Parameters with better predictability than precipitation at S2S timescale

Thierry Lefort, Philippe Peyrillé, Météo-France

ONLINE TRAINING WORKSHOP ON SUBSEASONAL TO SEASONAL (S2S) PREDICTION OF MONSOONS

Operational practice acquired through testbeds

Scientists ⟷ **Forecasters, Climatologists** ⟷ **Users**

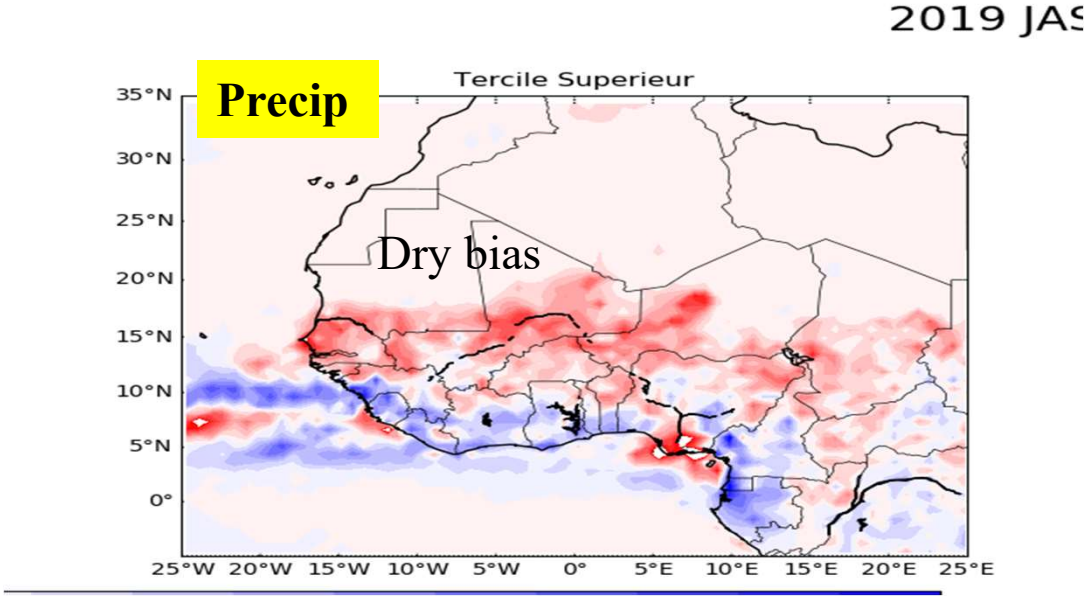
Briefing MISVA- CREWS

http://misva.sedoo.fr/ , 07-09-2021

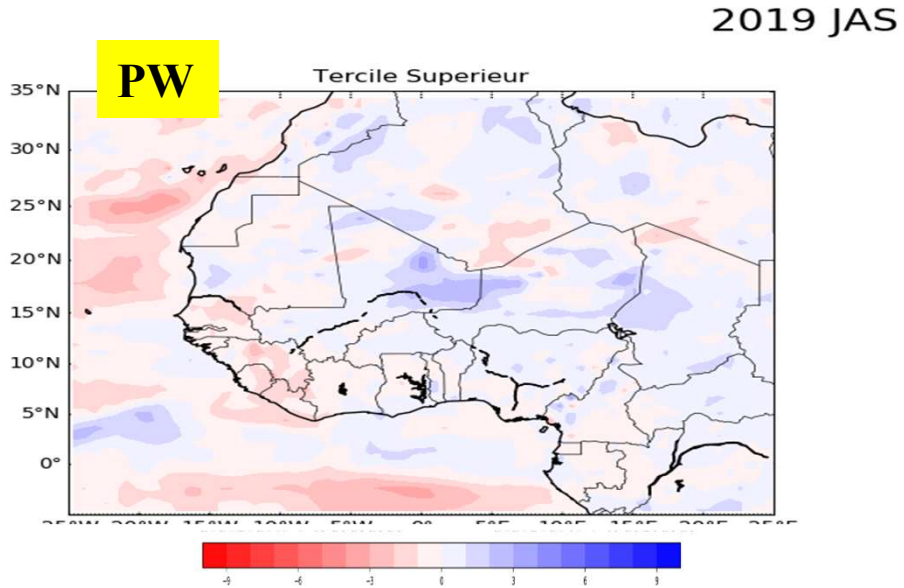
Accès enregistrement: https://bluejeans.com/s/0XmjzELrhz7

Evaluation of EPS hindcast

Source: Philippe Peyrillé



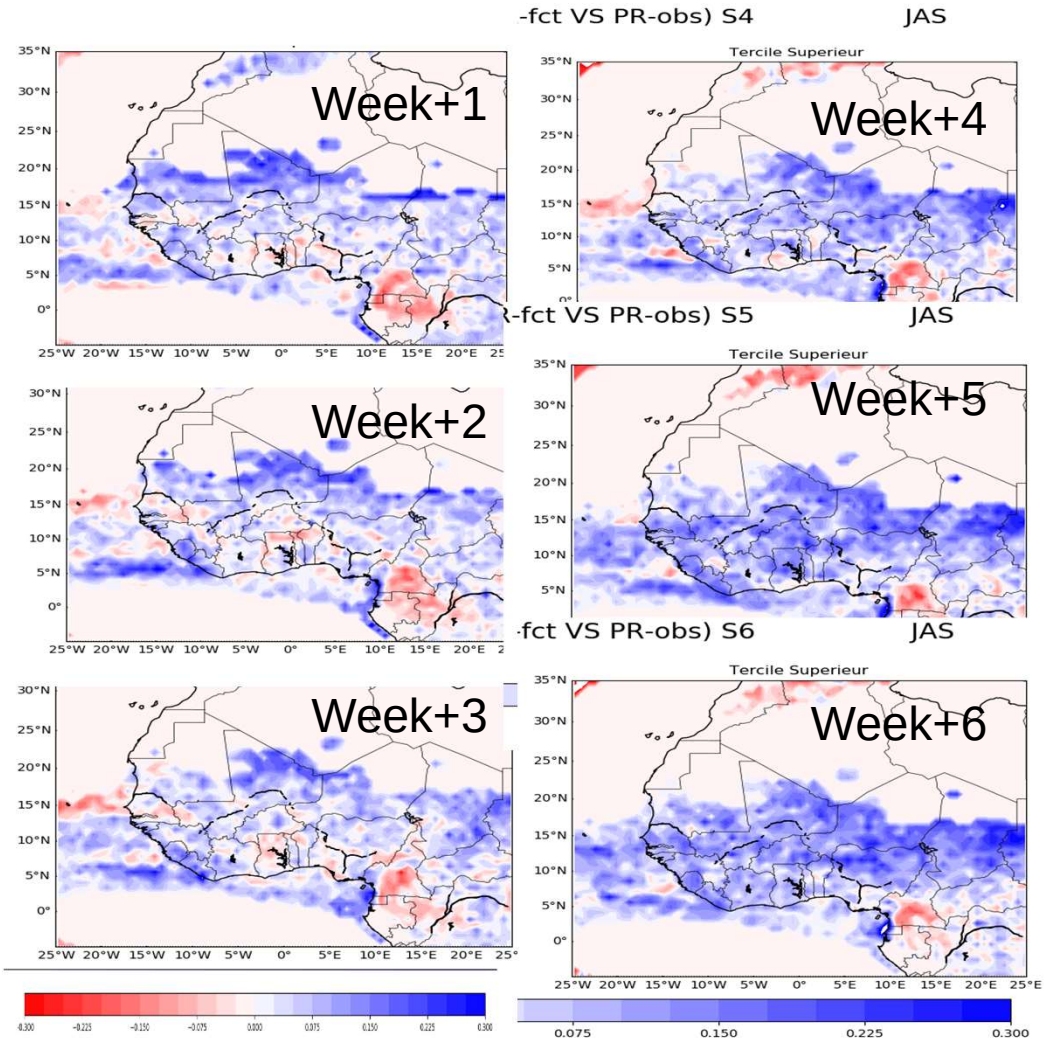
[1998-2017] **JAS mean bias** of the **upper tercile** for weekly mean precipitation (mm/d, top) and PW (mm, bottom).
TMPA3B42 is used as a reference for precipitation and ERAInterim for PW.



- Statiscal properties over the hindcast period have been evaluated for precipitation and PW
- The **dry bias of ECMWF model is confirmed** north of 10°N (top) while PW shows a very good performance (bottom)
- ⇒ **Using precipitation from EPS is not helpful north of 10°N. Information can be gained by using PW.**

Evaluation of PWopt product against forecast precip.

Source: Philippe Peyrillé



Difference of HSS targeting the observed upper tercile of weekly precipitation using forecast of Pwopt-PruppTercile for lead time week+1 (top), week+2 (middle), week+3 (bottom).
Blue shading indicates forecast of PW greater than PWopt performs better than forecast rainfall to predict the occurrence of the upper tercile of rainfall.

