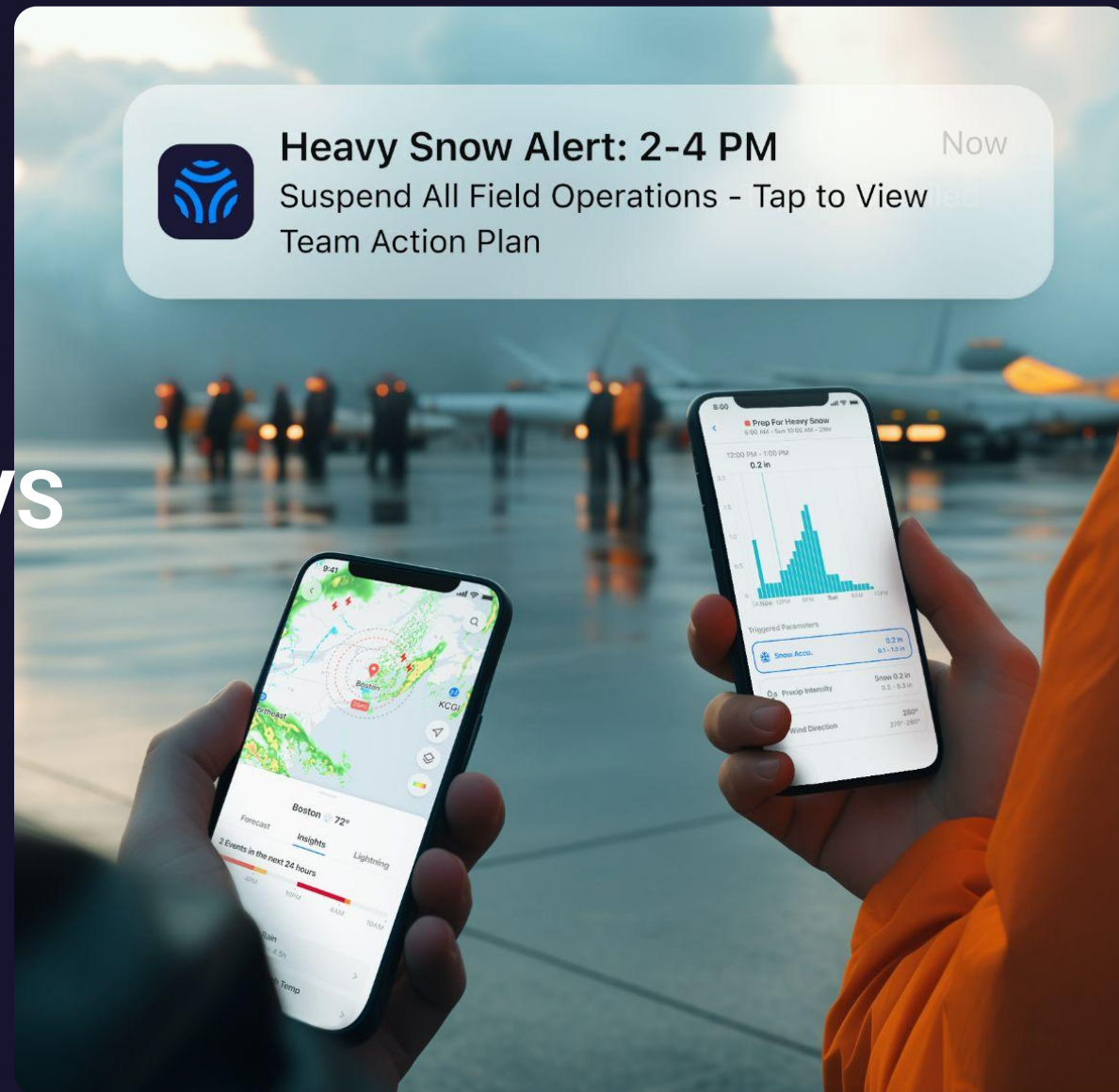


Other Forecast



Tommorow.io

VS



Mission operation

POLITICS

The US-built pier in Gaza broke apart. Here's how we got here and what might be next

WASHINGTON (AP) — A string of security, logistical and weather problems has battered the plan to deliver desperately needed humanitarian aid to Gaza through [a U.S. military-built pier](#).

Broken apart by strong winds and heavy seas just over a week after it became operational, the project faces criticism that it hasn't lived up to its initial billing or its [\\$320 million](#) price tag.



Soldiers from 1st Battalion, 501st Parachute Infantry Regiment, assist a fellow soldier who suffered heat stroke 24 August 2007 while conducting a foot patrol south of Baghdad during Operation Gecko. (Photo by David Furst, Agence France-Presse)

Disasters

WORLD NEWS

Wildfire in Greece triggers explosions at an ammunition depot and the relocation of fighter jets



Kenyan military deployed as East Africa floods kill dozens

REUTERS | April 25, 2024



Training

U.S. NEWS

Illinois National Guard member dies of heat injuries at Camp Shelby in Mississippi

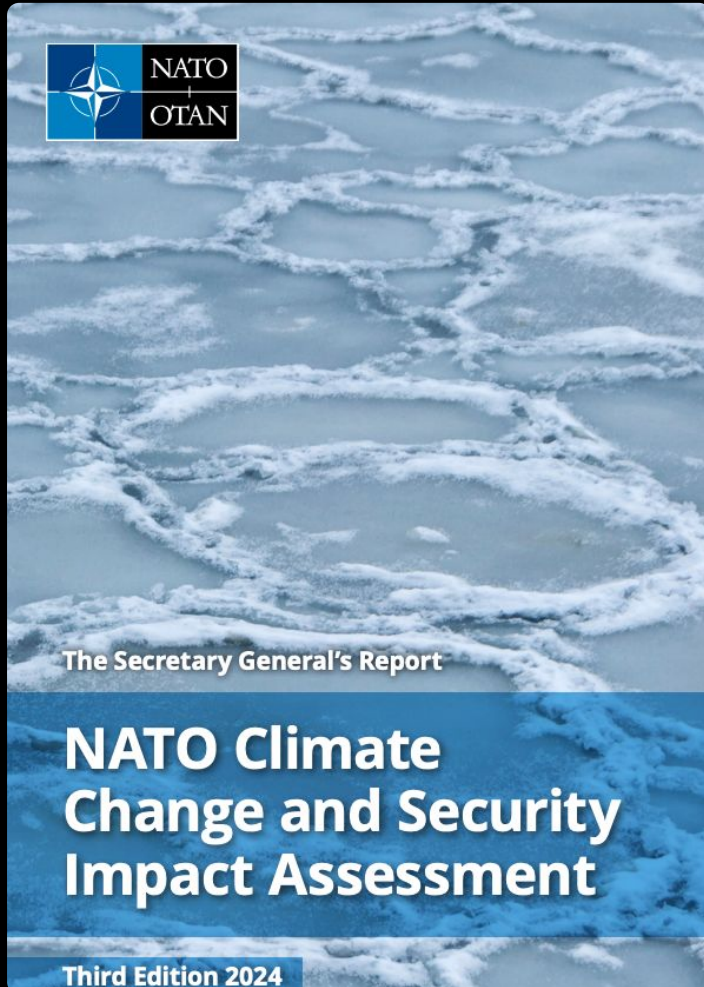
20-year-old soldier dies after suspected heat exhaustion from Darwin training exercise

Defence Forces

Sat 27 Mar 2021

Weather affects defense and security **decision-making** every day with impacts that mean the difference between mission **success or failure**

Climate Impacts in All Domains (2024)



Maritime

Operational strain

Rising seas and heavier storms damage piers, slow hulls, and degrade radar/sonar performance.

Wider mission load:

Melting Arctic ice forces more patrols and emergency responses in harsher sea states.

