

Topics

- Jet stream and Heat waves
- 'Transient '
- AI Convention
- India In Cannes
- What is flash drought ?
- Cobalt blue
- Bush moa
- Mains



By saurabh Pandey



Target Mains -2024/25

Q " Jet streams are the responsible factor for increase in heat waves frequency " Discuss
Q "जेट स्ट्रीम ऊष्मा तरंगों की आवृत्ति में वृद्धि के लिए जिम्मेदार कारक हैं" चर्चा करें

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This century, heatwaves are moving slower and lasting longer

Scientists analysed the upper atmosphere's air circulation patterns to see how the moving air could affect the big blobs of heat that render heatwaves; they found that over the years, the jet stream — a fast, narrow current of air that flows from west to east high up in the troposphere — has become weaker

Rohini Subrahmanyam

Growing up in the 1990s in India meant having seen an ad for a glucose-based drink on television in which the sun literally sucks the life-force out of children with a giant straw as they are playing. This ad has started to hit closer to reality. India has increasingly been in the grip of more frequent and intense heat waves, with outdoor workers especially struggling with the rising mercury.

A recent study published in *Science Advances* showed that it wasn't just India: the whole world is grappling with slower and longer heatwaves.

Temperature and circulation

Heatwaves have a terrible impact on human and animal life, with increased risk of wildfires, damaged crops, and worse health. Analysing temperatures around the world from 1979 to 2020, Wei Zhang, a climate scientist at Utah State University, and his colleagues studied how they have changed over time.

On average, they found, heatwaves have slowed down nearly 8 km/day each decade and lasted longer by about four days — the effects being particularly drastic in North America and Eurasia. Heatwaves have also increased in frequency, from about 75 events averaged over 1979-1983 to about 98 over 2016-2020. "In thinking about heatwaves and how they would change in the future, there are two pieces of the puzzle that climate scientists think about," Rachel White, an atmospheric scientist at the University of British Columbia, said. "One of them is thermodynamics: it's just about the temperature. As temperatures are getting warmer, heatwaves are going to get warmer. The second piece is the dynamics: the atmospheric circulation patterns that cause heatwaves."

There are still some open questions around how those might change in a warming world.

The heat moves

Previous studies have mostly focused on how frequent heatwaves are or how hot it gets during one. In this study, the researchers classified contiguous heatwaves as events with extremely high temperatures, covering more than a million square kilometres, and lasting for longer than three days. They then tracked the movement of these huge masses of hot air over space and time, studying how far and how fast they were moving — one of the first groups of scientists to do so.

Instead of just focusing on the frequency and the intensity of heatwaves, the study also checked how fast they were propagating and how long they lasted. By



Taking cover: Women cover their faces to protect from heat at Bikaner in Rajasthan on April 19. REUTERS

looking at how heatwaves move over time and space, Dr. White believes the study has bridged the gap between the thermodynamic and dynamic pieces of the heatwaves puzzle a little more than before.

"This study is looking at heatwaves like an object that can move and can travel and propagate, which you would miss if you were just looking at one point," she said. "If you just look at one point, you can be like, 'oh, the heatwave lasted for 5 days'. But the object itself lasted for longer, it just moved. That's what they are doing here, tracking them as they are moving, which is cool."

The guiding hand falters

But what could be causing them to move so sluggishly? The scientists analysed the upper atmosphere's air circulation patterns, to see how the moving air could affect these big blobs of heat. They found that over the years, the jet stream — a fast, narrow current of air that flows from west to east high up in the troposphere — has become weaker.

The jet stream guides atmospheric waves, waves that are caused by the earth's rotation and which influence the earth's surface temperature. As the jet stream weakens, these waves also move more slowly, leading to more persistent weather events, and more spells of high and slow-moving heat.