The use of PW outperforms the forecast of precipitation over the entire region and keeps a better predictability than forecast rainfall up to week +6.

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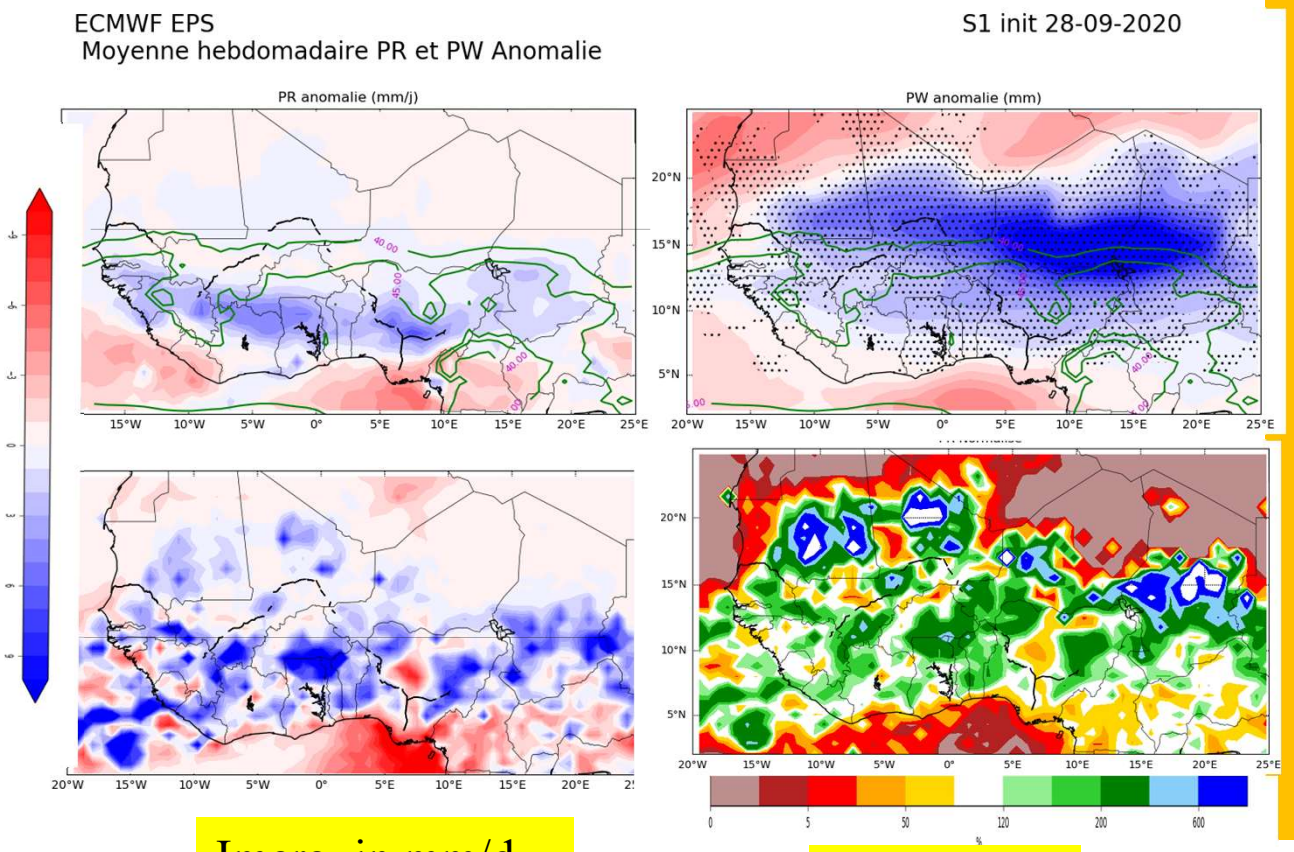
Example of product derived from this approach

Week-2 mean anomaly forecast of precipitation (mm/d top left) and PW (mm, and top right). IMERG observed weekly-mean anomaly of precipitation (mm/d bottom left) and % of the 2000-2019 climatology (bottom right) Precipitation, Right, PW). Stippling on the top right shows area where PW > PWopt for upper tercile of precipitation. EPS Forecast are initialized on 2020-09-21 and week-2 spans [09-28 -10-04] period.



Imerg in mm/d

Imerg in %

The anomalies of precipitation and PW are considered together when forecasting week 1 to week 4. In this typical example, ECMWF EPS indicates a positive rainfall anomaly south of 15°N, consistent with the known dry bias of this model north of 15°N (left). On the top right panel, the positive anomaly of PW indicates a large favoured region of precipitation around 10° N in agreement with the forecast precipitation anomaly but also north of 15°N, over Mauritania, northern Mali and Niger. **The stippling shows a favoured area of occurrence of the upper tercile of precipitation in the latter region, allowing to get informations from ECMWF model despite its dry bias.**

The observations of precipitation (bottom left) confirms the usefulness of using the anomaly of PW and region greater than Pwopt. Rainfall effectively occured over the region north of 15°N.

Source: Philippe Peyrillé

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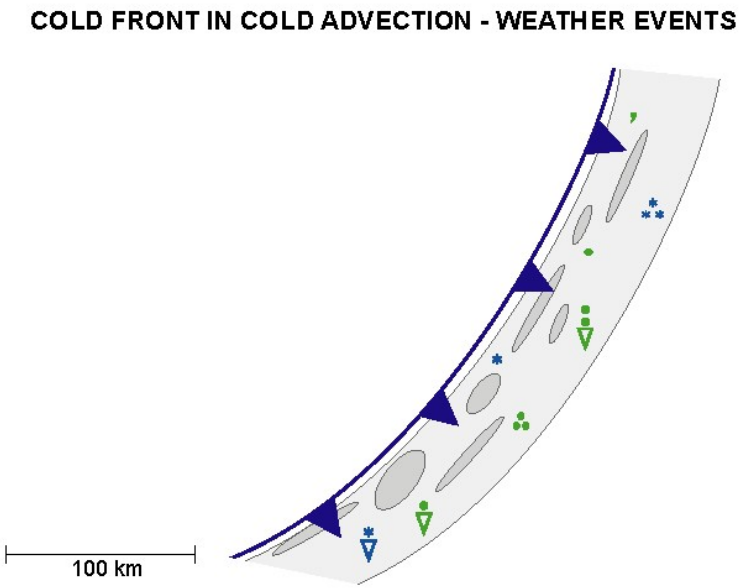
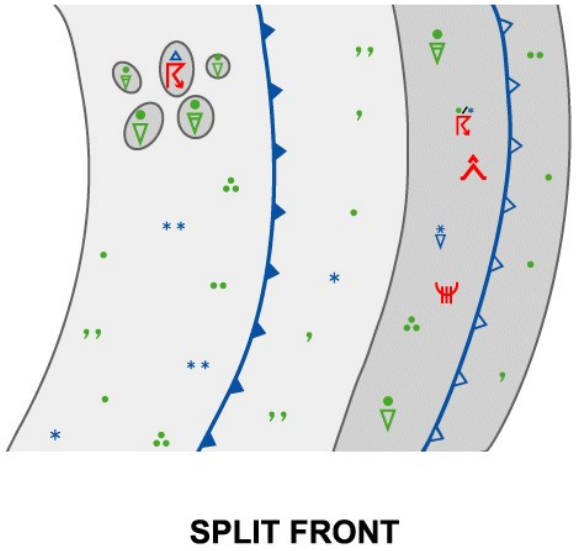
Not all MJO look the same

