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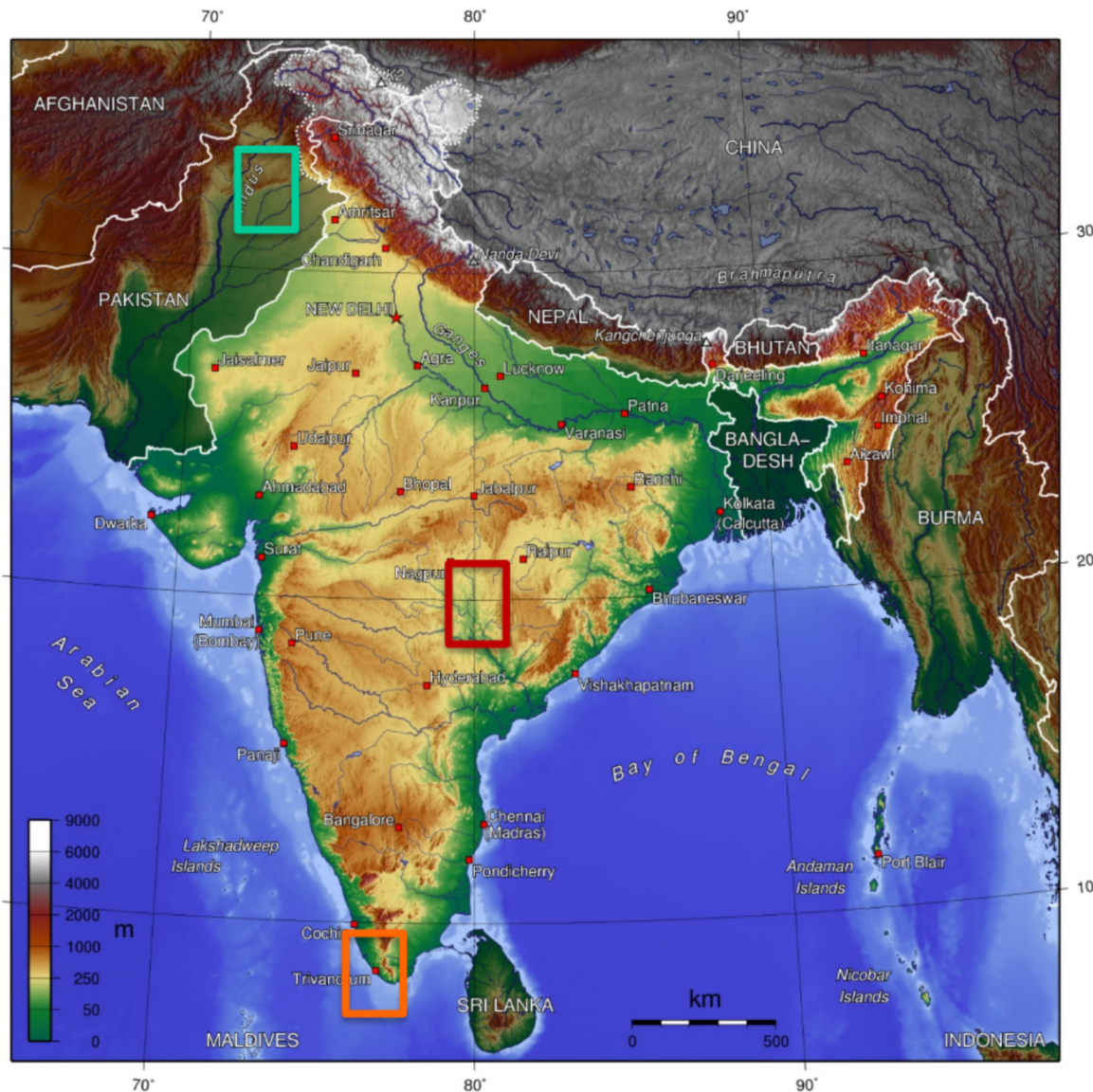
Space Research Institute (IKI), Russian Academy of Sciences, Moscow, Russia

Early forecasting of Indian Summer Monsoon: case study 2017



#impacts world2017 , 11th Oct, 2017

How far in advance can the monsoon be realistically predicted?



North Pakistan (32.5N,72.5E)
is the tipping element of
ISM where the ISM ceases
to exist.

The Eastern Ghats (20N, 80E)
is the tipping element of the
ISM where we deliver our
forecast of monsoon onset on
May 6.

Kerala state is the region
where the IMD delivers the
forecast of onset of monsoon
on **May 15.**



Stolbova V., Surovyatkina E., Bookhagen B., Kurths J., Tipping elements of the Indian monsoon: prediction of onset and withdrawal. *GRL*, 43, 1–9, April 20, 2016

What does the term 'tipping' mean?

One of the definitions of tip
overbalance or
cause to overbalance
to fall or turn over.