Given that heatwaves have such a huge impact on human health and the environment, we need to think about climate adaptation

WEI ZHANG
Climate scientist, Utah State University

To check if human activity had played a role in this outcome, the researchers ran simulations with temperature data from 1979 to 2020, but included scenarios with and without human greenhouse gas emissions. They found that though natural climate variability and natural events also influenced how heatwaves had changed, human activity and greenhouse gas emissions have played a dominant role in rendering the slower-moving and longer-lasting heat. Dr. White said the next steps would be to further tease apart the role of atmospheric air circulation patterns in contributing to heatwave dynamics on the ground. Country-specific changes in heatwaves over time would also be some of the missing pieces of the puzzle she would like to see. "I think there's just a lot that can be done with this dataset, now that they have created it," she said.

Dr. Zhang does plan to delve deeper into regional differences as part of the

group's next steps, while also working on climate adaptation strategies. "Given that heatwaves have such a huge impact on human health and the environment, we need to think about climate adaptation," he said.

Mitigation strategies

In densely populated urban areas, some strategies to better mitigate changes in heatwaves would be to plant more trees and increase green infrastructure — an undertaking Dr. Zhang has himself been involved in. Together with Tree Utah, an NGO, he has been engaging people in planting and taking care of trees. He has also been teaching a class on Climate Adaptation Science at Utah State University, where he helps students learn and apply climate adaptation strategies, with projects like working with farmers on alternative crops.

"This paper is another form of evidence that climate change is altering these extreme weather events," Dr. Zhang said. Adding to the already long list of studies, like how the intensity of hurricanes has increased or how there is extreme precipitation, this study, in Dr. Zhang's words, "is another signal of how climate change could influence our daily lives, our health, our environment — by changing the behaviour of heatwaves." (Rohini Subrahmanyam is a freelance journalist)

THE GIST

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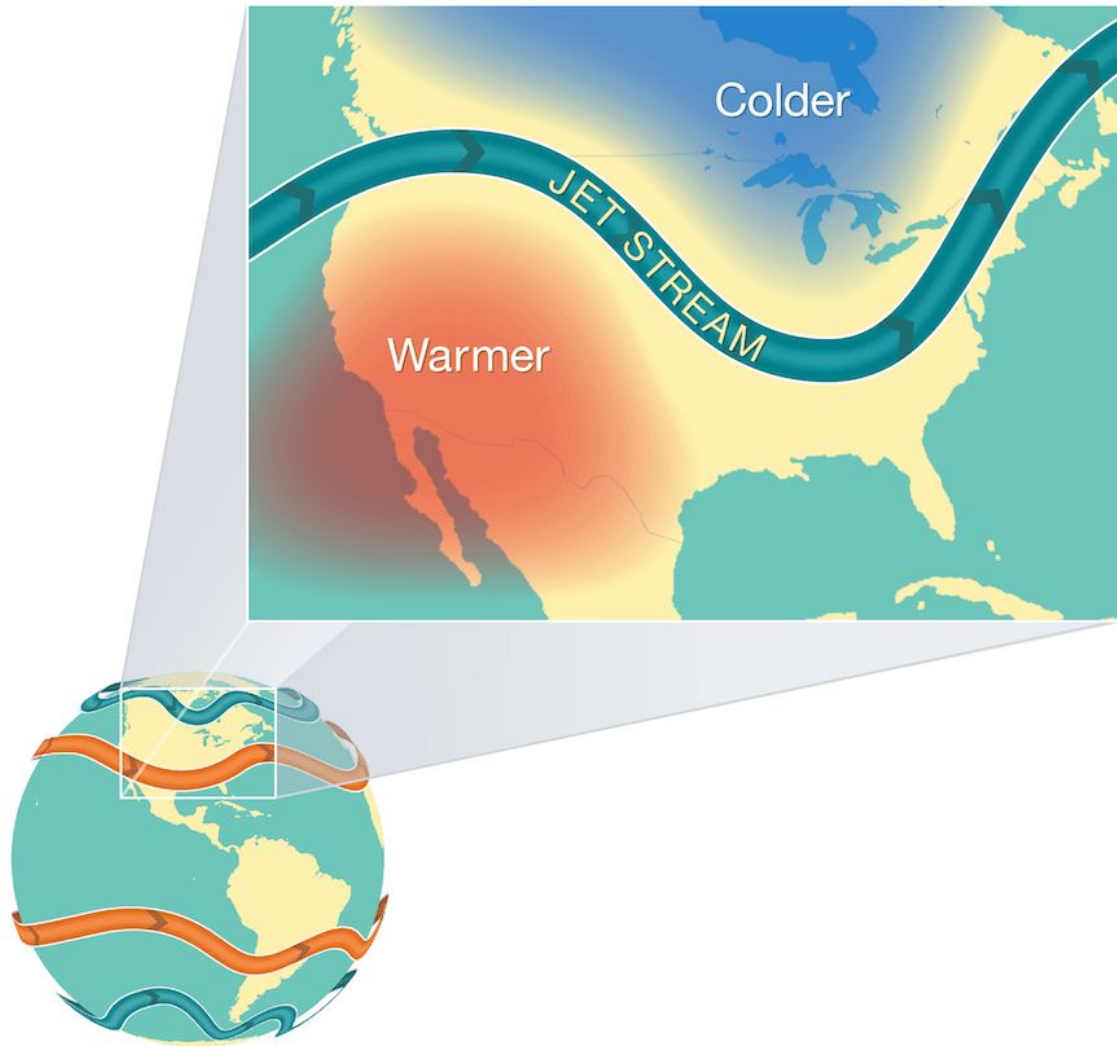
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About Jet stream