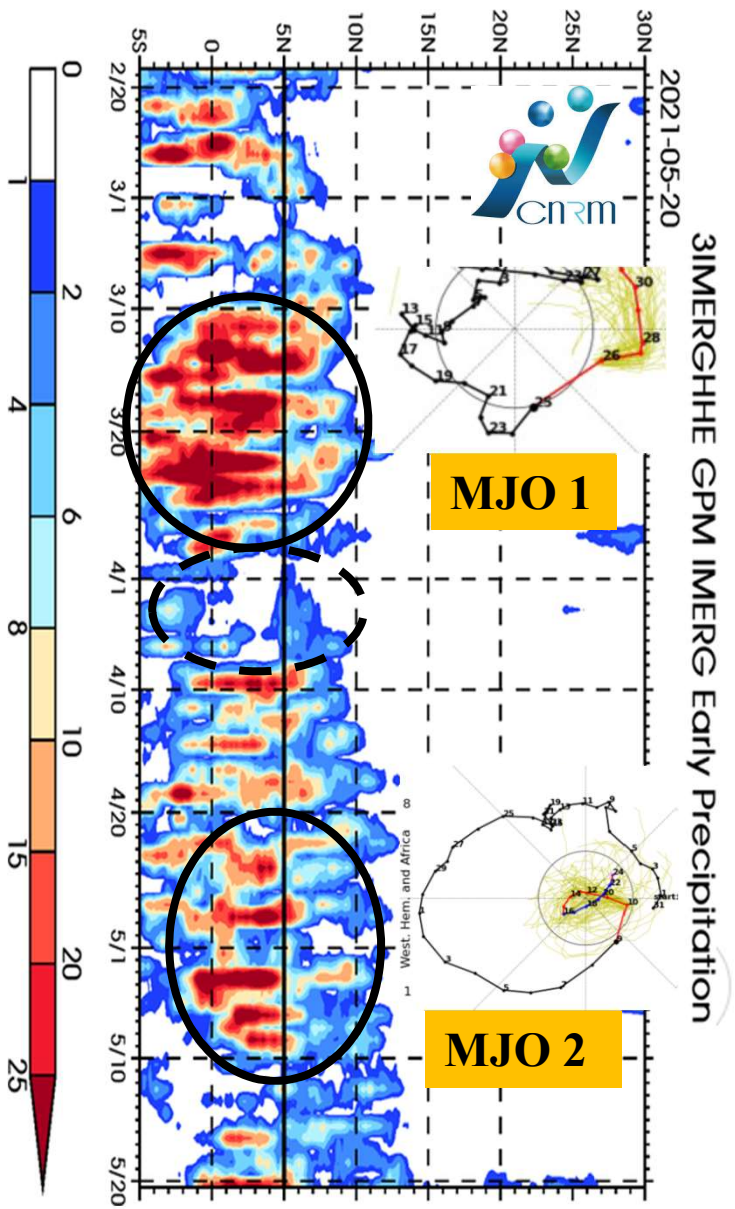
Produced by EUMeTrain



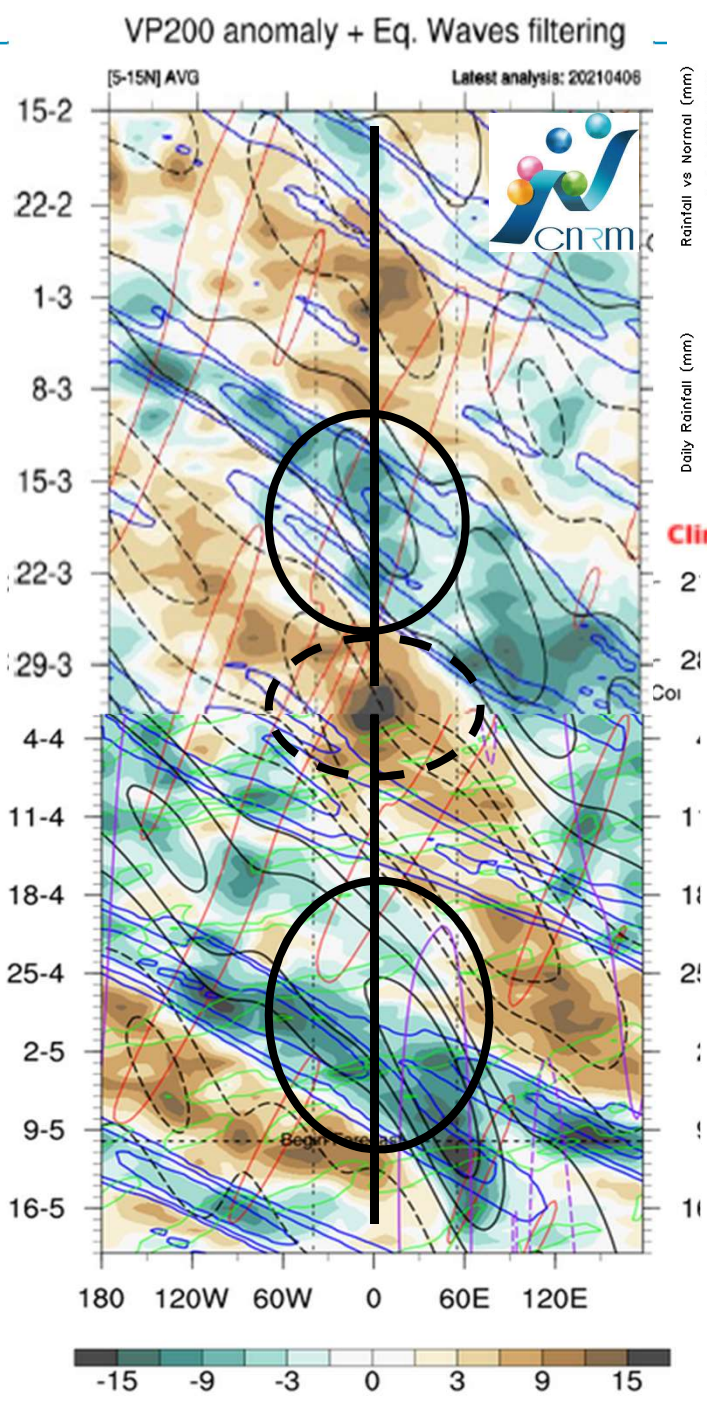


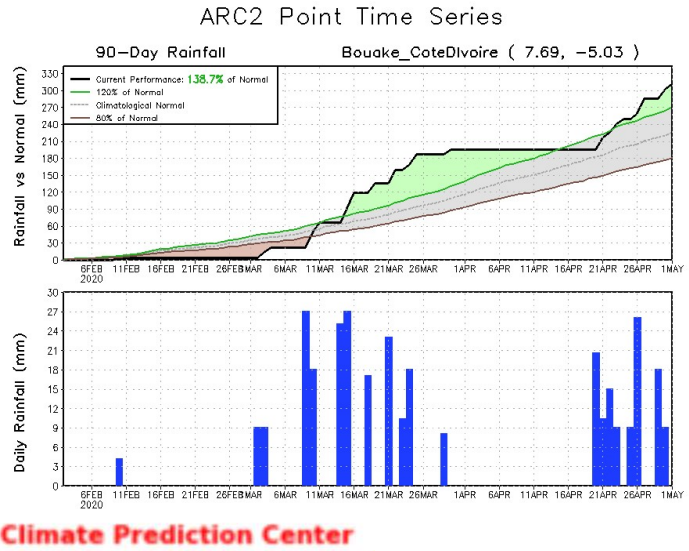
Not all cold front look the same…

What can distinguish a MJO event from another ?



Precip IMERG 10W-10E





Precip Bouake, Ivory Coast

2 pre-monsoon wet spells fit with VP200 very well

1st event was much more efficient

Why ?