Ground

Tougher terrain & threats

Extreme heat/cold, wildfires, and mud-locked routes endanger troops and hinder mobility.

Adaptation required

Land forces need sharper geo-intel, updated kit, and resilient infrastructure to stay mission-ready.

Air

Higher risk envelope

Surging extremes -heat, turbulence, cross-winds - slash climb and landing margins, complicating every flight plan.

Response imperative

Air forces must adopt finer forecasts, new procedures, and hardier gear to keep sorties safe and on time.

From Forecast To Fire Control

Weather intelligence to support
mission success



Full independence in mission planning
and real-time weather intelligence
for decision-making level.

Use Cases



Air

Aerial Route Planning | Rotary Wing Mission | Tactical UAV Operations
Airfield Operations | ISR



Ground

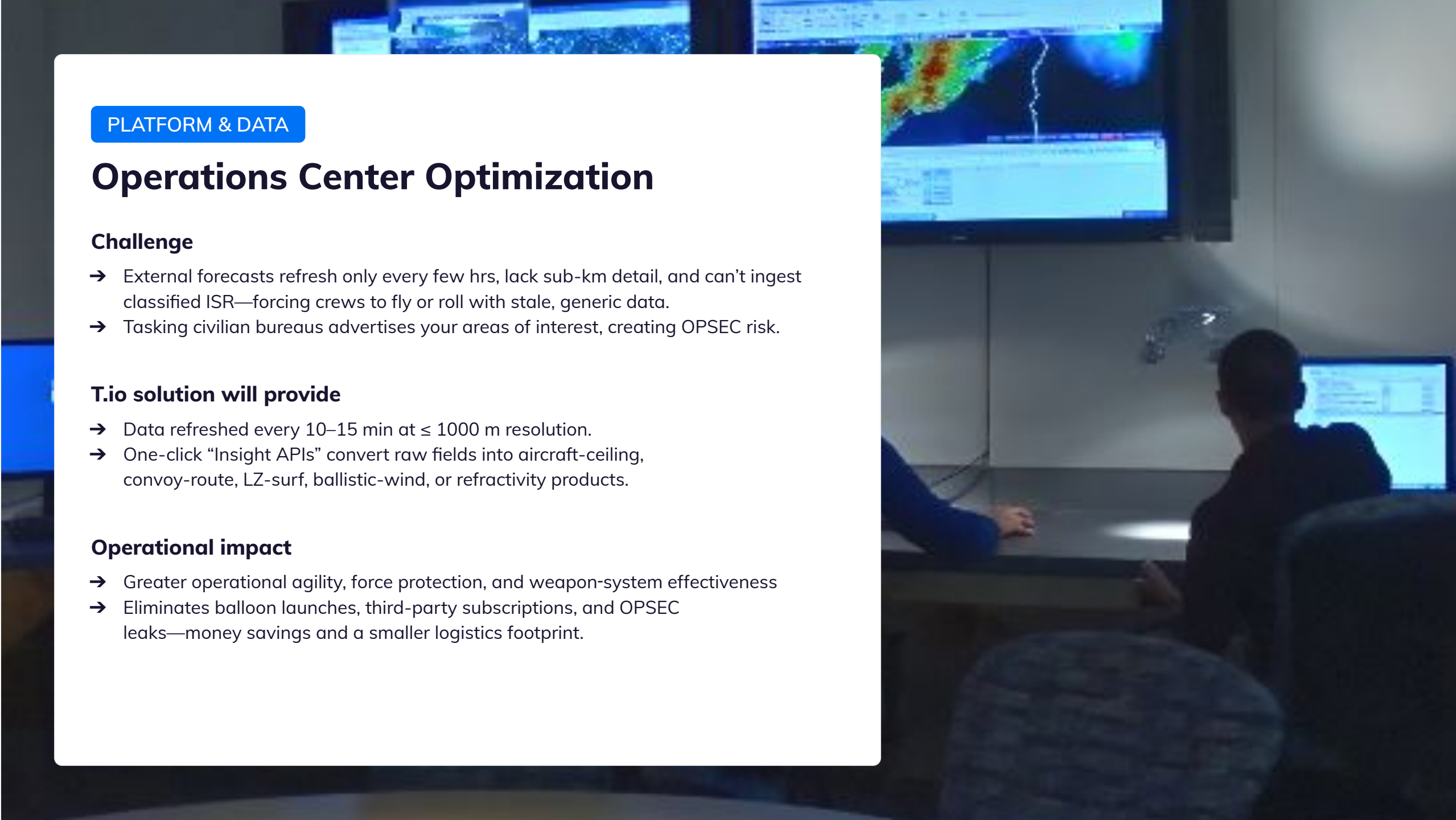
Artillery Support | Radar Optimization | Installation Protection
Field Exercise Planning | Logistics Sustainment



Maritime

Navy Harbor | Control Special Operations | Surface Warfare

Ops Center Optimization



PLATFORM & DATA

Operations Center Optimization

Challenge

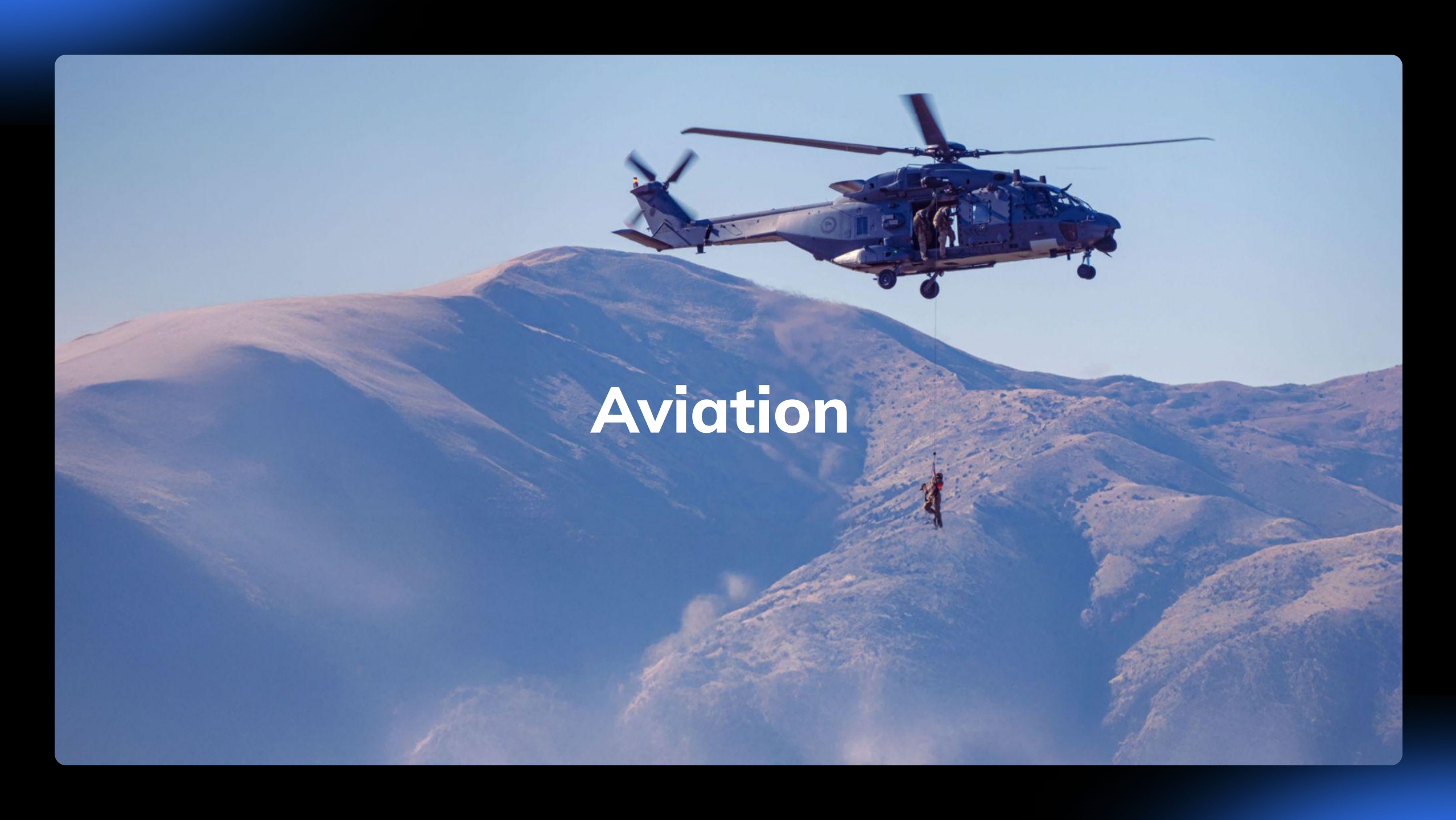
- External forecasts refresh only every few hrs, lack sub-km detail, and can't ingest classified ISR—forcing crews to fly or roll with stale, generic data.
- Tasking civilian bureaus advertises your areas of interest, creating OPSEC risk.

