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What Sabahans should know about the 2026 haze crisis

Daily Express (KK), Malaysia



Activists gathered in front of the Indonesian embassy in Kuala Lumpur to submit an official memorandum calling for transparency and corporate accountability across borders on September 4, 2026. (Pic: AFP)



AirAsia planes sit on the tarmac shrouded with haze from Indonesian forest fires at the airport in Kuching. (Pic: AFP)

■ First of a series

Audrey J Ansibin

SABAH'S worst haze episodes are often not born in the State. They can begin hundreds of kilometres away, where vast forest and peatland fires in Kalimantan send dense smoke plumes across Malaysian Borneo, carried by seasonal winds before eventually blanketing cities and communities in Sabah.

Professor in Climate Change, Atmospheric Science and Environmental Management at Universiti Malaysia Sabah (UMS), Prof Dr Justin Sentian, said transboundary smoke from Kalimantan is the primary driver of severe air pollution in Sabah, far outweighing local burning. "The overwhelming majority of severe pollution comes from across the border, specifically driven by large-scale forest and peatland fires in Kalimantan, which are often sparked by land-clearing practices," he said.



Prof Dr Justin Sentian

He said the scale of burning across Kalimantan compared with Sabah and Sarawak illustrated the disparity. Based on hotspot counts provided by the Asean Specialised Meteorological Centre (ASMC) over the period cited, Kalimantan recorded 1,272 hotspots, compared with only 26 in Sabah and Sarawak.

"This vast disparity between local and transboundary sources is starkly illustrated by recent satellite data," he said.

At the time of writing, the Air Pollutant Index (API) in Kota Kinabalu stood at 17, placing it in the unhealthy range. Sentian said the smoke affecting Sabah can be traced using a combination of satellite observations, ground-based air-quality monitoring and atmospheric modelling.

"Based on HYSPLIT backward trajectory model analysis, the haze affecting cities like Kota Kinabalu can be traced directly back to its origins in Kalimantan," he said.

"Prevailing wind patterns act as a conveyor belt, lifting dense smoke plumes from the high-concentration fire zones across the border and funneling them straight into Sabah and Sarawak."

Tracking where the smoke comes from Sentian said determining the origin of haze requires scientists to combine information from above, on the ground and within the atmosphere.

From space, satellites used by agencies such as ASMC can detect thermal hotspots associated with active fires and track the movement of smoke plumes.

On the ground, the Department of Environment (DOE) operates a continuous ambient air-quality monitoring network which measures pollutants, including fine particulate matter such as PM_{2.5}.

"These localised API readings provide the vital, real-time health data needed for government officials to issue advisories, restrict outdoor activities, or close schools when pollution reaches dangerous levels," he said. But satellite hotspot maps alone do not establish where the smoke affecting a particular town originated.

For this, scientists can use the HYSPLIT model developed by the US National Oceanic and Atmospheric Administration (NOAA).

By conducting backward trajectory analysis, meteorologists can trace the path of an air mass arriving at a location such as Kota Kinabalu and determine where it travelled from. This helps establish the connection between fires in one region and degraded air quality in another.

"Ground-level monitoring by Malaysia's DOE alongside satellite hotspot tracking from ASMC and HYSPLIT trajectory modelling consistently confirm this source-receptor relationship," Sentian said.

Sabah's vulnerable zones

Not every part of Sabah is equally exposed to smoke transported from Indonesia.

Sentian said the southern and west coast regions were particularly vulnerable because of their geographical position and prevailing seasonal winds. "Tawau and Keningau act as the frontline due to their immediate geographical proximity to North Kalimantan, often experiencing the earliest and most severe spikes in air pollution when fires break out just across the border," he said.

On the west coast, he identified Kota Kinabalu, Beaufort, Sipitang and Kumanis as particularly susceptible during the drier months. He said the Southwest Monsoon, generally associated with the June-to-October period, could transport smoke from fire-prone areas

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in Kalimantan towards Sabah.

Conversely, areas such as Sandakan are generally less exposed to the direct pathway of southwesterly winds, although actual haze conditions depend on the prevailing weather and wind patterns at the time.

Smoke can travel hundreds of kilometres from Kalimantan but does not necessarily mean there is a major fire nearby. Fine particles from fires can remain suspended in the

atmosphere and be transported over considerable distances.

"During severe episodes, the pollution blanketing the state can originate from distant sources, such as massive peatland and forest fires in Central, West, or South Kalimantan," he said.

The Southwest Monsoon acts as a massive atmospheric conveyor belt, transporting the plumes across the vast landmass of Borneo and sometimes even to neighbouring countries," he said.

Backward trajectory modelling can then be used to reconstruct the air mass's journey over several days and identify its likely source region.

When drought turns peat into fuel

The severity of a haze episode is also closely tied to climate and weather.