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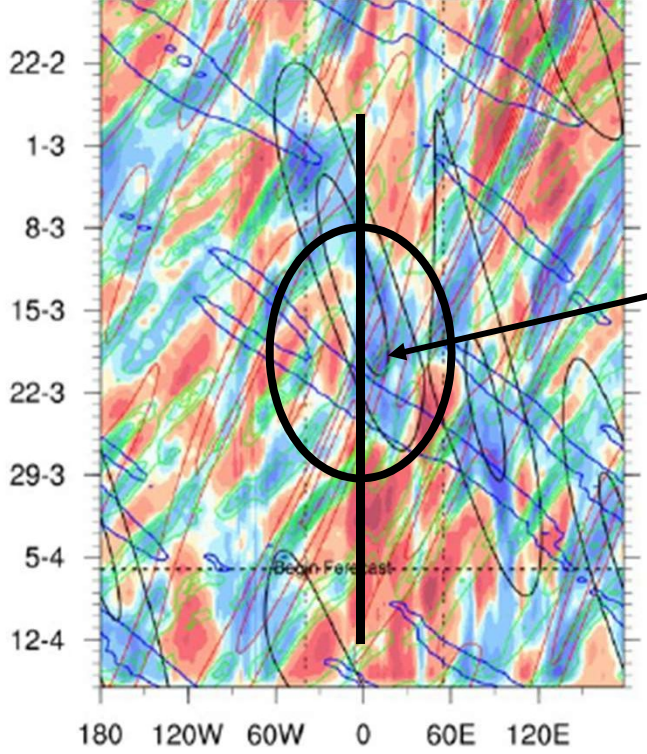
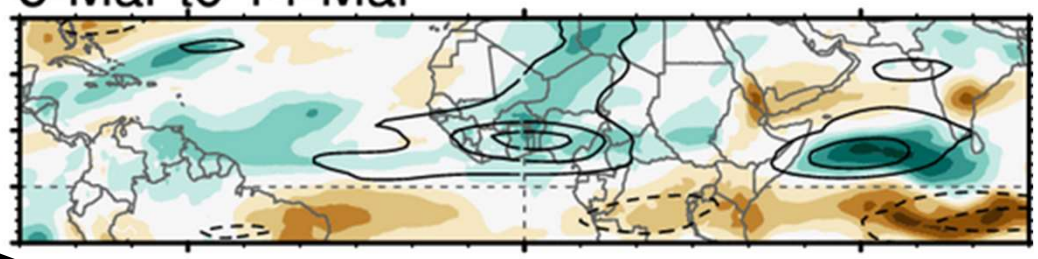
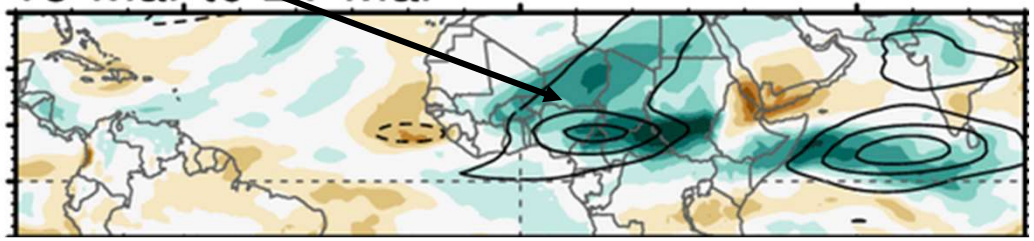
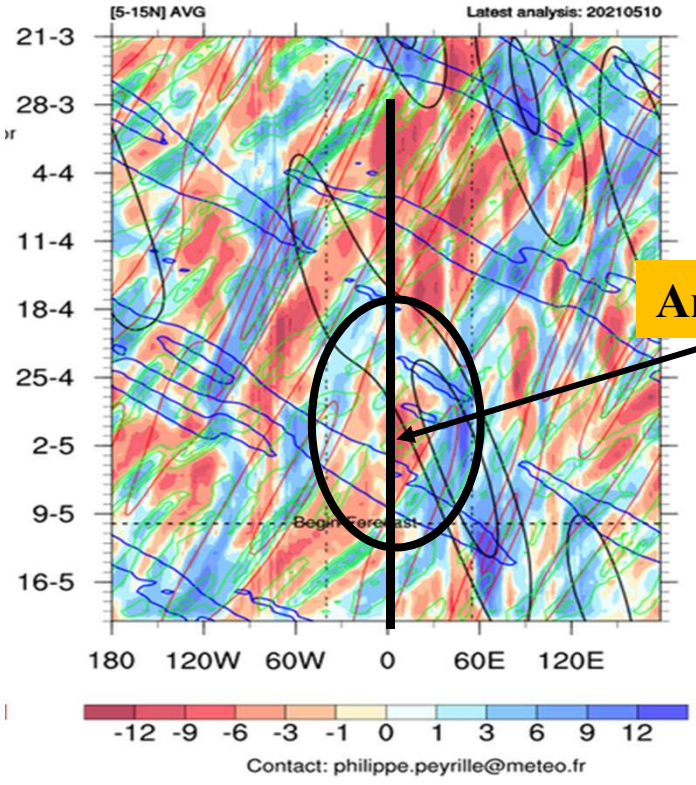