T.io solution will provide

- Data refreshed every 10–15 min at ≤ 1000 m resolution.
- One-click “Insight APIs” convert raw fields into aircraft-ceiling, convoy-route, LZ-surf, ballistic-wind, or refractivity products.

Operational impact

- Greater operational agility, force protection, and weapon-system effectiveness
- Eliminates balloon launches, third-party subscriptions, and OPSEC leaks—money savings and a smaller logistics footprint.

A military helicopter, likely a UH-60 Black Hawk, is shown in flight against a clear blue sky. The helicopter is positioned in the upper right quadrant of the frame. It has a dark camouflage paint scheme. A hoist rescue system is deployed from the side of the helicopter, with a person suspended in a basket or seat, hanging from a cable. The background consists of a vast, rugged mountain range with rolling hills and valleys. The lighting suggests it might be early morning or late afternoon, as the mountains have a warm, golden-brown hue. The word "Aviation" is superimposed in the center of the image in a large, white, sans-serif font.

Aviation

Aerial Route Planning

Challenge

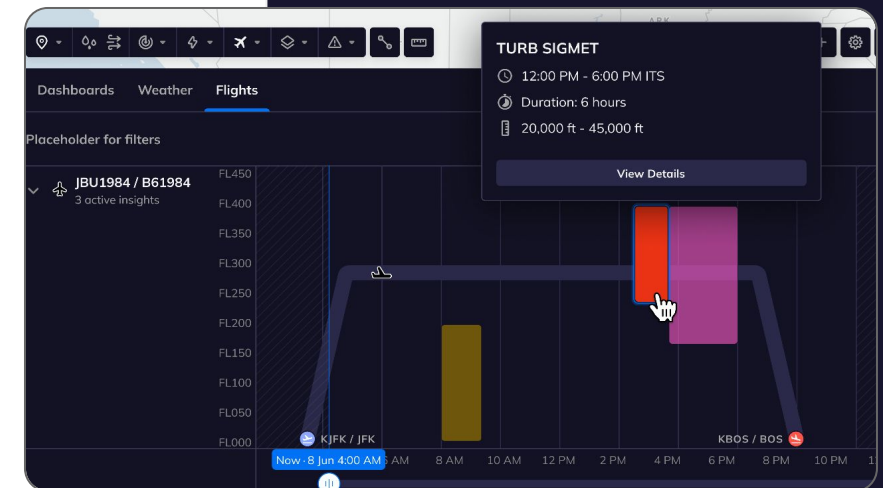
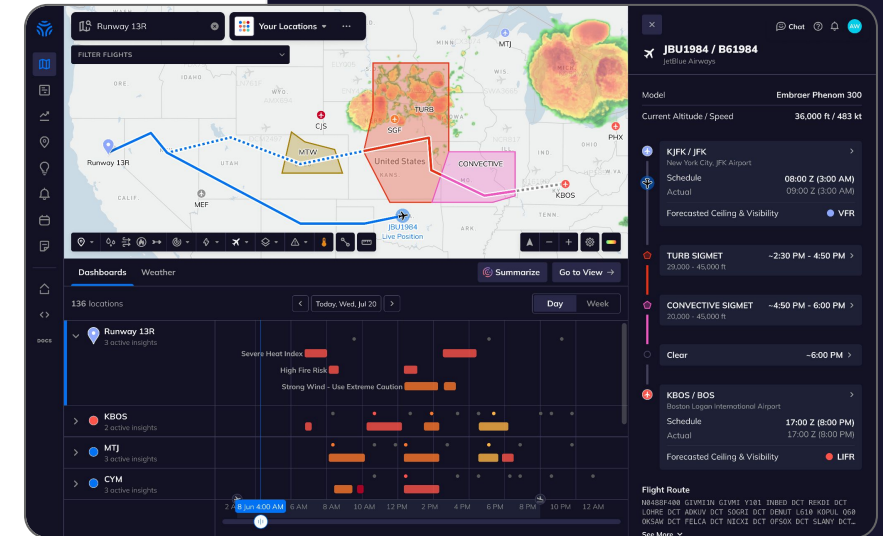
- Region-wide forecasts miss pop-up fog, icing layers and low-ceilings along low-level routes.
- Extra fuel & divert margins eat payload; late reroutes erode surprise.
- Repeated data pulls from civilian met services leak planned corridors and altitudes.

T.io solution will provide

- Hyper-local, minute-level weather & hazard layers rendered on any 3D flight path
- Routes API auto-flags thresholds (Sigmet's, icing, dust) .

Operational impact

- Cuts route-planning cycle
- 30 % fewer weather-driven divers
- Real-time reroutes avoid downdrafts, icing layers, turbulence ect.



Rotary-wing platforms Mission Planning

Challenge

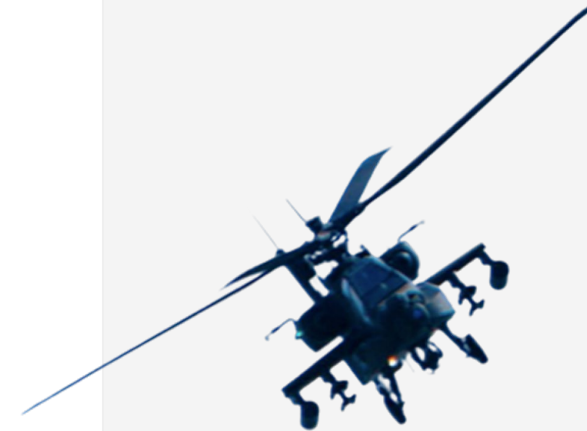
- Generic forecasts miss brown-/white-out, density-altitude spikes, rotor-icing layers, and low-level wind-shear along nap-of-the-earth routes.
- No hover-OGE (Out of Ground Effect) margin or Brown-Out risk maps ⇒ payload off-load, rollover incidents, surprise downdrafts at LZs.

T.io solution will provide

- Sub-Kilometer & radar-sat data refresh every 10–15 min; outputs Density-Altitude, Hover-OGE Margin, Brown-Out Probability, rotor-icing, wind-shear layers.
- Insights & LZ-Scoring API auto-flags red/yellow/green thresholds and proposes alternate LZs/routes.

Operational impact

- Shorten route/LZ planning cycle
- +10–15 % average payload (fuel off-load) and 30 % fewer brown-out
- Real-time re-routes avoid downdrafts, icing, and ceiling-driven threat envelopes, boosting sortie completion and crew survivability.