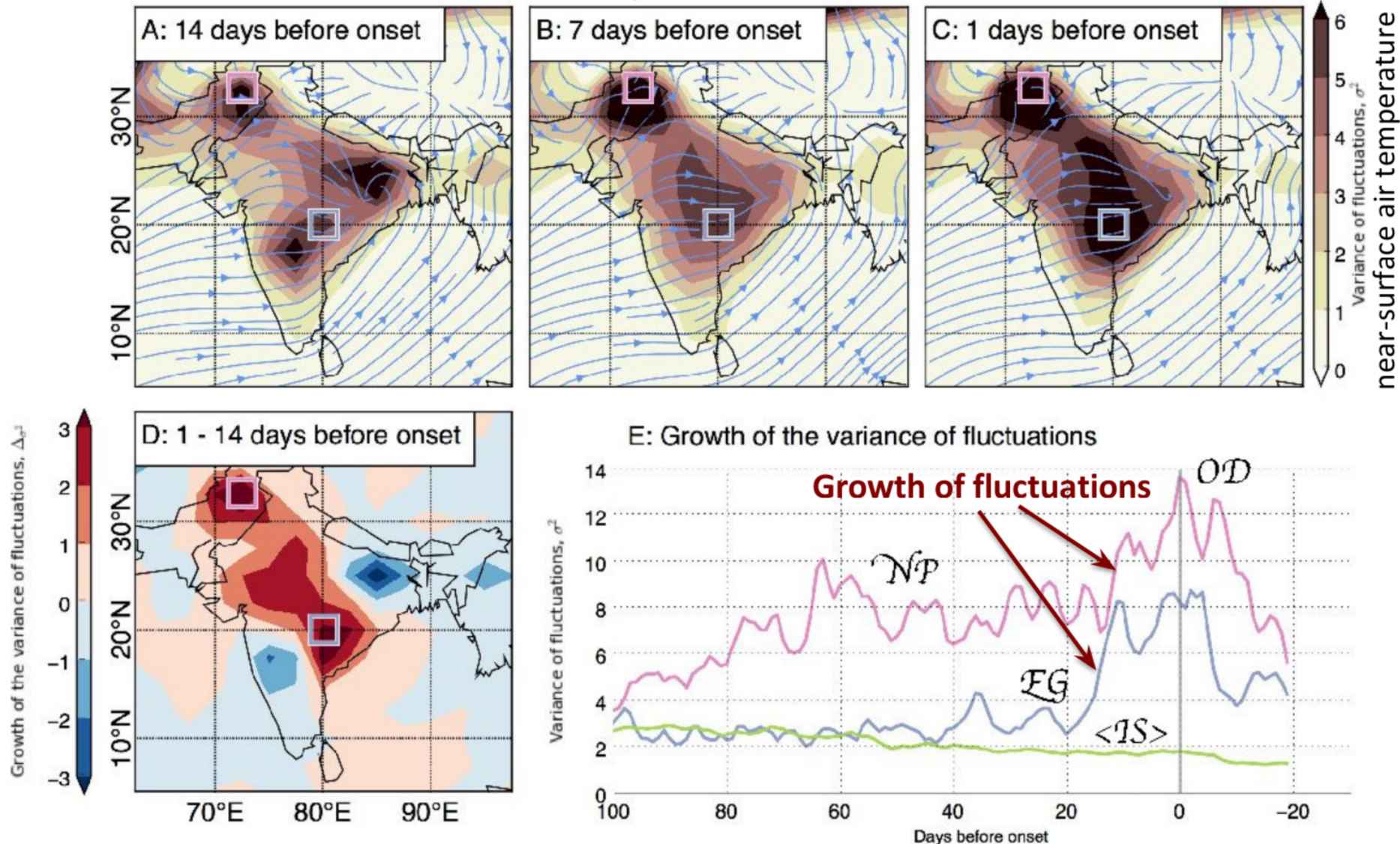
“The hay caught fire when
the candle tipped over.....”