Sentian said El Niño, drought and changing rainfall patterns can combine to create ideal conditions for large and persistent fires.

When an El Niño event occurs, it drastically reduces rainfall and raises temperatures across Southeast Asia, triggering intense and prolonged drought. "No-aid. The effects can be particularly severe in degraded peatlands."

As water tables fall, exposed peat dries out and becomes highly flammable.

"Once ignited, typically for agricultural land clearing, these peat fires burn deep underground, smouldering for weeks and producing dense, toxic smoke," he said.

The absence of sufficient rainfall weakens moisture sources.

Rain can suppress fires and remove some suspended particles from the atmosphere, while prolonged dry conditions allow fires to continue burning.

At the same time, seasonal winds can transport the resulting smoke far beyond the original fire zone.

The result is a combination of fire, drought and wind capable of turning local land-clearing fires into a regional haze crisis.

Climate change adds another layer

Sentian said rising temperatures and changes in climate could increase the conditions favourable for larger and more persistent fires.

Higher temperatures can accelerate drying, including the drying of peatlands, while prolonged dry periods can leave vegetation and peat more vulnerable to ignition. He said climate factors could compound the effects of naturally occurring climate cycles such as El Niño.

"These compounding climate factors create a drier, hotter environment where fires, once ignited, are much harder to extinguish, leading to more intense and enduring transboundary haze events," he said.

However, he stressed that haze does not necessarily become worse every single year. The weather can trap the smoke.

Even when smoke reaches Sabah, weather conditions determine whether it disperses or accumulates.

Sentian said atmospheric stability, weak surface winds and temperature inversions can trap pollutants close to the ground.

During a temperature inversion, warmer air above can act as a "lid," limiting vertical mixing and preventing smoke-filled air from the surface from dispersing upwards.

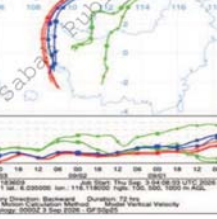
Topography can further influence the distribution of pollution. Kota Kinabalu, for instance, sits between the South China Sea and the Crocker Range.

Under certain stable atmospheric conditions, smoke transported into the area may accumulate instead of dispersing quickly. The result can be rapid increases in local pollution levels even when there is no major fire immediately around the city.

Local fires still matter

While Kalimantan may be the dominant source during major regional haze episodes, Sentian stressed that Sabah's own fires cannot be ignored.

NOAA HYSPLIT MODEL
Backward trajectories ending at 0100 UTC, 03 Sep 26
00 UTC 02 Sep GFSQ Forecast Initialization



Where does the air over Kota Kinabalu come from? This 72-hour NOAA HYSPLIT model tracks three air paths. Red and blue show lower-level air moving in from the southern South China Sea, bringing moist air along the Sarawak coast. Green shows higher-level air travelling from the direction of West Kalimantan towards Sabah. The model suggests that although much of the low-level air reaching Kota Kinabalu comes from the sea, air from inland Borneo can also be carried towards Sabah – potentially bringing smoke and other pollutants with it.

Agricultural land clearing, bush fires and local peat fires can worsen air quality, particularly when the atmosphere is already polluted by transboundary smoke.

"Although the total number of local hotspots is minimal compared to Kalimantan, local burning creates a severe compounding effect," he said.

He highlighted degraded peat areas along parts of Sabah's west coast, including Kumanis, Bongawan, Kuala Penyu, Sipitang and Beaufort, as areas that can become vulnerable during drier dry spells.

Local smoke can therefore add to an already polluted air mass. "When this dense, local smoke is released into an atmosphere already saturated with cross-border pollution, the two sources mix to create a severe compounding effect," he said.

This is why local enforcement against open burning remains important even when the dominant source of a haze episode lies outside Sabah.

One haze, two sources

In reality, haze does not have to come from just one source. Transboundary and local fires can occur simultaneously.

During a prolonged dry season, smoke from Kalimantan may already be raising pollution levels across Sabah while the same dry conditions encourage local fires.

Sentian said the combined effect could result in significantly poorer air quality in affected communities.

The distinction matters because reducing local burning may not eliminate a transboundary haze episode – but it can prevent additional pollution from being added to the atmosphere.

Don't judge haze by your eyes

Perhaps one of the most dangerous misconceptions, Sentian said, is assuming that a clearer-looking sky means safer air.

"Relying solely on how smoky the sky looks is a dangerously unreliable way to gauge the actual health risks of haze," he said.

The principal concern is PM_{2.5} – fine particles measuring 2.5 micrometres or less in diameter.

Because of their tiny size, they can penetrate deep into the lungs and are associated with cardiovascular and respiratory health effects.

A person may therefore be exposed to unhealthy concentrations of fine particles even when the sky does not look particularly dramatic.