High resolution Low-Altitude weather intelligence for drones and tactical UAVs

Challenge

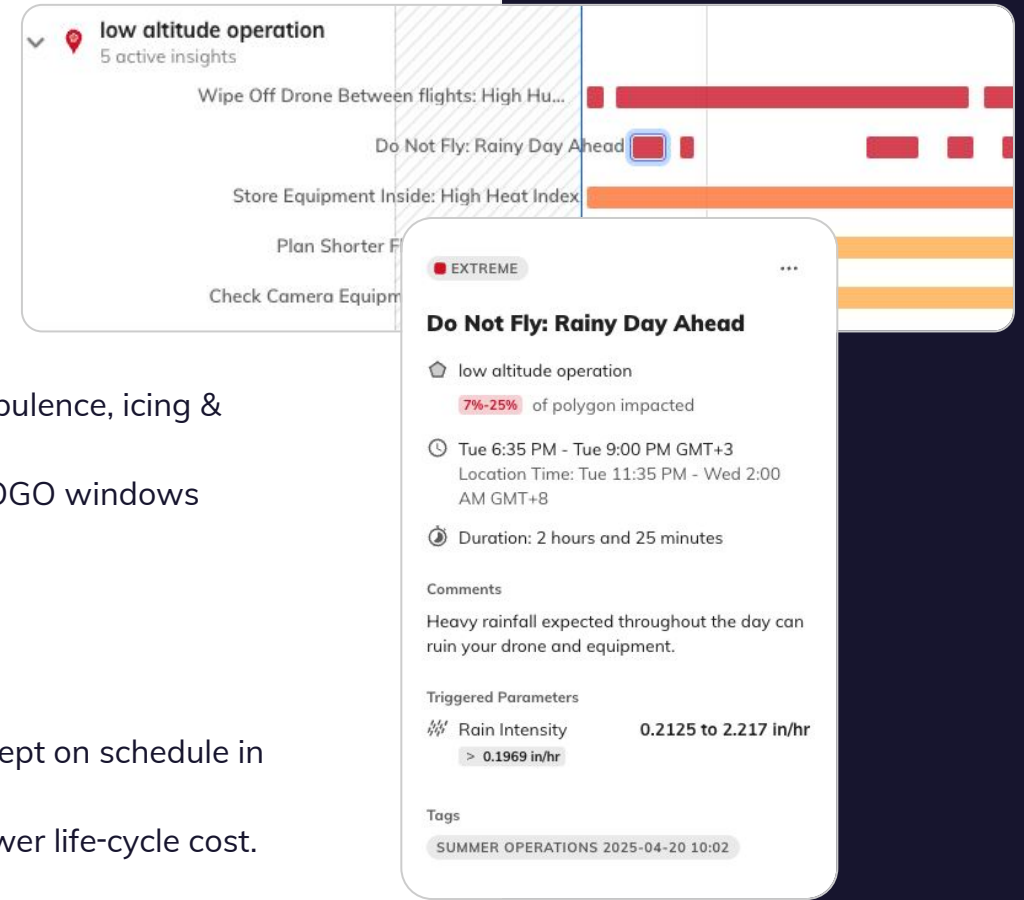
- Lightweight airframes, exposed electronics and small power margins mean even drizzle, 20–25 kt gusts, icing, or $-10 / +40^{\circ}\text{C}$ extremes quickly exceed most sUAS flight envelopes.
- Launch crews & ground-control stations work in the open; surprise squalls soak radios, over-heat batteries and waste hours when a sortie is scrubbed.

T.io solution will provide

- Sub-kilometre model nests refreshing every 10–15 min with wind-gust, rain-rate, turbulence, icing & heat-stress layers.
- Drone Insights & Route API turns platform limits into instant red/yellow/green GO/NOGO windows and alternate LZs.
- Auto-alerts for both airframe limits and crew exposure

Operational impact

- > 30 % drop in weather-scrubbed launches and idle crew time; hundreds of sorties kept on schedule in customer pilots.
- Fewer lost airframes, safer operators and leaner logistics free combat power and lower life-cycle cost.
- Rapid re-planning keeps the blue OODA loop inside adversary reaction time.



Airfield Operations

Challenge

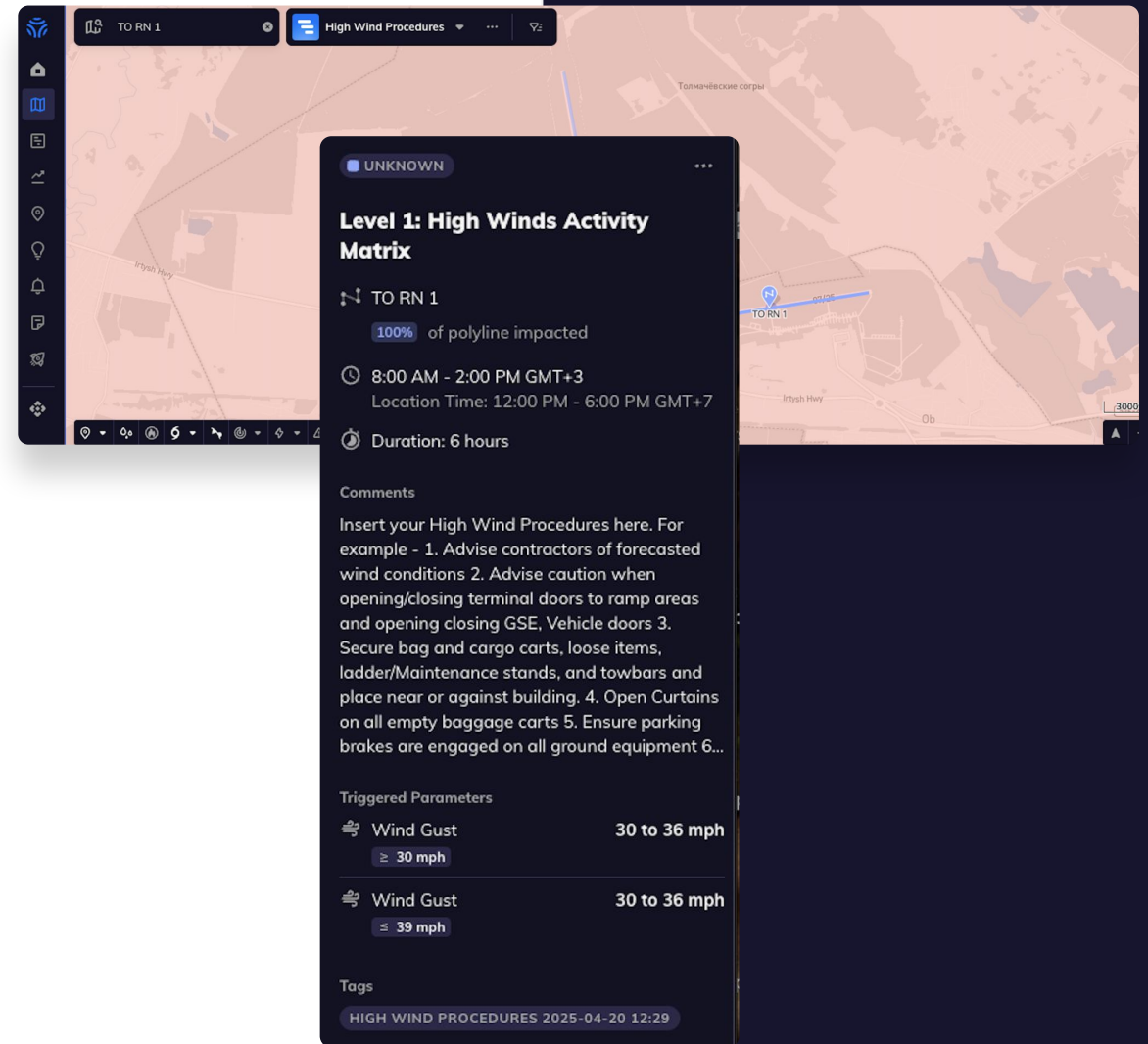
- Sudden cross-wind gusts, wind-shear, micro-bursts, and fast-moving rain/ice bands turn a “green” runway into a no-go in minutes;
- Controllers lack runway-specific wind-component and contamination forecasts, so late calls trigger go-arounds, diversions, overruns — weather is a leading factor in runway-excursion accidents.