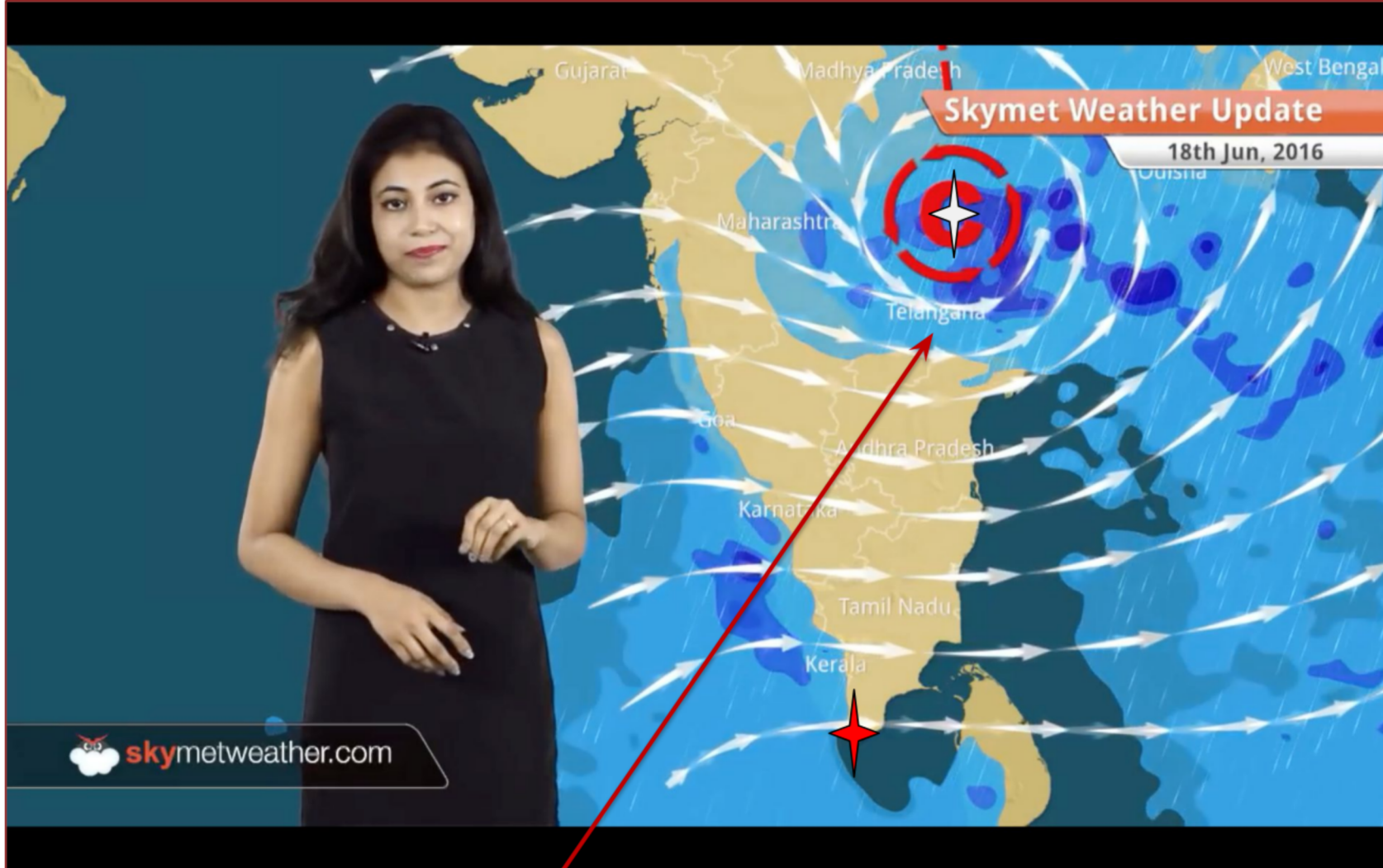
- ✓ The candle is an origin of the problem – a tipping element of the system.
- ✓ The time when the candle tipped over is a tipping point.
- ✓ An open window which gives the direction of flame propagation is the second tipping element of the system.

Tipping elements and prediction of monsoon

DATA: ERA40: near -surface air temperature, 0.25 °/0.25° resolution, (1958-2001)



- Stolbova V., Surovyatkina E., Bookhagen B., Kurths J., Tipping elements of the Indian monsoon: prediction of onset and withdrawal. Geophysical Research Letters 43, 1–9, 2016, 2016
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The topography of the EG (20 N, 80E) creates a favorable condition for the formation of a low-pressure system, and when the ITCZ reaches the EG, two branches of monsoon merge: the Arabian Sea and the Bay of Bengal.

We predict the occurrence of these conditions.

<https://www.pik-potsdam.de/services/infodesk/forecasting-indian-monsoon>

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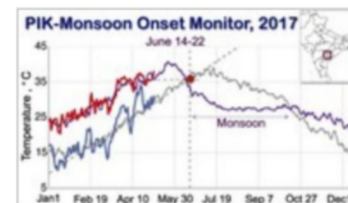
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Welcome to the PIK monsoon page!

This web page provides a long-term forecast of the onset and withdrawal of the Indian Summer Monsoon (the Southwest Monsoon) for the central part of India. The long-term forecast means 40 days in advance for the onset date, and 70 days in advance for the withdrawal date. Our approach is based on a teleconnection between the Eastern Ghats (EG) and North Pakistan (NP) - Tipping Elements of Indian Summer Monsoon.

LATEST NEWS

July 30, 2017
Earliest Forecast of the Withdrawal Date of Indian Summer Monsoon - 2017 from the Central part of India.



Daily mean near-surface air temperature till May 5, 2017 for

NEWS

- New forecast method predicts 2017 Indian Summer Monsoon onset
- Successful forecast of onset and withdrawal of the Indian Summer Monsoon
- Prediction of Monsoon withdrawal
- Successful early forecasting of Indian Monsoon



Indian Summer Monsoon - 2017

The PIK- monsoon onset monitor news

May 08, 2017

Forecast of the Onset date of the Indian Summer Monsoon - 2017 over the central part of India

The Indian Summer Monsoon (the Southwest Monsoon) is likely (with a 73% probability) to set over the central part of India, the Eastern Ghats region (20°N,80° E) on or **around 18th June (+/- 4 days)**.

The region of our forecast locates in the central part of India in the area of the Eastern Ghats (EG).