- Jet streams are narrow bands of strong wind that generally blow from west to east all across the globe.
- Earth has four primary jet streams: two polar jet streams, near the north and south poles, and two subtropical jet streams closer to the equator.

What Causes Jet Streams?

- Jet streams form when warm air masses meet cold air masses in the atmosphere.



- The Sun doesn't heat the whole Earth evenly. That's why areas near the equator are hot and areas near the poles are cold.
- So when Earth's warmer air masses meet cooler air masses, the warmer air rises up higher in the atmosphere while cooler air sinks down to replace the warm air.
- This movement creates an air current, or wind. A jet stream is a type of air current that forms high in the atmosphere.



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WHAT IS IT?

Astronomical transients: burning bright in the blink of an eye

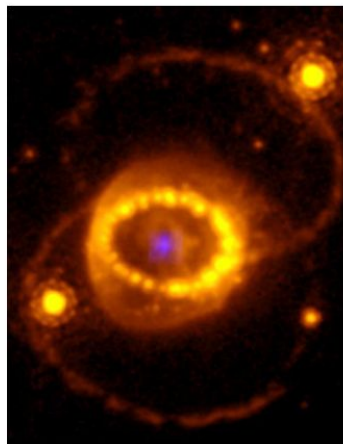
Vasudevan Mukunth

In astronomy, a 'transient' is any celestial object whose brightness changes in short spans of time. There are many kinds of astronomical transients, all of them united by phenomena that are violent in some measure. Astronomers study transients to understand where their violence comes from and what that can tell us about non-transient events.

On May 21, in fact, the Indian-American astronomer Shrinivas Kulkarni was awarded the Shaw Prize for Astronomy in 2024 for his work on the physics of astronomical transients.

One of the most well-known such transients is supernovae — when the outer layers of large stars blow up while their cores implode because the stars have run out of elements to fuse. Many a supernova has been known to become so bright that it emits light more intensely than the stars in the rest of its host galaxy combined. Another famous transient is the active galactic nucleus (AGN). The centres of massive galaxies host supermassive black holes. Sometimes, these black holes actively feast on matter in their orbit. Interactions between the black holes and the matter in this process cause the latter to acquire energy and glow with a changing brightness.

In 2007, astronomers discovered a mysterious new transient called a fast



Moment of shine: The aftermath of supernova 1987A. Supernovae are one of the most well-known astronomical transients. AP

hundreds of FRBs even though they're hard to spot: they can emit more than 10-times as much energy as the Sun in a few milliseconds. We don't know what causes them.

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'Transient'

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An overview of Europe's AI convention

What is the scope of the Framework Convention on Artificial Intelligence and Human Rights, Democracy and the Rule of Law? What is the difference between a framework convention and a protocol? How does the convention address national security concerns?

EXPLAINER

Krishna Ravi Srinivas

The story so far:

The global governance of Artificial Intelligence (AI) is becoming more complex even as countries try to govern AI within their borders in various ways, ranging from acts of law to executive orders. Many experts have articulated a global treaty to this effect, but the obstacles in its path are daunting.