T.io solution will provide

- Sub-km runway grids refresh every 10–15 min, outputting head-, tail- & cross-wind, gust, shear, standing-water / ice depth, lightning range and runway-condition-code forecasts.
- Cross-Wind Monitors & Insight API auto-flag threshold breaches (e.g., cross-wind > 25 kt, RCR < 3) and feed tower displays instantly.

Operational impact

- Cuts last-minute weather closures, go-arounds and diversions by 20 %+ at customer airports;
- Faster reopen decisions protecting schedules and prevents manpower burnout.
- Fewer runway excursions/incursions and safer ramp ops boost overall airfield safety margin.



Intelligence, Surveillance and Reconnaissance

Challenge

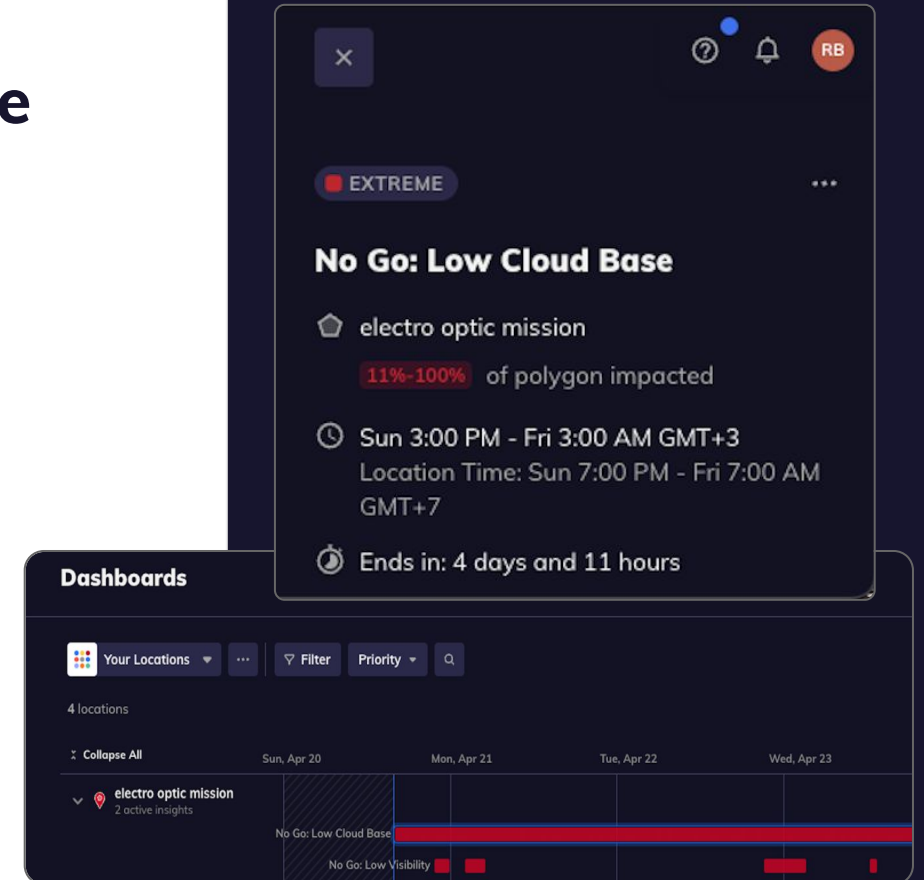
- EO/IR detection range collapses in fog, low cloud, haze, dust, rain & thermal crossover; sensor performance can swing $\pm 70\%$ within an hour.
- Generic MET products give airport-style vis & cloud, not line-of-sight transmittance, aerosol load, or thermal-contrast windows for a specific target grid.
- Crews waste flight hours or deploy ground posts only to find imagery unusable, burning scarce ISR cycles and exposing assets.

T.io solution will provide

- Sub-km, 10-min refresh of visibility, cloud-base, aerosol AOD, rain-rate, turbulence, dew-point spread, thermal-gradient layers.
- EO Mission Insight converts those layers into Target-Acquisition Probability, slant-range transmittance and “green window” timelines for each sensor band.

Operational impact

- Up to 40 % increase in usable collection windows and 25 % fewer aborted sorties in customer trials.
- Higher-contrast imagery improves positive-ID rates, speeding intel dissemination; fewer wasted flight hours lowers cost per intelligence product.





Ground

METCM for Artillery in NATO format

Challenge

- Accurate gunnery needs a full wind/temperature column; today units burn helium, trucks and a 4-6-person crew to launch met balloons for every move or fire-plan.
- If balloons can't go up (night, rain, enemy ISR) batteries rely on generic model winds, forcing extra "bracketing" rounds and longer target engagement.

T.io solution will provide

- Digital MET CM messages (wind, temp, pressure at 30–50 m layers) straight into FCS—no balloon or radar sounding needed.
- Ballistic-Wind Insight API auto-flags gust fronts, fronts or jet-over-target and pushes corrected angles to guns in seconds.