Conversely, humidity can make haze appear thicker because water droplets and particles scatter light, reducing visibility.

"The most hazardous component of transboundary smoke is fine particulate matter, specifically PM_{2.5}," Sentian said.

Therefore, he advised the public to rely on official API readings and health advisories rather than visual appearance alone.

PM_{2.5} is the main concern

Haze contains a mixture of particles and gases, but Sentian identified PM_{2.5} and PM₁₀ as key pollutants of concern.

PM₁₀ consists of inhalable particles measuring 10 micrometres or less, while PM_{2.5} is considerably smaller and can penetrate deeper into the respiratory system.

PM_{2.5} from biomass and peat smoke is particularly concerning because prolonged exposure is associated with inflammation and increased risks to respiratory and cardiovascular health.

Gaseous pollutants, including carbon monoxide and ground-level ozone, can also contribute to poor air quality.

This is why simply waiting for the smoke smell to disappear is not a reliable indication that conditions have returned to normal.

Mask and indoor air

Sentian also cautioned against assuming that any mask provides adequate protection from fine particles.

Surgical and cloth masks are not designed to provide the same level of filtration and fit as particulate respirators.

Properly fitted N95 or equivalent particulate respirators offer substantially better protection against fine airborne particles.

But staying indoors does not automatically mean being completely protected. Outdoor PM_{2.5} can enter buildings through openings and ventilation pathways, particularly where buildings are not well sealed.

Where appropriate, reducing outdoor air infiltration and using a properly rated HEPA air purifier can help improve indoor air quality.

degraded peatlands can become highly combustible.

He also noted that today's sophisticated satellite and ground monitoring systems make haze much more visible than it was decades ago.

Real-time hotspot tracking and continuous PM_{2.5} measurements mean that pollution episodes are now detected and documented much more precisely.

Sabah needs to predict, not just react

Looking ahead, Sentian said Sabah needs to move beyond simply monitoring pollution after it arrives.

He advocated an integrated, high-resolution forecasting system capable of predicting the movement and concentration of haze before it reaches communities.

He pointed to MyCMAQ (Malaysian Community Multiscale Air Quality) and the use of atmospheric models combining weather and air-quality information.

Such systems can simulate pollutant transport and atmospheric chemistry rather than merely showing where fires are burning.

Sentian also proposed expanding ground monitoring with localised IoT sensor networks in vulnerable areas such as Tawau, Beaufort and Kumanis.

Peatland groundwater sensors could provide early warning when water tables fall to dangerous levels, while geostationary satellite observations could provide continuous fire detection.

The ultimate goal, he said, should be 24-to-48-hour predictive haze forecasts, allowing authorities to act before pollution peaks.

This could include advance public-health advisories, restrictions on outdoor activities and, where necessary, decisions concerning schools.

Three things governments can do

Sentian identified three practical priorities for Sabah and its regional neighbours.

1. Restore and reveget peatlands – Degraded peatlands need to be restored through measures such as revegetation, canal blocking and reforestation.

Maintaining higher water tables reduces the likelihood of peat drying into highly combustible fuel during severe droughts. This needs to happen not only in Sabah but also in major fire-prone areas of Kalimantan.

2. Strengthen cross-border fire response – Regional cooperation under the Asean Agreement on Transboundary Haze Pollution (AATHP) should be strengthened.

Sentian proposed greater sharing of satellite information and faster joint responses to fires, particularly those occurring in areas where smoke can rapidly cross international boundaries.

The objective is to extinguish fires before they grow into major regional smoke events.

3. Build predictive early-warning systems – Finally, Sabah needs better local forecasting and community-level warning systems.

Combining chemical-transport models with dense IoT monitoring networks could provide localised forecasts 24 to 48 hours ahead.

Such warnings would allow authorities to prepare schools, outdoor workers and vulnerable communities before hazardous PM_{2.5} concentrations arrive.

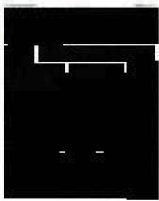
Clean air has no borders

For Sabahans staring out at a hazy skyline and wondering where the smoke came from, Sentian's answer is straightforward: look beyond the immediate horizon.

"Haze is primarily an invisible, long-distance transport problem rather than just a local fire issue," he said. While local agricultural and peat fires can worsen the situation, the severe pollution during major haze episodes can originate from massive forest and peatland fires across Kalimantan.

The smoke is then carried by atmospheric circulation across Borneo.

"Ultimately, the smoky sky is proof that clean air knows no national borders," Sentian said. And that, he argued, is why solving Sabah's haze problem cannot stop at Sabah's borders. Regional cooperation, peatland restoration, stronger fire prevention and enforcement, and better early-warning systems will all be needed if Sabah is to breathe easier when the next major dry spell arrives.



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SUMMARIES

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