Forecast has been issued 40 days in advance

<https://www.pik-potsdam.de/services/infodesk/forecasting-indian-monsoon>



Monsoon to hit central India between June 14-22

New Delhi, DH News Service, May 9 2017, 1:35 IST



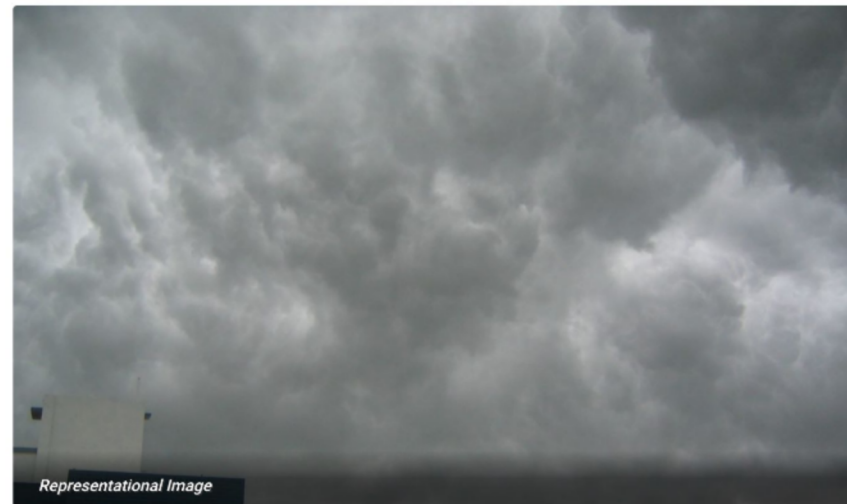
Since last year, the German institute began forecasting the onset and withdrawal of monsoon using its own weather model.

Premier Association
of the
Sugar Industry In India

Monsoon to hit TS on June 18

Scientists from Germany develop forecast method which predicts accurately.

By [TelanganaToday](#) | Published: 14th May 2017 10:50 pm



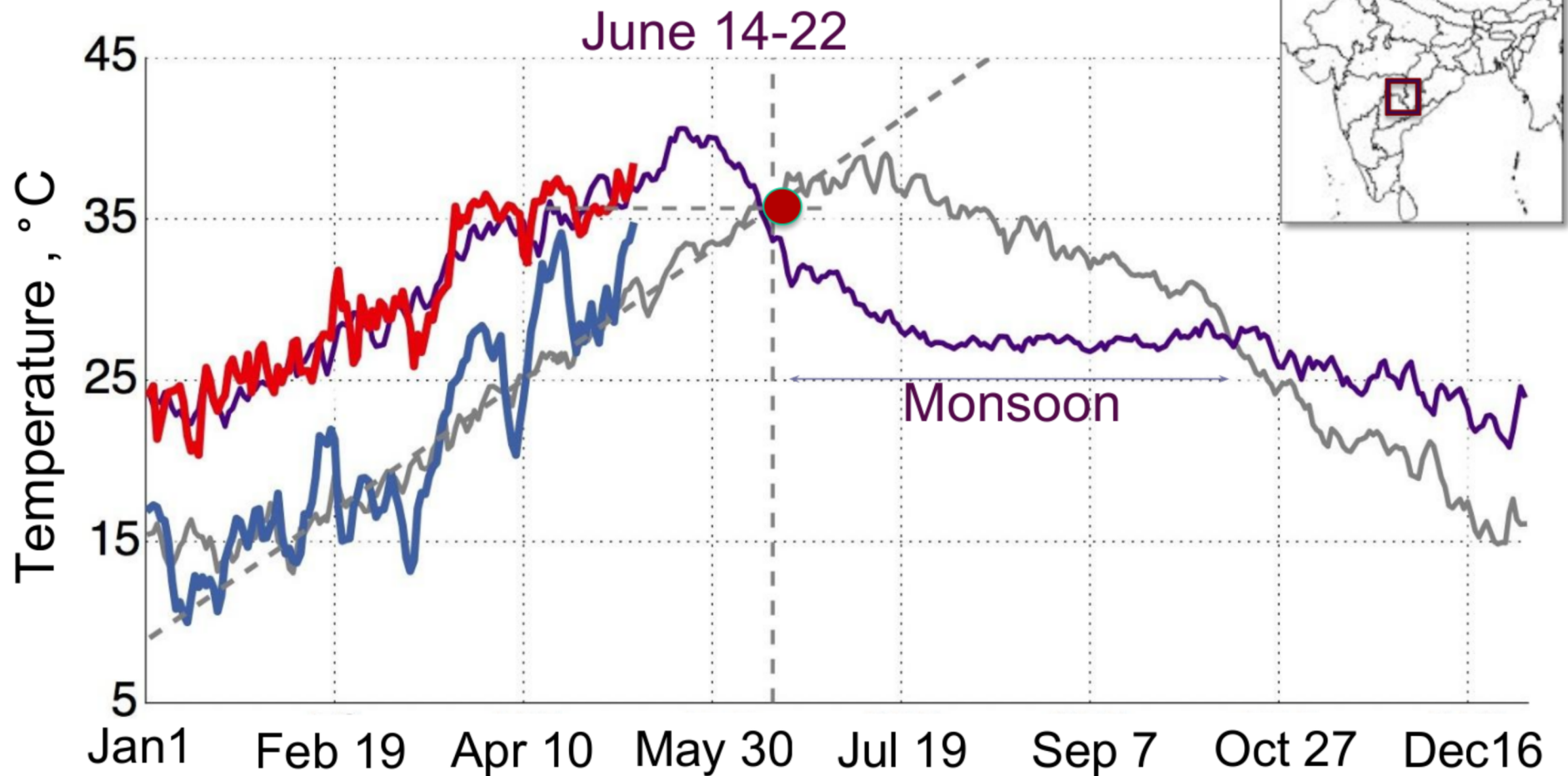
Hyderabad: The southwest monsoons will hit Telangana and other parts of Central India on or around June 18, according to an early forecast method developed by weather scientists from Potsdam Institute for Climate Impact Research (PIK), Germany.