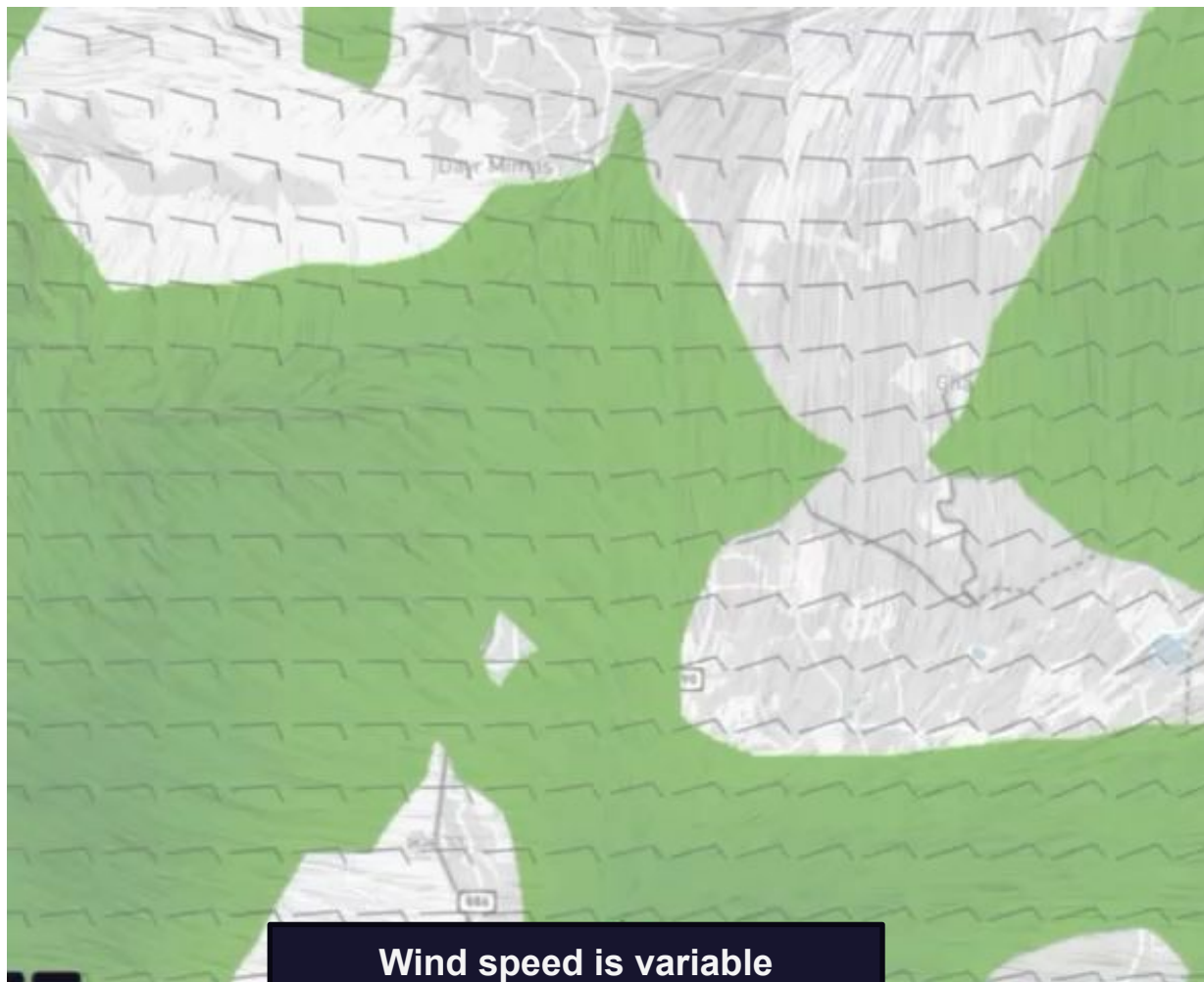
Operational impact

- Removes two of three support vehicles and $\frac{2}{3}$ of the met crew; Army studies show multi-million-dollar O&S savings after retiring balloons.
- Fewer adjustment rounds ($\approx 20\text{--}30\%$) and faster first-round-effects, saving ammo and reducing counter-battery exposure.
- Smaller logistics footprint and faster TOT keep the fires OODA loop ahead of enemy relocation

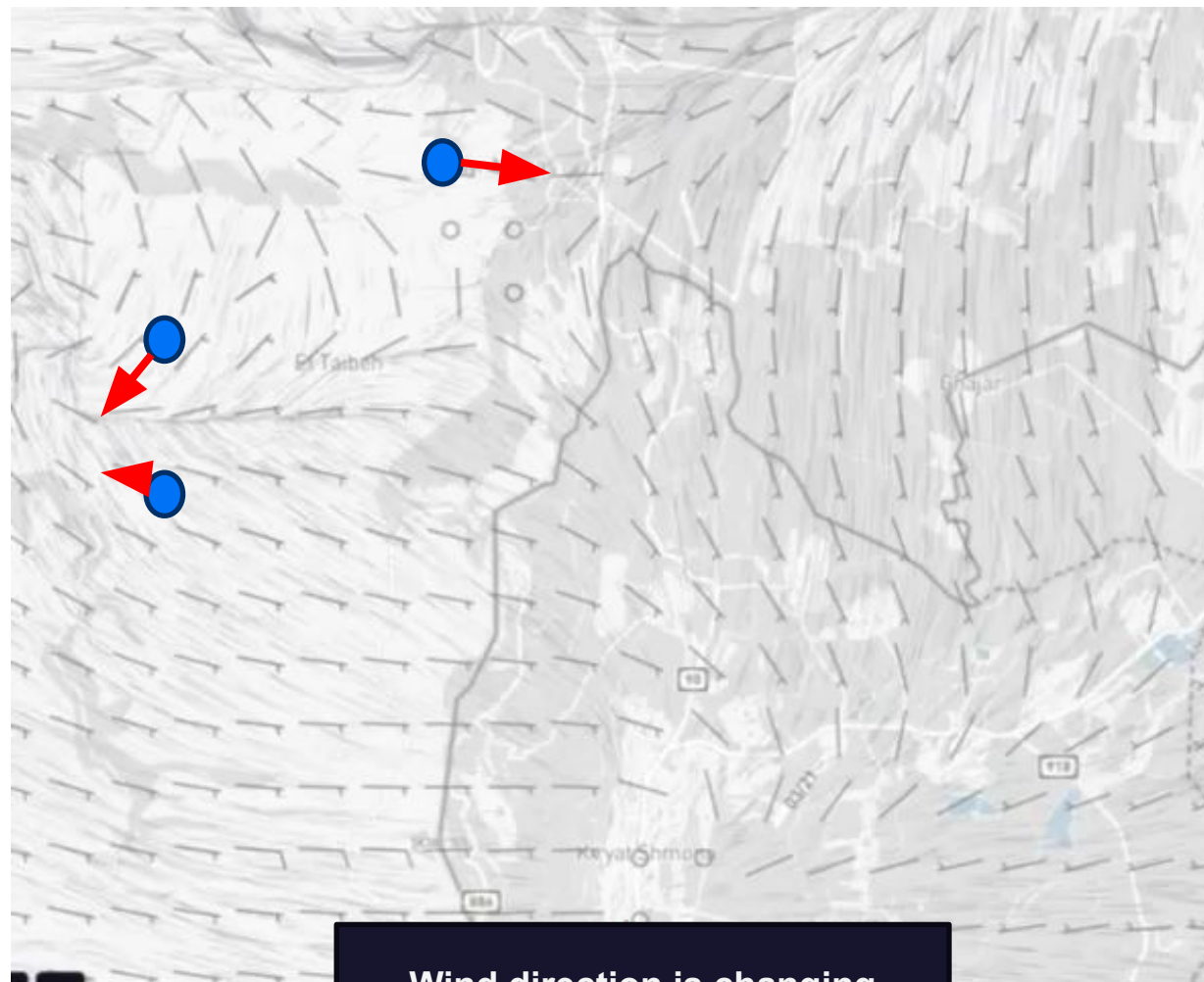


METCM3167167 261302 003008				
Zone	Dir Mils	Speed Knots	Temp °K	Press mBar
00	382	004	2945	1008
01	491	009	2897	0996
02	506	010	2872	0967
03	522	008	2834	0922
04	502	006	2792	0867
05	378	005	2758	0816
06	315	005	2746	0764
07	347	009	2709	0720
08	370	010	2674	0676
09	365	012	2649	0634
10	357	017	2631	0594
11	350	022	2607	0556
12	340	032	2554	0504
13	329	040	2484	0440
14	317	043	2412	0383

Problem Space Definition – Layer uniformity varies within a small geographic area



Wind speed is variable
(Green area above 5 knots)



Wind direction is changing

METCM-R for Radar Propagation (Refraction / Ducting)

Challenge

- Shallow temperature-and-humidity layers bend the radar beam (ducting), causing ghost targets, blind zones, or range errors that crews may notice only after clutter blooms.
- Units still launch helium weather balloons 1–2 × per day (fuel, gas, crew, signature) or just accept degraded detection until the atmosphere changes back.

T.io solution will provide

- Modified-refractivity, duct-height & “beam-bending risk” along each antenna azimuth—no balloons needed.
- Auto-alerts in plain language (“Surface duct forming < 25 m — raise tilt 0.3°”) sent straight to any console; data packaged in the NATO METCM.