What is Europe's AI convention?

Although there are many ethical guidelines, 'soft law' tools, and governance principles enshrined in many documents, none of them are binding or are likely to result in a global treaty. There is also no ongoing negotiation for an AI treaty at the global level anywhere. Against this background, the Council of Europe (COE) took a big step by adopting the Framework Convention on Artificial Intelligence and Human Rights, Democracy and the Rule of Law, also known as the 'AI convention', on May 17. The COE is an intergovernmental organisation formed in 1949, with currently 46 members. The agreement is a comprehensive convention covering AI governance and links to human rights, democracy, and the responsible use of AI. The framework convention will be opened for signature on September 5.

What is a framework convention?

A 'framework convention' is a legally binding treaty that specifies the broader commitments and objectives under the convention, and sets mechanisms to achieve them. The task of setting specific targets is left to subsequent agreements. Those agreements that are negotiated under the framework convention will be called protocols. For example, the Convention on Biological Diversity is a framework convention while the Cartagena Protocol on Biosafety is a



ISTOCKPHOTO

protocol under it that deals with living modified organisms.

The framework convention approach is useful because it allows flexibility even as it encodes the core principles and processes by which the objectives are to be realised. Parties to the convention have the discretion to decide the ways in which to achieve the objectives, depending on their capacities and priorities. The AI convention can catalyse the negotiation of similar conventions at the regional level in other places. Then again, as the U.S. is also a member of the COE, the convention can indirectly affect AI governance in the U.S. as well, which matters because the country is currently a hotbed of AI innovation.

What is the scope of the convention?

Article 1 of the convention states: "The

provisions of this Convention aim to ensure that activities within the lifecycle of artificial intelligence systems are fully consistent with human rights, democracy and the rule of law".

Article 3 states: "The scope of this Convention covers the activities within the lifecycle of artificial intelligence systems that have the potential to interfere with human rights, democracy, and the rule of law as follows: a. Each Party shall apply this Convention to the activities within the lifecycle of artificial intelligence systems undertaken by public authorities or private actors acting on their behalf. b. Each Party shall address risks and impacts arising from activities within the lifecycle of artificial intelligence systems by private actors... in a manner conforming with the object and purpose of this Convention."

Does it address national security?

The exemptions in Articles 3.2, 3.3, and 3.4 are broad and pertain to the protection of national security interests, research, development and testing, and national defence, respectively. As a result, military applications of AI are not covered by the AI convention. While this is a matter of concern, it's a pragmatic move given the lack of consensus on regulating such applications. In fact, the exemptions in Articles 3.2 and 3.3 – while broad – don't completely rule out the convention's applicability vis-a-vis national security and testing, respectively.

Finally, the 'General Obligations' in the convention pertain to the protection of human rights (Article 4), the integrity of democratic processes, and respect for the rule of law (Article 5). While disinformation and deep fakes haven't been addressed specifically, parties to the convention are expected to take steps against them under Article 5. In fact, the convention indicates (in Article 22) that parties can go beyond the commitments and obligations specified.

Why do we need the AI convention?

The AI convention doesn't create new and/or substantive human rights specific to AI. Instead, it asserts that existing human and fundamental rights that are protected by international and national laws will need to stay protected during the application of AI systems as well. The obligations are primarily directed towards governments, which are expected to install effective remedies (Article 14) and procedural safeguards (Article 15). In all, the convention takes a comprehensive approach to mitigating risks from the use of AI systems for human rights and democracy. There are bound to be challenges to implementing it, particularly at a time when AI regulation regimes are yet to be fully established and technology continues to outpace policy.

Krishna Ravi Srinivas is Adjunct Professor of Law, NALSAR University of Law, Hyderabad, and Associate Faculty Fellow, CeRAI, IIT Madras.

THE GIST

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AI Convention



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Double treat at Cannes as Payal and Anasuya bag awards

Press Trust of India

CANNES

India received a double treat at the Cannes Film Festival this year, with filmmaker Payal Kapadia taking home the Grand Prix award for her spellbinding drama *All We Imagine as Light* and Anasuya Sengupta, one of the lead stars of the film *The Shameless*, bagging the Best Actress award in the Un Certain Regard category.