The forecast method is based on analysis of observational data that allows predicting monsoon onset date more than a month in advance in the central part of India where early forecasting has never been made, Elena Surovyatkina, the research scientist from PIK, who led this study said.

Meanwhile, an early forecast method at the Potsdam Institute for Climate Impact Research said that the monsoon would reach Central India between June 14 and 22.



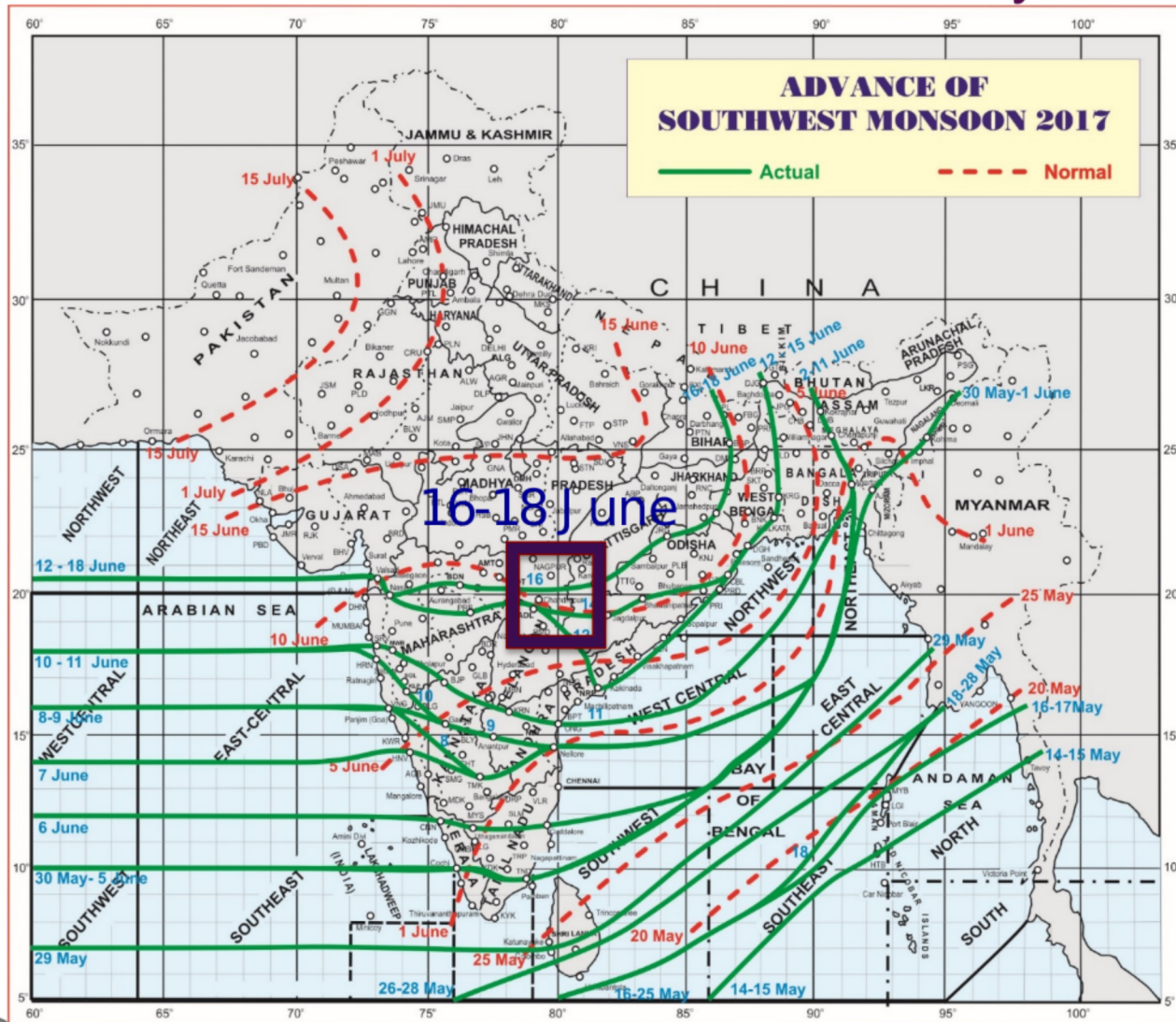
PIK-Monsoon Onset Monitor, 2017



Daily mean near-surface air temperature till **May 8, 2017**, for the Eastern Ghats (red) and North Pakistan (blue). Violet and gray lines- past 5-years average for same regions. The tipping point (red) indicates the critical temperature and the forecasted onset date. The forecasted withdrawal dates are from 7th to 17th October.