Operational impact

- generate an **updated M-profile (and duct / path-loss products) at any grid point, on any refresh cycle, for any radar frequency and antenna height.**



Installations and infrastructure protection

Challenge

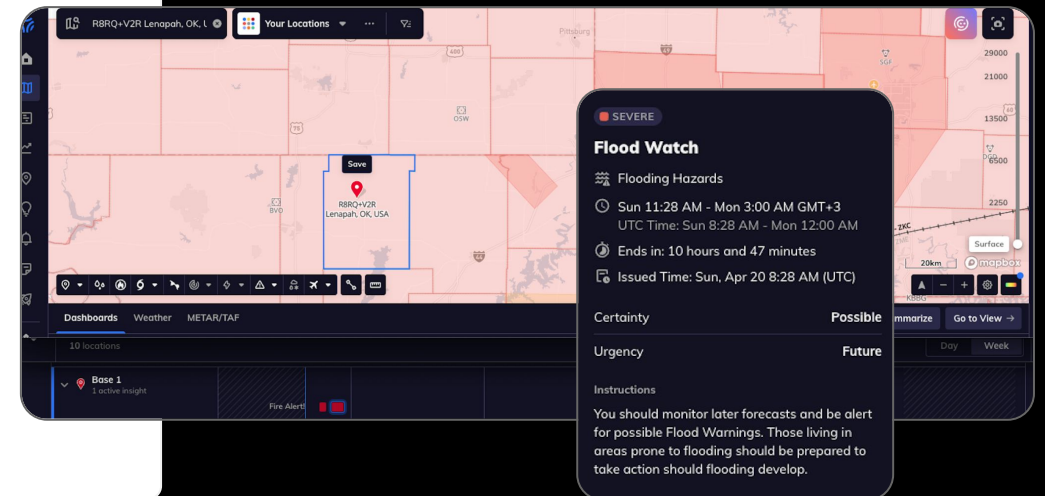
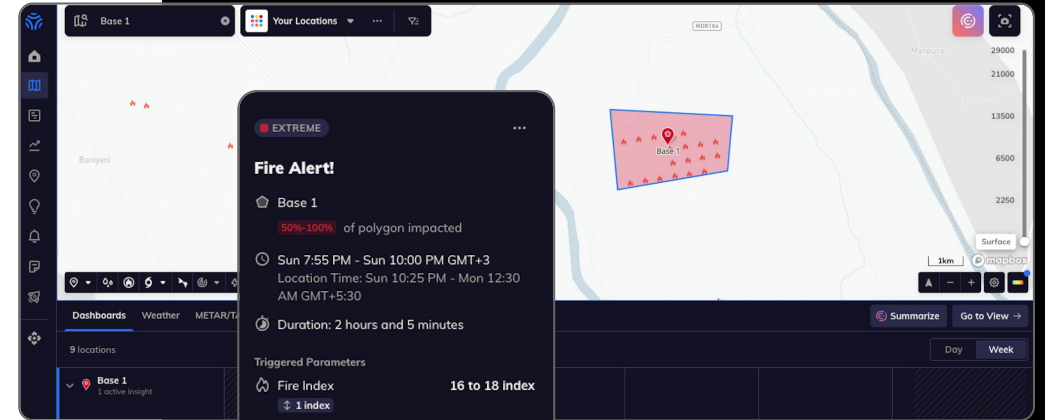
- Flash-floods and wildfires can cripple bases within hours;
- Standard forecasts and sirens trigger late evacuations, over- or under-reactive sandbag/fire-break efforts and costly false alarms.
- Deploying spotters or manual gauges across the perimeter is labour-intensive and still leaves blind spots..

T.io solution will provide

- Deliver Flood-Risk Index (river & urban) and Fosberg Fire-Weather Index / Active-Fire layer for every facility gate, runway and ammo dump.
- Rule-based alerts (“Flood risk > High at POL yard in 90 min” / “Fire-index > 45, winds > 15 kt”) push.

Operational impact

- Hours of lead time let engineers preposition pumps, close fuel valves, light back-burns and protect power nodes—cutting damage-repair bills and downtime.
- Fewer false alarms mean less lost training tempo, tighter logistics, and higher base readiness during regional crises.



Weather intelligence for Field Exercise planning

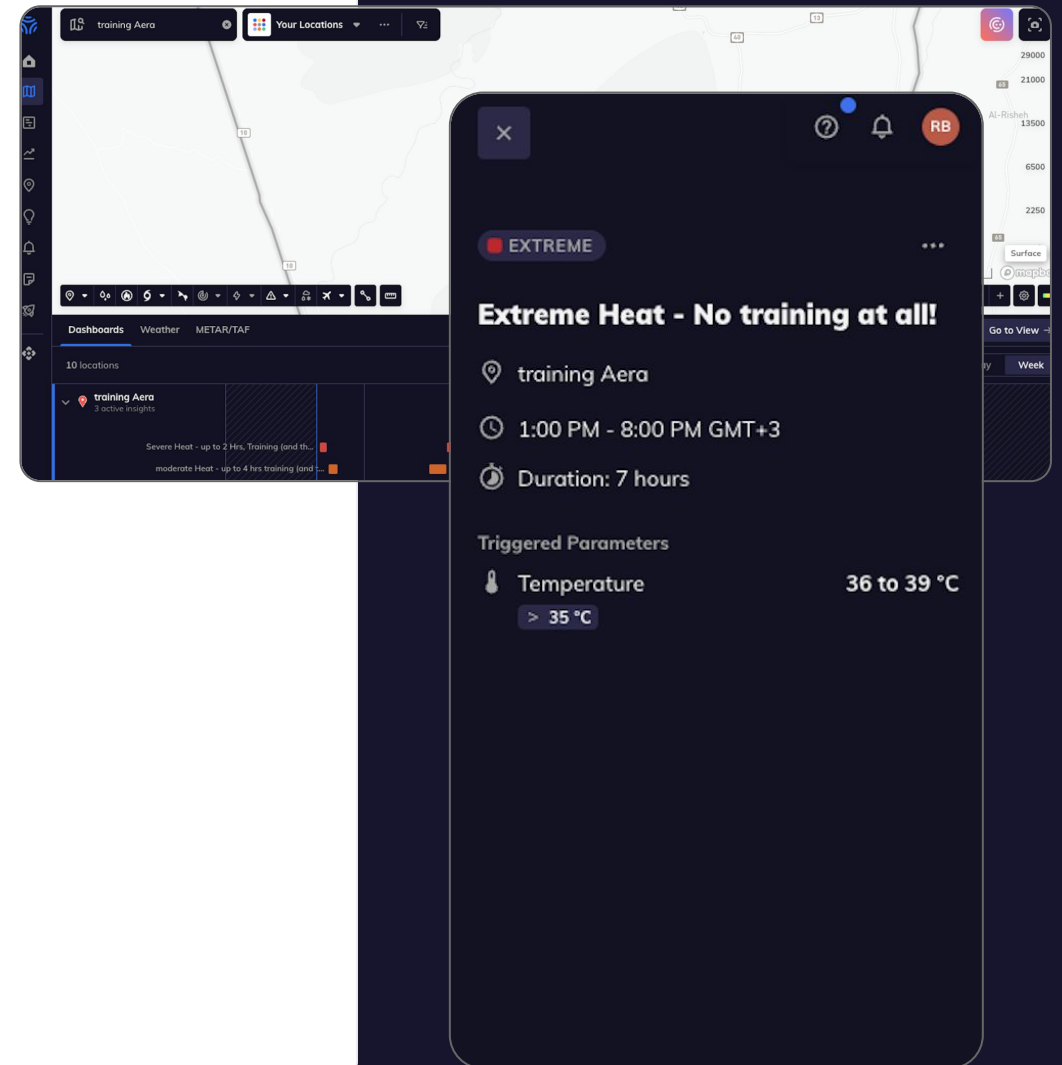
- Climate extremes are now routine: 2024 was the hottest year ever recorded, and 84 % of 44 major Army bases worldwide already log more “heat-risk” days than their 15-year average; militaries across NATO and partner nations still report thousands of heat or cold injuries every year
- Standard forecast lack WBGT, wind-chill, frostbite time or slope-by-slope microclimates, so units either cancel ranges too early or push on until med-evac is needed.
- Reactive calls waste ammunition, fuel and resources.

T.io solution will provide

- Heat-Stress Index, Wind-Chill, Frostbite-Risk for every lane, LZ and bivouac site.
- Simple “Training GO/NO-GO” rules (e.g., WBGT > 32 °C → red flag; wind-chill < -25 °C → 30 min exposure limit) auto-alert.