Ano PW > 0

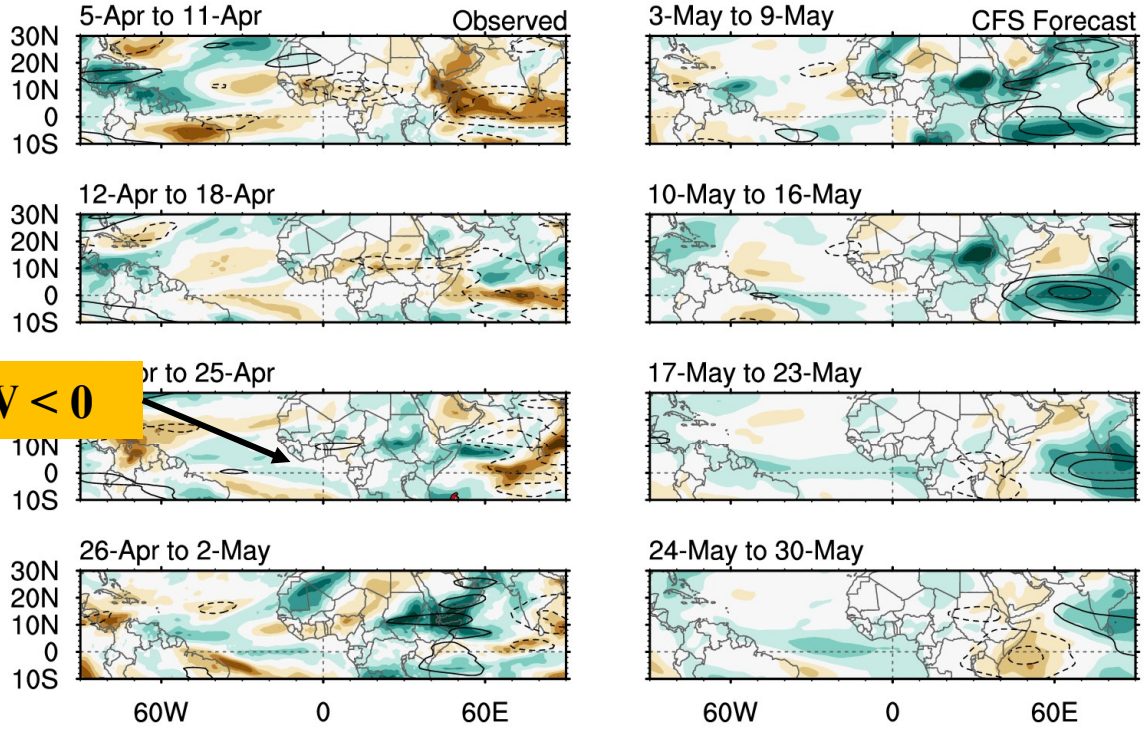




TCWV anomaly (mm) + Eq. Waves filtering



Ano PW < 0



ncics.org/mjo

7-day PWAT with CFS forecasts

Mon 2021-05-03 1014 UTC

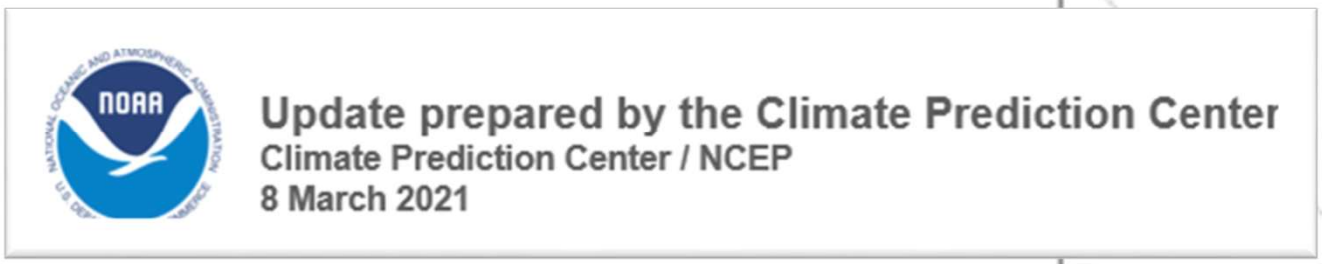
MJO
Kelvin x2
Low
ER

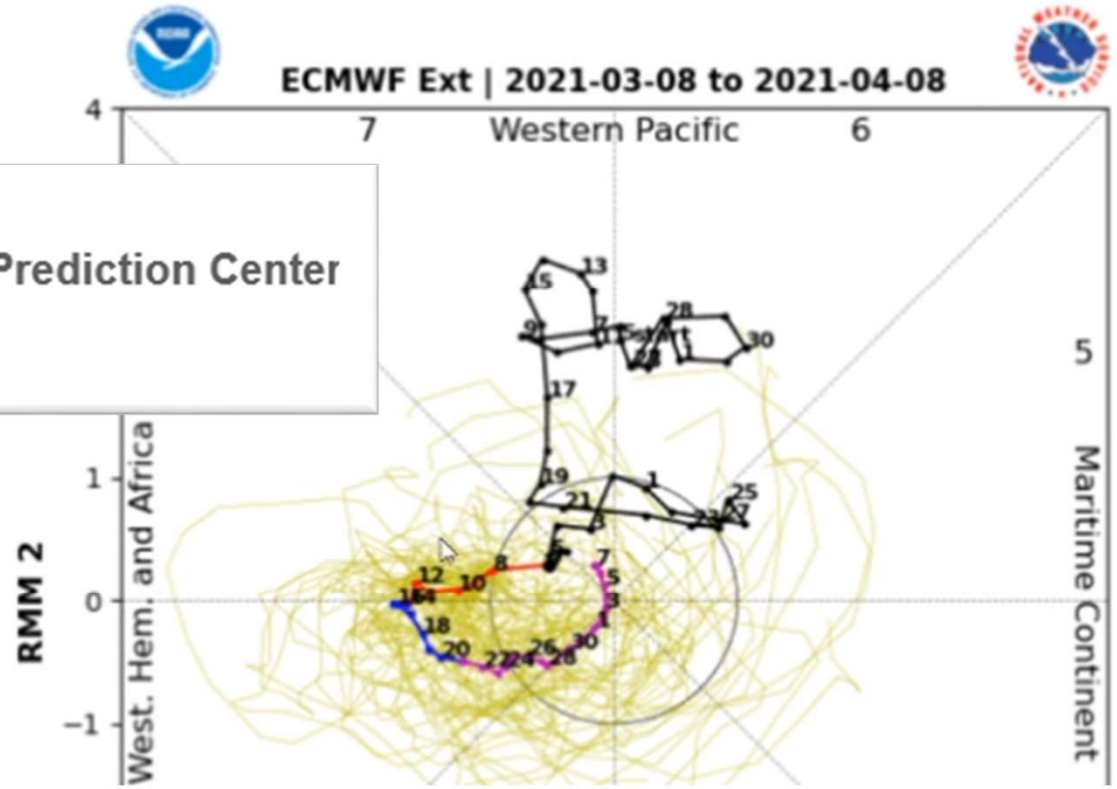
Contours every 3 kg m-2

Carl Schreck
carl_schreck@ncsu.edu

MJO in VP200, not in RMM index

Run 8 March 2021

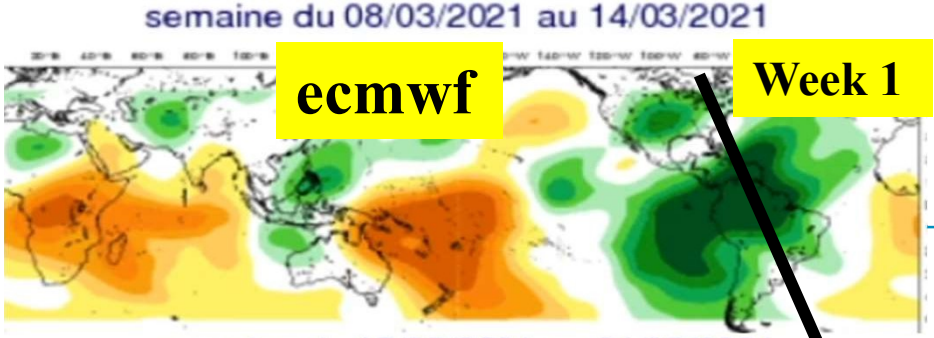




Overview

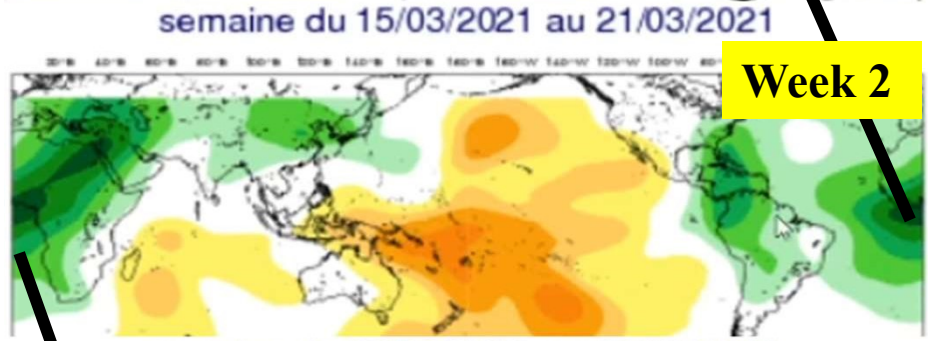
- The MJO remains active, although the RMM-based MJO index remains weak. The signal is more apparent in the CPC upper-level velocity potential based index.

In RMM index, no MJO expected for late March – early April

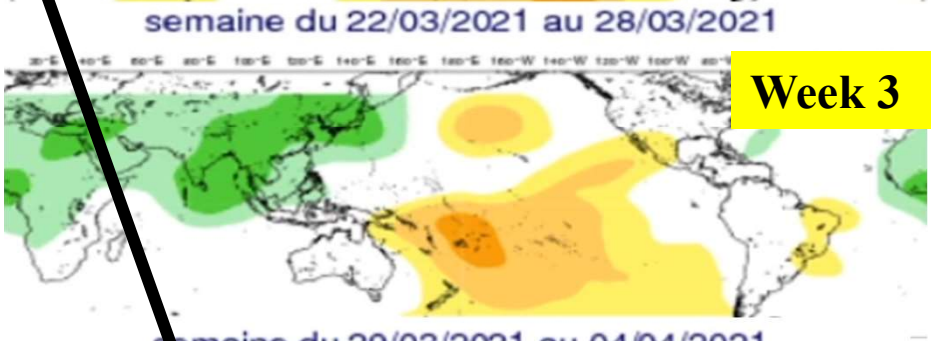


ecmwf

Week 1



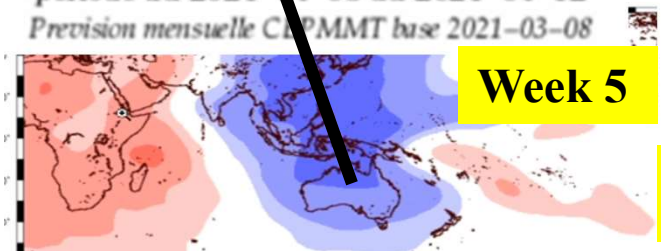
Week 2



Week 3

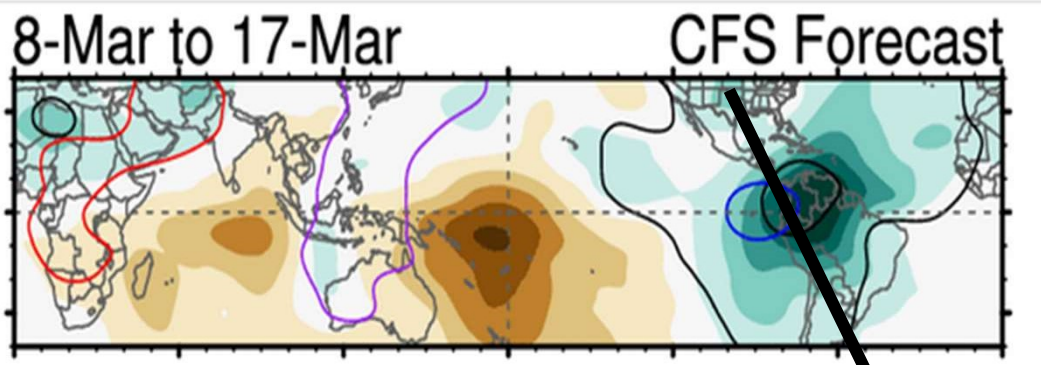
Week 4

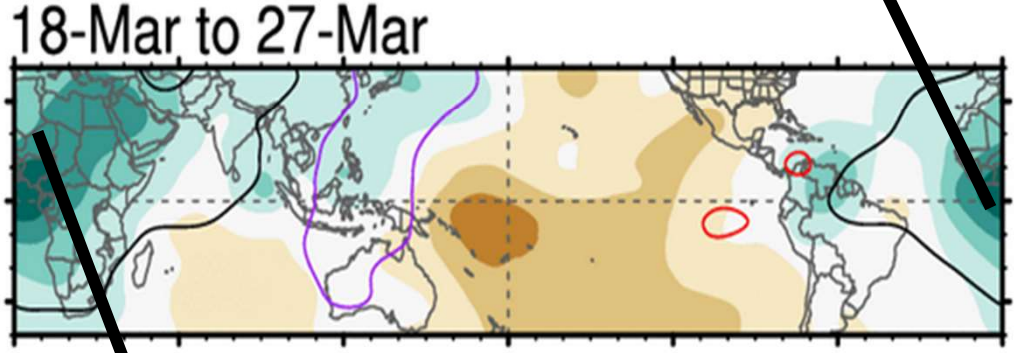
Obvious propagation of a MJO, stronger than la Nina low frequency