The Evidence for successful PIK-Monsoon onset forecast - 2017

Onset forecast: June 18 \pm 4 days



The Map of Advance of Southwest Monsoon by the Indian Meteorological Department (<http://www.imd.gov.in/pages/allindiawxfcbulletin.php>)

Indian Summer Monsoon - 2017

The PIK- monsoon onset monitor news



July 30, 2017

Earliest Forecast of the Withdrawal Date of Indian Summer Monsoon - 2017 from the Central part of India.

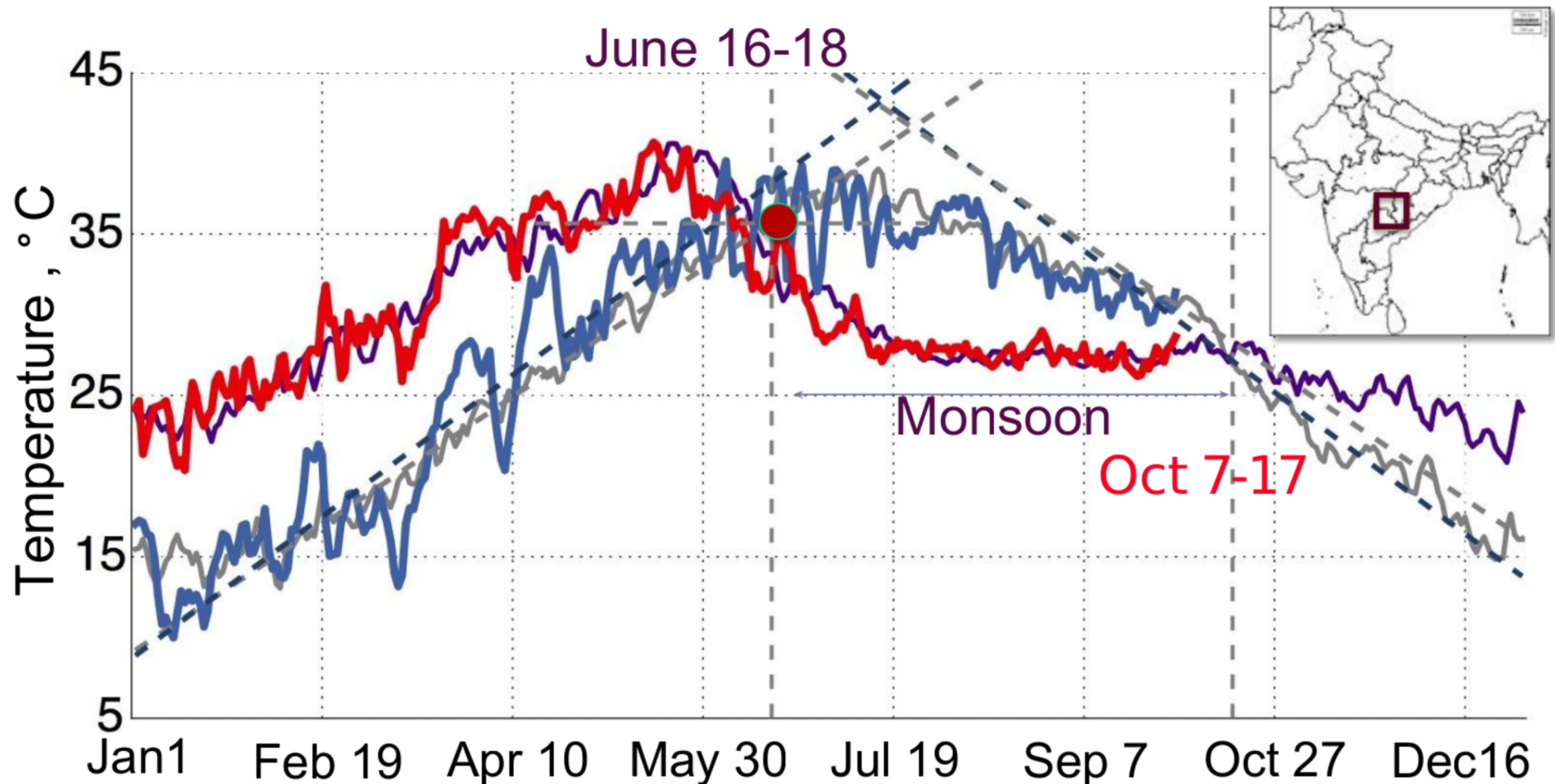
The Indian Summer Monsoon (Southwest Monsoon) is likely (with an 84% probability) to withdraw from the Central part of India (20N, 80E) around 12th October (+/- 5 days), namely between **7th and 17th October 2017**.