The Grand Prix award is the second-most prestigious prize of the festival after the Palme d'Or, while the Un Certain Regard celebrates films with unusual styles and non-traditional stories.

Ms. Kapadia's feature directorial debut, which screened on Thursday night and has received glowing reviews in the international press, already registered its name in the history books after it became the first Indian film in 30 years and first-ever by an Indian woman director to be showcased in the main competition.

The screening of the



Filmmaker Payal Kapadia winning the Grand Prix Award for *All We Imagine As Light* at Cannes Film Festival; actors Rohit Kokate, Omara Shetty, Bulgarian director Konstantin Bojanov and Anasuya Sengupta arrive for the screening of the film *The Shameless*. GETTY IMAGES, AFP

film received an eight-minute standing ovation from the audience members. *All We Imagine as Light*, a Malayalam-Hindi feature, has two nurses as the protagonists. An alumna of the Film and Television Institute of India (FTII), Ms. Kapadia is best known for her acclaimed documentary *A Night of Knowing Nothing*, which premiered at the 2021 Cannes Film Festival's Director's Fortnight sidebar where it won the Oeil d'or (Golden Eye) award.

The main competition jury was chaired by filmmaker Greta Gerwig and also included Spanish di-

rector Juan Antonio Bayona, Turkish actor-screenwriter Ebru Ceylan, Italian actor Pierfrancesco Favino, American actor Lily Gladstone, Japanese director Hirokazu Kore-eda, Lebanese actor-director Nadine Labaki and French stars Eva Green and French actor Omar Sy.

Ms. Sengupta, who starred in Bulgarian director Konstantin Bojanov's Hindi movie *The Shameless*, is the first Indian artist to win the top acting honour in the Un Certain Regard category.

In her acceptance speech on Friday night,



Ms. Sengupta dedicated the award to the "queer community and other marginalised communities" for bravely fighting for their rights all over the world.

Fight for equality

"You don't have to be queer to fight for equality, you don't have to be colonised to know that colonising is pathetic – we just need to be very, very decent human beings," the actor said.

The win at Cannes is a landmark moment in Ms. Sengupta's career. She earlier played a supporting part in the 2009 Bengali

film *Madly Bangalee*, directed by Anjan Dutt, and worked as a production designer after shifting to Mumbai.

The Shameless, which had its premiere at Cannes on May 17, forays into a dark, disturbing world of exploitation and misery in which two sex workers, one who bears the scars of her line of work, the other a young girl days away from ritual initiation, forge a bond and seek to throw off their shackles. Ms. Sengupta plays the central character of Renuka, who escapes from a Delhi brothel after stabbing a

Sean Baker's *Anora* crowned with Palme d'Or

Anora, a raw, highly explicit and often hilarious story about a New York erotic dancer, was crowned with the Palme d'Or at the Cannes Film Festival on Saturday. It confirmed its director Sean Baker as one of the leading voices of American indie cinema. AFP

policeman to death and takes refuge in a community of sex workers in northern India, where she meets Devika (Omara), a young girl condemned to a life of sex work.

The actor celebrated her win on Instagram, where she posted pictures with Un Certain Regard jury head, Canadian director Xavier Dolan, and German-Luxembourg star Vicky Krieps. "I won, guys, held so lovingly by my heroes. I'm here for you, to be the one you need THANK YOU @festivaldecannes," Ms. Sengupta wrote in the caption.



“India In Cannes”

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Warming climate intensifies flash droughts worldwide

The Hindu Bureau

Sudden, severe dry spells known as flash droughts are rising in intensity around the world, with a notable exception in mountainous Central Asia, where flash drought extent is shrinking, according to new research. Heat and changes to precipitation patterns caused by a warming climate are driving these trends, the study

found. The new study is the first to apply a systematic, quantitative approach to the global incidence of flash drought, mapping hotspots and regions of rapid increases in recent decades.