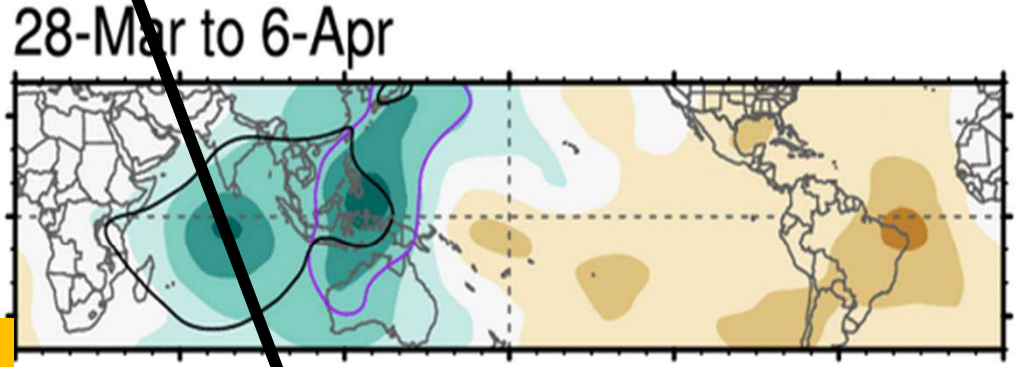


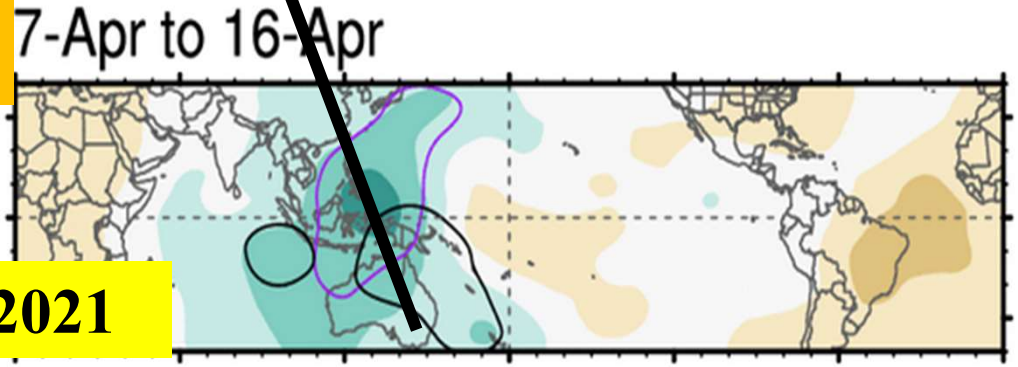
Week 5

Run 8 March 2021



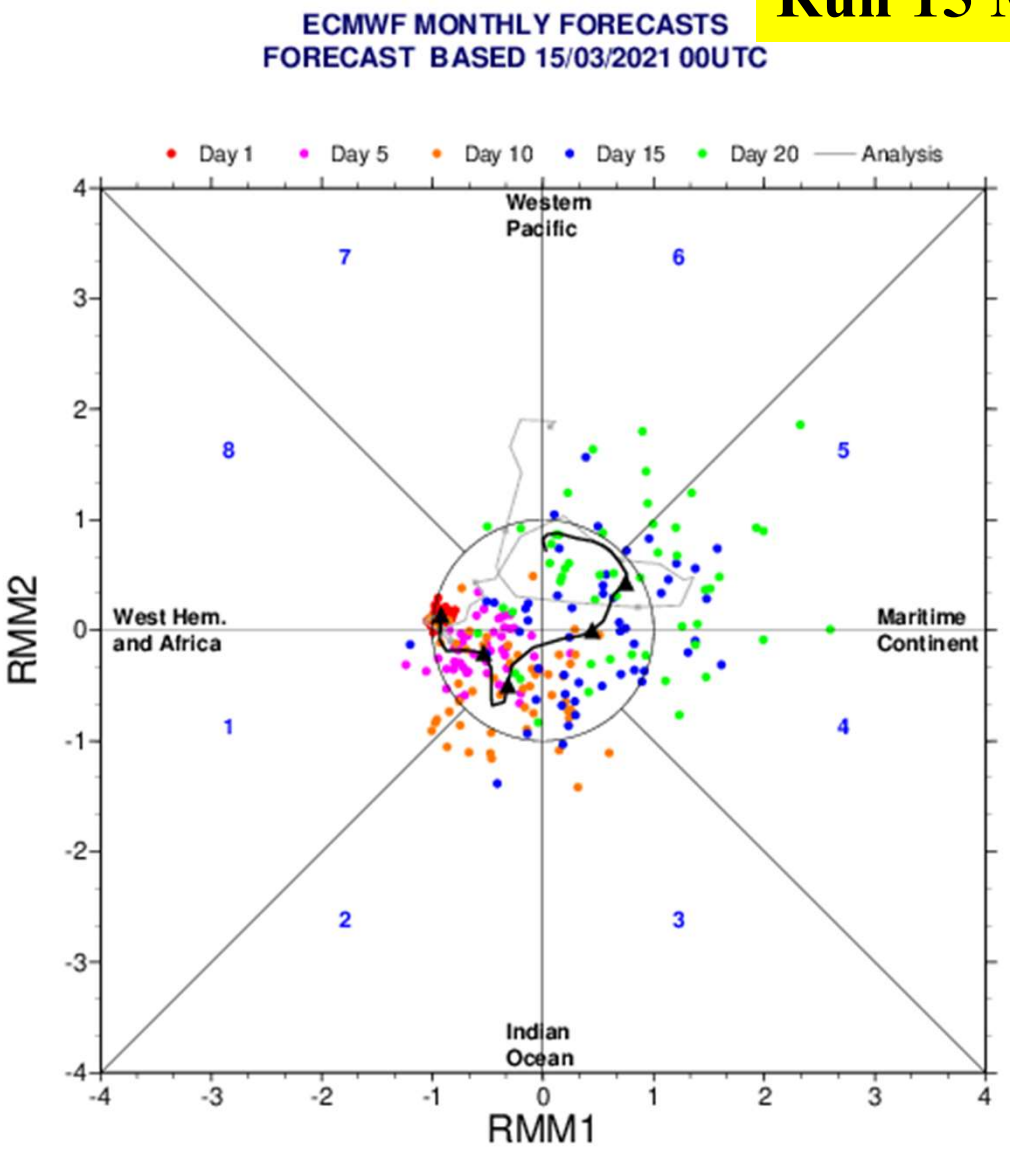


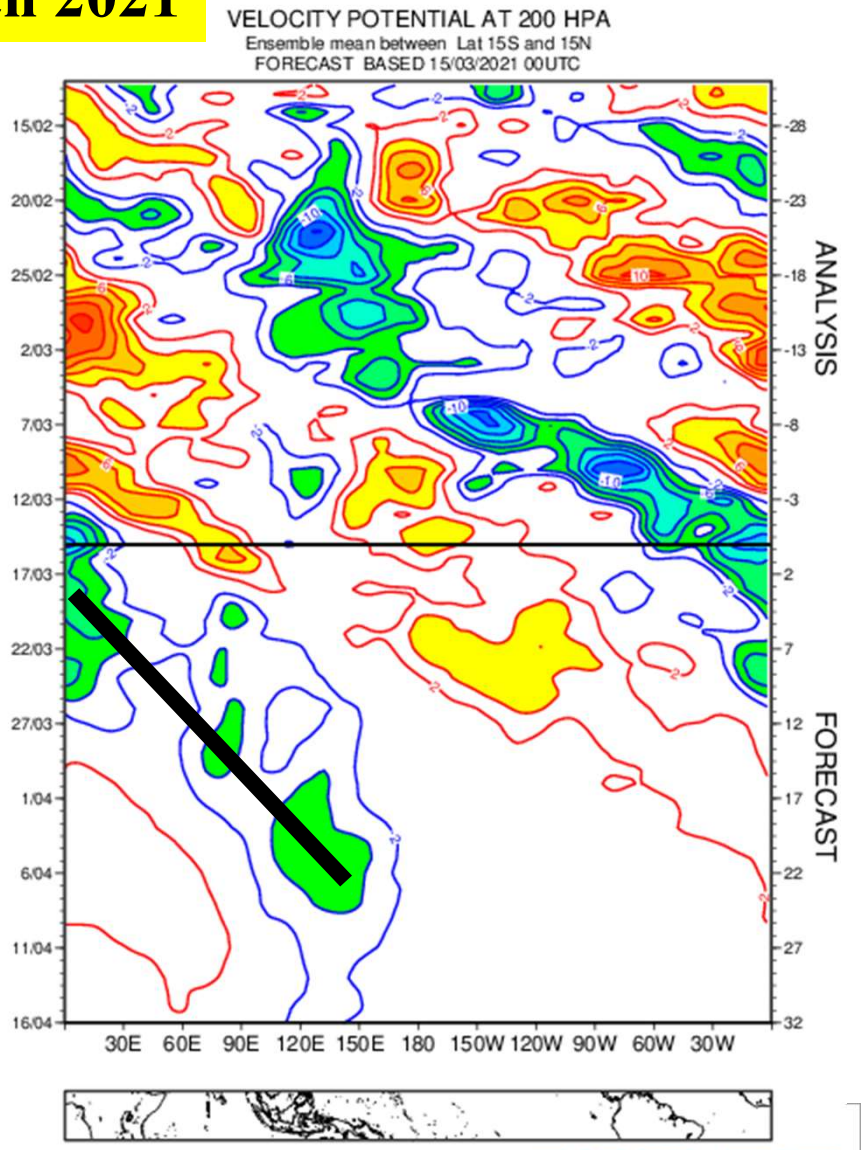




Comparison RMM index and VP200

Run 15 March 2021





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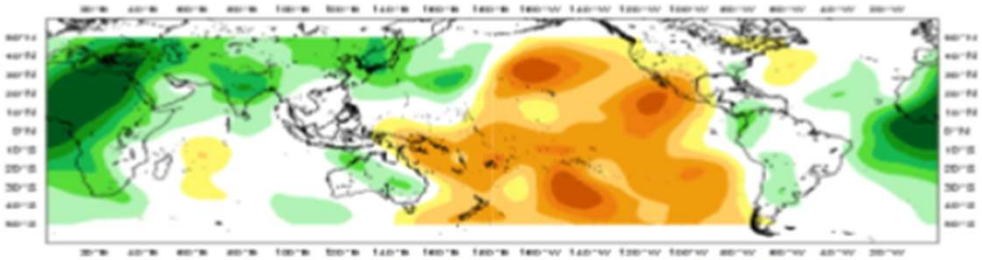
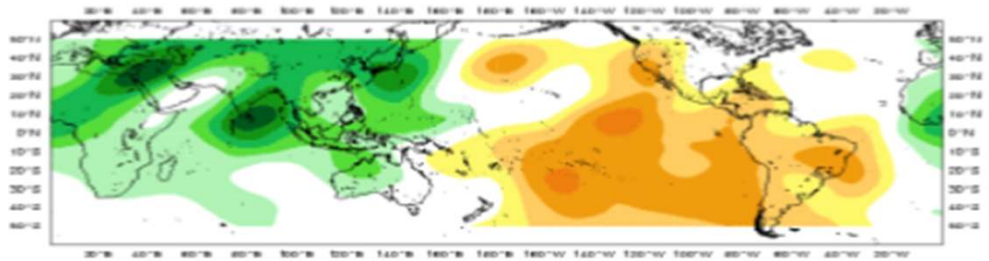
ECMWF and CFS agree on propagative VP200