Forecast has been issued 70 days in advance

<https://www.pik-potsdam.de/services/infodesk/forecasting-indian-monsoon>

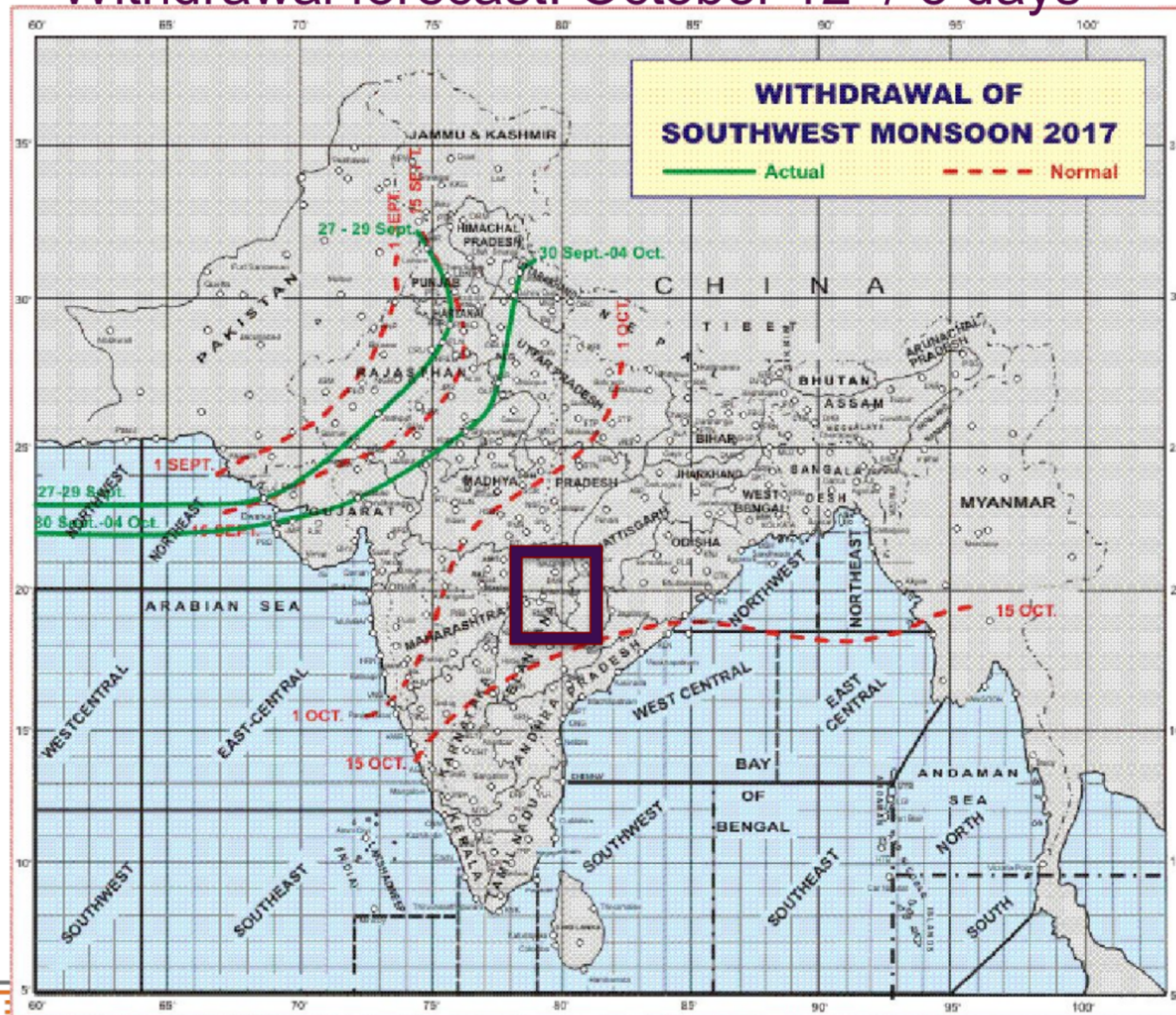


PIK-Monsoon Withdrawal Monitor, 2017



Daily mean near-surface air temperature till **October 1, 2017**, for the Eastern Ghats (red) and North Pakistan (blue). Violet and gray lines- past 5-years average for same regions. The tipping point (red) indicates the critical temperature and the forecasted onset date. The forecasted withdrawal dates are from 7th to 17th October.

Withdrawal forecast: October 12+/-5 days



German modelling to crack monsoon code

IIT-Madras associates itself with Potsdam Institute for Climate Impact Research's project, IMD kept in the loop



శుక్రవారం గోల్కొండపలో టల్లో 'ప్రెడిక్షన్ ఆఫ్ మాన్ సూన్ ఫర్ ఇండియా, తెలంగాణ' సదస్సులో మాట్లాడుతున్న జర్మనీ ప్రాఫెసర్ సెలీనా. చిత్రంలో ముగ్గురు టోగు రామన్న పోచారం శ్రీనివాసరెడ్డి, ఈటల రాజేందర్, ఎమ్మెల్యే చెన్నమనేని రమేష్

10న రాష్ట్రానికి రుతుపవనాలు

(మొదటిపేజీ తరువాయి) పరిశోధనలు చేస్తున్నదని, తెలంగాణ రాష్ట్ర ప్రయోజనాల దృష్ట్యా ఇక్కడికి వచ్చి ఆ పరిశోధనా

వాసరెడ్డి మాట్లాడుతూ.. జర్మనీ ప్రాఫెసర్ అందించిన వివరాలు ఎంతో ఉపయోగంగా ఉన్నాయన్నారు. తాను విదేశాల్లో పర్య

Eastern Ghats, North Pakistan serve as tipping elements in monsoon prediction

DC CORRESPONDENT
CHENNAI JUNE 9

● The key to their research is in finding the regions where conditions for an occurrence of Indian monsoon originate

A team of researchers led by the Potsdam Institute for Climate Impact Research (PIK) in Germany has identified two regions — the Eastern Ghats and North Pakistan — that serve as tipping elements in accurately predicting the arrival and departure of southwest monsoon.