Operational impact

- **35 % fewer heat/cold casualties** and **25 % fewer weather-scrubbed training days** in customer brigades.
- Saves \$-hundreds-of-thousands per rotation in wasted ammo, overtime and med-evac costs; preserves thousands of training man-hours.



Weather intelligence for logistics Sustainment

Challenge

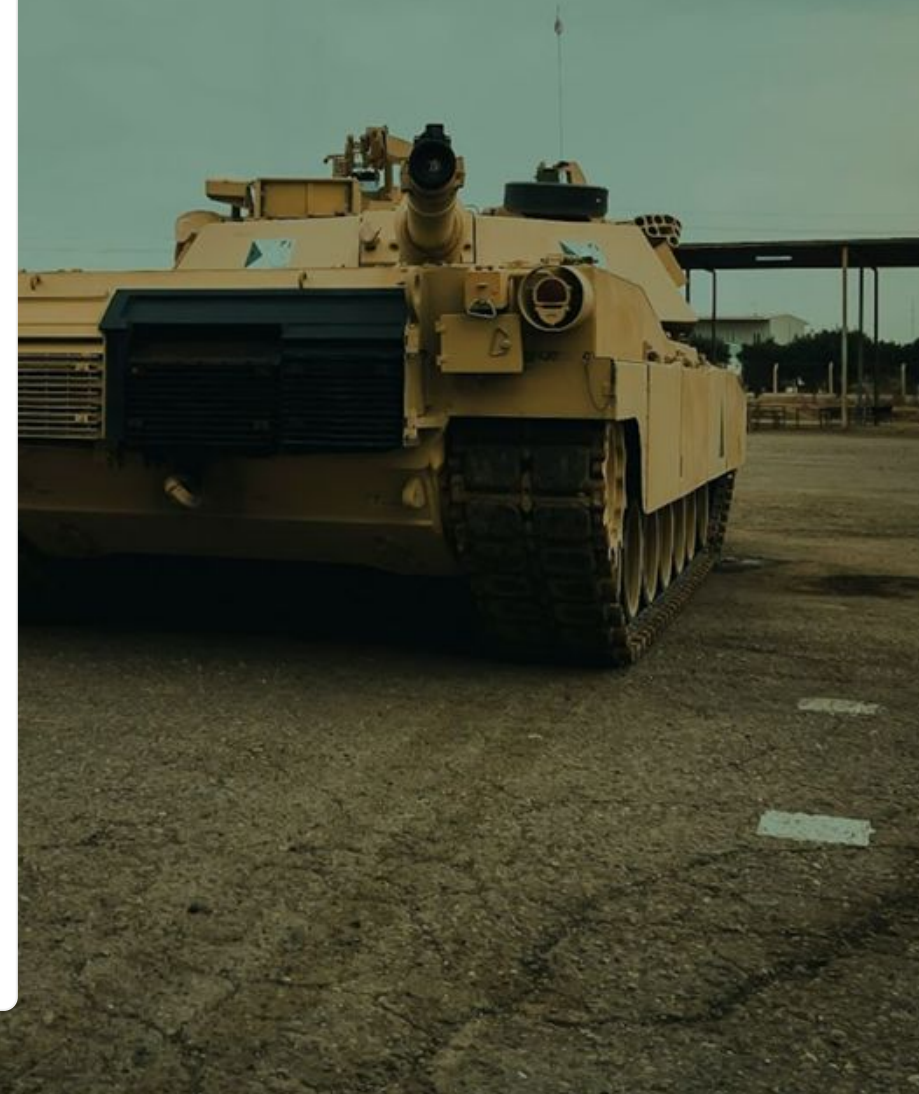
- Standard briefings just say “chance of rain/snow”; no route-by-route cross-wind, black-ice, dust-storm or flood-depth outlooks, so units launch and then discover a closed pass or washed-out culvert.
- Result: extra fuel, crew-hours, recovery assets—and longer exposure in chokepoints.

T.io solution will provide

- Routes API overlays snow, ice, cross-wind, visibility and flood-depth on every segment and proposes alternates instantly.
- Auto-alerts (“Black-ice risk > High on Segment 23 in 60 min—hold launch”) feed to any BMS.

Operational impact

- Fewer stuck trucks & recovery ops cut risk and keep the supply OODA loop ahead of combat tempo.
- A leaner convoy footprint frees lift for ammo and humanitarian cargo instead of tow rigs and spare parts



Maritime



Navy Harbor Control

Challenge

- Unwarned squall-line gusts, cross-pier swell, heavy surge, dense fog or lightning force last-second pauses in fuel bunkering, ammo on-/off-load, gangway access and topside work.
- Generic coastal forecasts give only offshore wave height and “patchy fog,” so tugs, fenders and crane crews scramble late—stretching turnaround and racking overtime.

T.io solution will provide

- Harbor Ops API serves pier-by-pier steady/gust wind, surge height, swell direction, visibility/fog odds, lightning radius, tide & current.
- Auto-alerts (“Gust > 38 kt at Pier 3 in 45 min — double headlines, pause bunkering”) push.

Operational Impact

- Timely mooring & bunkering cuts tug hours, crane idle time and demurrage, saving \$- while keeping crews safer topside.
- A proactive OODA loop means ships get alongside, serviced and underway on schedule - weather stops dictating harbor tempo.



Marine Special Operations

Challenge

- Near-shore ops fail fast when surf height, rip-current speed, sea-state or overnight fog shift by inches or minutes
- Standard forecasts give only deep-water wave height and “patchy fog,” so RHIBs launch, then hit 2 m plunging breakers, or swimmer teams abort on unseen currents—burning fuel, time and surprise.

T.io solution will provide

- Surf & Current API outputs breaker height/type, rip-current velocity, sea-state, fog/vis, SST and tide for every LZ, craft lane or diver entry point.
- Auto-alerts (“Rip-current > 1 m s^{-1} at LZ Otter 45 min out”) feed.

Operational impact

- Trials with boat units show 30 % fewer weather-scrubbed inserts and 15 % longer green-window use, saving fuel and reducing swimmer fatigue.
- Fewer surprise breakers and currents cut rollover/capsize risk and personnel loss, boosting mission success and preserving costly SOF readiness.
- Faster go/no-go calls keep the assault OODA loop inside adversary coastal-defence reaction time.



Naval Surface Warfare

Challenge

- Severe storms, rogue waves and choke-point disruptions already add 3 % extra vessel demand and double waiting times on key routes (UN Trade, 2024).
- Generic forecasts gives only deep-water significant wave height; no leg-by-leg view of wind-sea vs. swell, polar low tracks, lightning belts or drifting sea-ice, so ships sail blind, then slow-steam, divert or heave-to—burning fuel and schedule.

T.io solution will provide

- Marine Routes API streams wave spectrum, swell direction/period, wind-gusts, visibility, icing, lightning & current across every waypoint.
- “Green/Yellow/Red” rules (e.g., $H_s > 4$ m, peak period < 8 s → reduce speed) auto-alert shore Fleet-Ops; alt-routes and ETAs recalc in seconds.

Operational impact

- Naval support fleets show 20 – 30 % fewer weather-diversion days and 5 - 7% bunker-fuel savings by picking lower-sea-state lanes.
- Better storm-avoidance cuts slamming and cargo-shift risk, preserving crew safety and hull integrity.
- Fast replans keep the fleet’s OODA loop ahead of weather swings and chokepoint closures - missions stay on timeline and logistics costs fall.



The imperative and the opportunity



Disruptions and loss due to weather are entirely avoidable



Tomorrow's technology can ensure resilience now



Our unique data as a service (DaaS) is essential (LLMs run out of data)



Not all AI/ML is created equal



Our software as a service (SaaS) provides customizable predictive insights

Delivering a Decisive Advantage On the Battlefield With Weather Intelligence



Thank You!