ECMWF, Prévision mensuelle

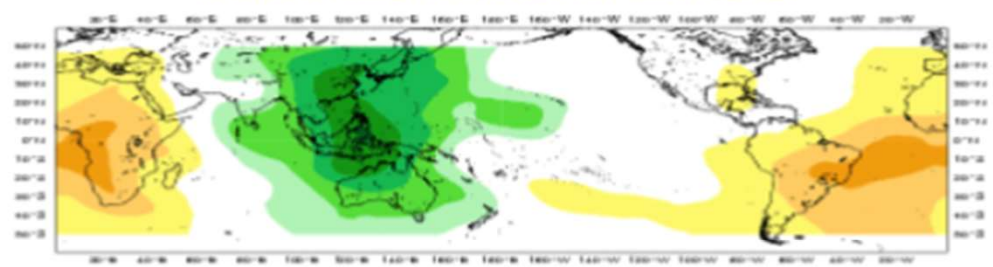
semaine du 15/03/2021 au 21/03/2021



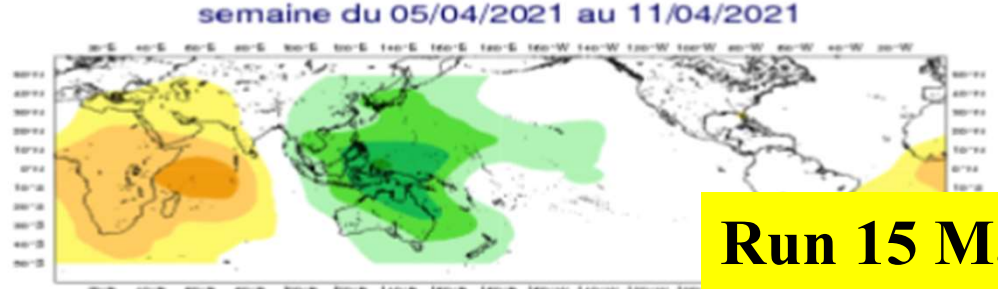
semaine du 22/03/2021 au 28/03/2021



semaine du 29/03/2021 au 04/04/2021

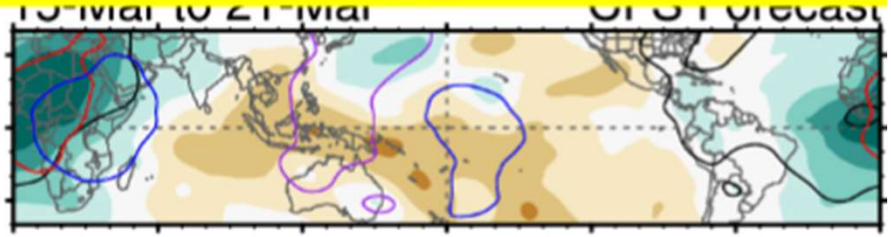


semaine du 05/04/2021 au 11/04/2021

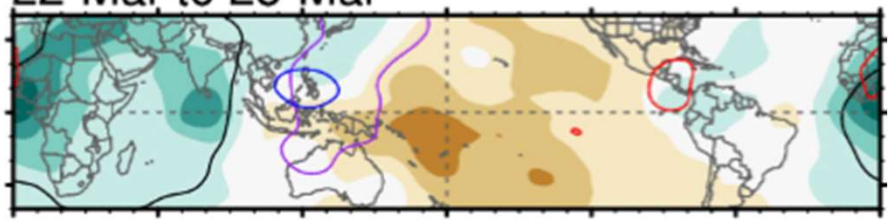


CFS, source C.Schreck

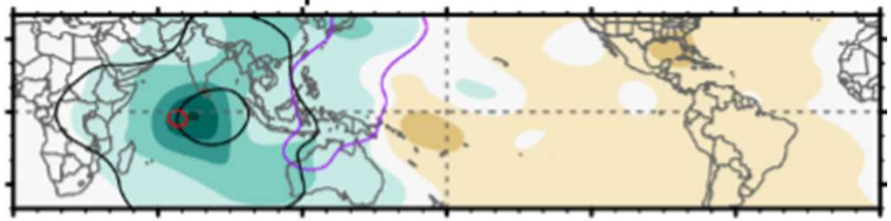
https://ncics.org/portfolio/monitor/mj



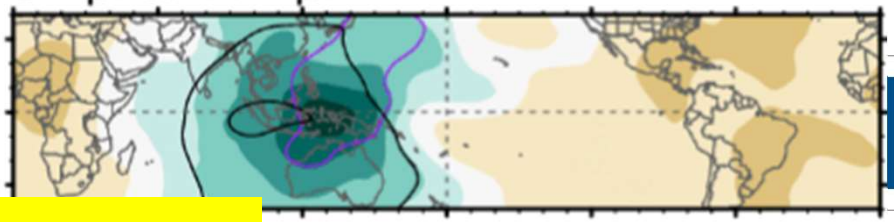
22-Mar to 28-Mar



29-Mar to 4-Apr

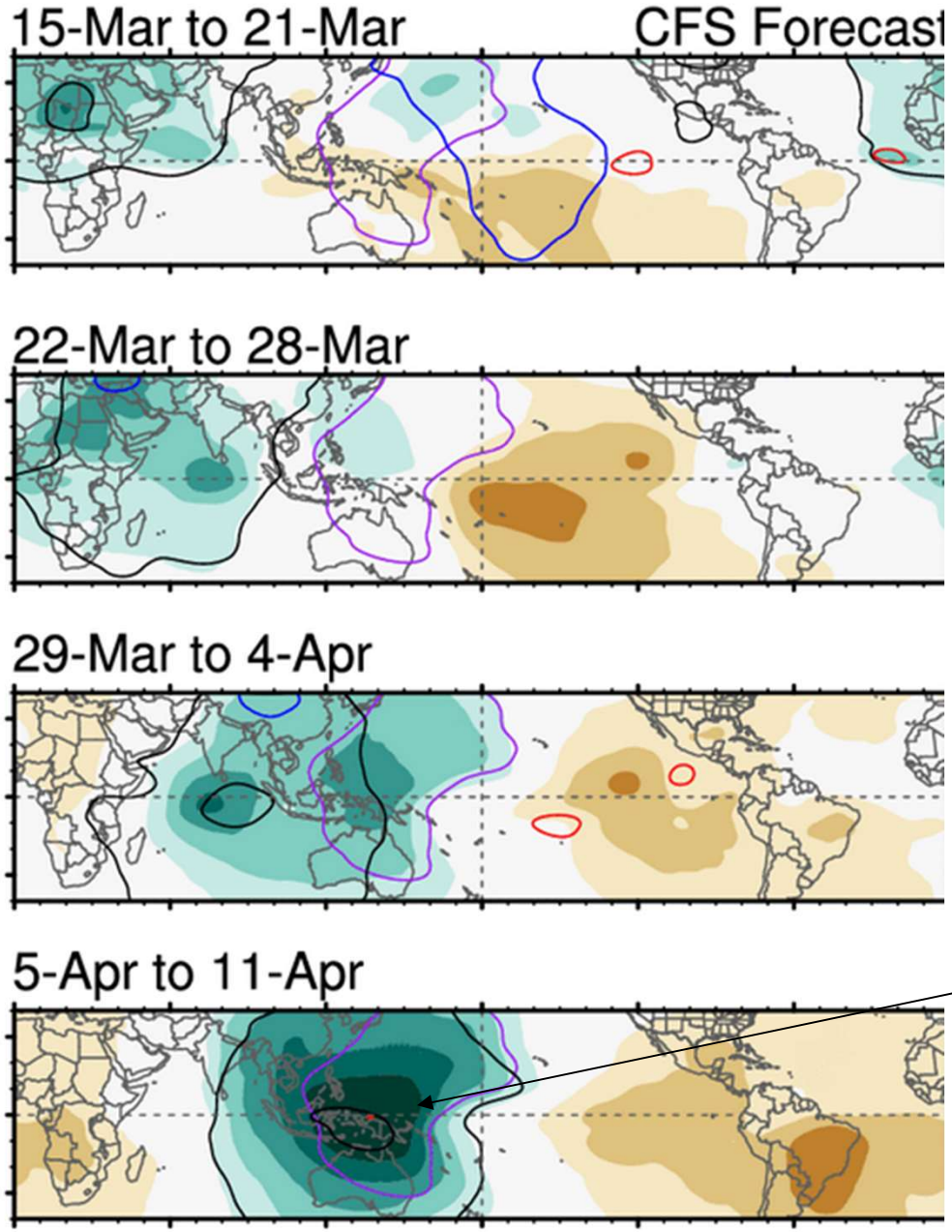