As per their research, analysing air temperatures and relative humidity in these areas predict the arrival and departure of the monsoon earlier. "The tipping point is critical to predicting the onset of

monsoon. Once it is onset, it's difficult to change," said professor Elena Surovyatkina from Russian Academy of Sciences' Space Research Institute.

"This year, we predicted as early as May 6 that monsoon will hit India on June 13 with plus or minus four days. India Meteorological Department had announced only on May 15

that monsoon will onset over Kerala on June 7," she said.

"We predicted well before 30 days when monsoon would hit central India. It will surely help the farmers in these regions. Based on our method we can predict the withdrawal of monsoon by July 15 based on the observations from the same regions," she added.

The key to their research is in finding the regions where conditions for an occurrence of Indian monsoon originate.

"We can see a pattern before the onset of monsoon. We use the precursors not to predict the time but

to predict places where the critical transition originates. We take air surface temperature and calculate fluctuation."

"We applied our method for data from 1957 to 2015. Our prediction about the onset of monsoon was 74 per cent successful and withdrawal of monsoon 84 per cent correct. Even for El Nino years our predictions were nearly 60 per cent correct," she said.

When asked whether they had discussions with the IMD about using their new method to predict the southwest monsoon she said formal discussion is yet to take place.

Gulf Times | 21
Thursday, April 21, 2016

INDIA |



Germans develop new method to predict India's monsoon

AFP
Berlin

Climate researchers in Germany said yesterday they had found a way to more accurately predict the Indian monsoon, which could help maximise the subcontinent's food and hydro-power supplies.

Improved forecasts of when the heavy summer rains start and end could help millions of farmers plant crops at the right time, and allow energy providers

to estimate when dams and reservoirs fill up, they said.

Global warming already affects monsoon stability and will make accurate forecasting ever more important, as deviations can spark droughts and floods, said the Potsdam Institute for Climate Impact Research (PIK).

"The timing of Indian summer monsoons, on which the livelihoods of many millions of people depend, is likely becoming more erratic," said project leader Juergen Kurths. "This makes early and accurate forecasting ever more crucial."

The scientists said they had developed a novel prediction method based on a network analysis of regional weather data, and would propose their model to the Indian Meteorological Department.

"We can predict the beginning of the Indian monsoon two weeks earlier, and the end of it even six weeks earlier than before - which is quite a breakthrough, given that for the farmers, every day counts," said Veronika Stolbova of PIK and Zurich University.

"We found that in North Pa-

kistan and the Eastern Ghats, a mountain range close to the Indian Ocean, changes of temperatures and humidity mark a critical transition to monsoon," said Stolbova in a statement.

Usually the focus has been on Kerala region, said Stolbova, lead author of the study published in the scientific journal the Geophysical Research Letters.

The team said it used an advanced mathematical approach called network analysis of complex non-linear systems, combined with subtle statistical analyses of the early warning

signals for the monsoon onset and withdrawal.

"These precursor phenomena are often buried by huge piles of weather data and hence get overlooked," said PIK guest scientist Elena Surovyatkina of the Russian Academy of Sciences' Space Research Institute.

Kurths said they had looked at the climate system "as a network, just like the social networks so many people are using in their everyday life".

"On Facebook or Twitter, you can follow how news is

spreading, one posting leading to many others. In the climate system, not people but geographical regions are communicating - admittedly in a quite complex way."

Like Facebook postings or tweets that get shared again and again, the scientists explained, temperature and humidity get transported from one place to another by atmospheric flows such as winds.

Information about monsoon timing is key for Indian farmers, who usually grow all-important crops like rice, soybean and cot-

ton during the June-September monsoon season.

The scientists said they had tested their method with historical monsoon data and achieved correct predictions in more than 70% of cases for the start of the monsoon, and in more than 80% for its withdrawal.

The authors said their method could improve the time horizon of monsoon prediction compared to that now used in India - both during relatively normal times, and in years when the El Nino phenomenon affects the rainy season.

tists led by Potsdam Institute for associated with the project and riculture, power etc.

mation is the last 14 years. In 73 %

Conclusion

Our approach is based on a teleconnection between two geographical areas - the Eastern Ghats (EG) and North Pakistan (NP), which we defined as Tipping Elements of Indian Summer Monsoon.

We have found the Tipping Elements approach allows us predicting the timing of the upcoming monsoon onset and withdrawal for 40 and 70 days in advance respectively.

Our results show that our method allows predicting the monsoon not only retrospectively (over the period 1951-2015) but also in the future. In 2016 and 2017, we proved that such early prediction of the monsoon timing is possible.

The proposed approach is applicable to different kind of season, which exhibits properties of critical transition. Our prediction is based on observational data only when the model cannot accurately anticipate the transition or does not exist yet.



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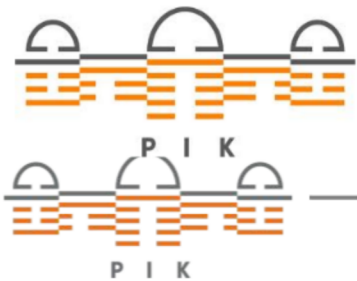
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