Tracking measures

Many parts of the world have witnessed flash droughts for a longer time, with faster onset speed. The study defined and

tracked three critical measures of drought severity: speed of onset, duration and geographic extent. It analyzed 40 years of NASA's MERRA-2 climate data, from 1980 to 2019, drawn from weather observations, satellite imagery and modeled root-zone soil moisture, with the aim of improving prediction and disaster preparedness. The study is published in the journal *Geophysical Re-*

search Letters.

South America, particularly southern Brazil and the Amazon is experiencing strong intensification in all three dimensions of flash drought, aligning with deforestation patterns in the region, high temperatures and less rain. Congo, Angola, Zambia, Zimbabwe, South Africa, Lesotho, and Madagascar are also hotspots. High temperatures were found

to be more important than declining precipitation in the African watersheds.

Land cover is also important to flash drought vulnerability. Savanna and grasslands are more susceptible to flash droughts than other ecotypes, particularly in humid and semi-humid climates, the study found.

In Central Asian watersheds, centered on high mountains, including the

Himalaya Karakoram, Tianshan and Hindu Kush, flash drought extent shrank over the study period, bucking the worldwide trend. Climate-driven changes in precipitation, melting snowpack and a shift from snow to rain in the mountains have kept soils moist. These changes can cause an increase in flash floods, which have been observed in the region.

What Is Flash Drought?



- **Flash drought is simply the rapid onset or intensification of drought.**
- **It is set in motion by lower-than-normal rates of precipitation, accompanied by abnormally high temperatures, winds, and radiation.**
- **Together, these changes in weather can rapidly alter the local climate.**
- **Higher temperature increases evapotranspiration—the process by which water is transferred from the land to the atmosphere by evaporation from the soil and by transpiration from plants—and further lowers soil moisture, which decreases rapidly as drought conditions continue.**

- **If not predicted and discovered early enough, changes in soil moisture that accompany flash drought can cause extensive damage to agriculture, economies, and ecosystem goods and services.**



Question Corner

Colour blue

Is there any blue pigment with enhanced colour properties, reduced cost and lower cobalt content than cobalt blue?

The Egyptians and Babylonians used lapis lazuli 6,000 years ago. In 1802, a French chemist synthesised cobalt blue. In 2009 scientists discovered YInMn Blue, otherwise known as Oregon Blue. But most of these pigments have limitations. In 2020, researchers reported a new class of 'cool' blue colourants that are inexpensive and more environmentally friendly. For the last 200 years, cobalt blue has been a dominant commercial blue pigment because of its

colour intensity, ease of synthesis and versatility. However, 33% of the colourant by mass is carcinogenic, making cobalt blue relatively expensive and environmentally harmful to produce. The Oregon State University researchers were inspired by the crystalline structure of a light-blue mineral called hibonite. The team substituted aluminum ions in hibonite with cobalt, nickel or titanium ions. The resulting series of pigments showed a range of intense blue colours, some with reddish hues.

Readers may send their questions / answers to questioncorner@thehindu.co.in



Cobalt Blue

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Genome of the extinct little bush moa reconstructed

Using ancient DNA recovered from a fossil bone, scientists have reconstructed a complete genome of the little bush moa, an extinct species of flightless bird that once roamed the forested islands of New Zealand. The work allowed the scientists to determine the bird's likely population size, and even suggests that the moa's eyes could detect ultraviolet light. The moas made their homes in the island's dense forests and grasslands as recently as 700 years ago.

Bush moa

- The bush moa, little bush moa, or lesser moa (*Anomalopteryx didiformis*) is an **extinct** species of **moa** from the family **Emeidae**.
- It was the smallest known species of moa, only slightly taller than a **turkey** (approx. 1.3m tall). A slender bird, it weighed around 30 kilograms (66 lb)
- The species went extinct alongside other native New Zealand wildlife around 500-600 years ago, following the arrival and proliferation of the **Māori people** in **New Zealand** (who called them "moariki"), as well as the introduction of **Polynesian dogs**

- Scientists at **Harvard University** assembled the first nearly complete genome of the species from toe bones, thus bringing the species a step closer to being "**resurrected**" in the future by using the **emu** as a proxy.



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