5-Apr to 11-Apr



Run 15 March 2021

Clear propagative signal in VP850 too



Strong signal at Week 4
when MJO constructively interfers
with the Low Frequency la Nina state

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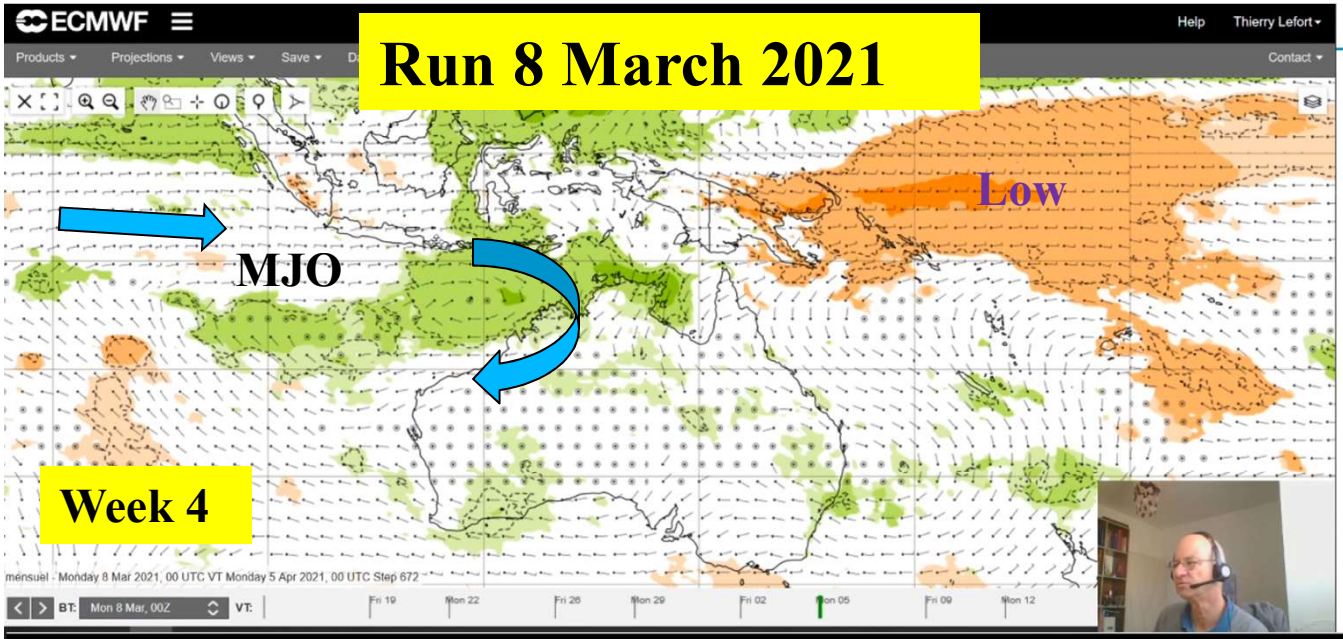
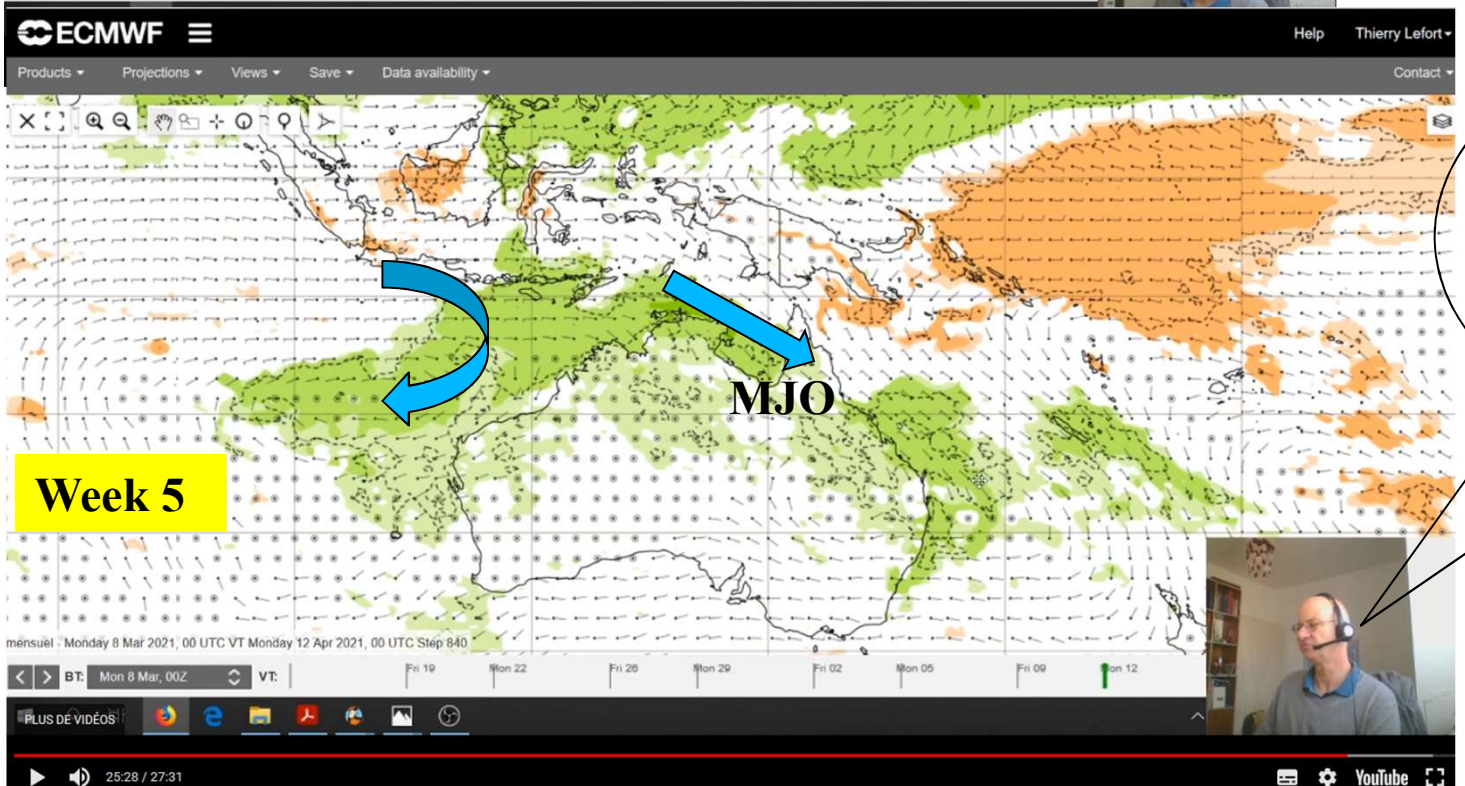
Weekly rain anomaly and 850hPa wind





Experimental S2S prediction for New Caledonia and French Polynesia

« A new offensive of the MJO during the first decade of April... »

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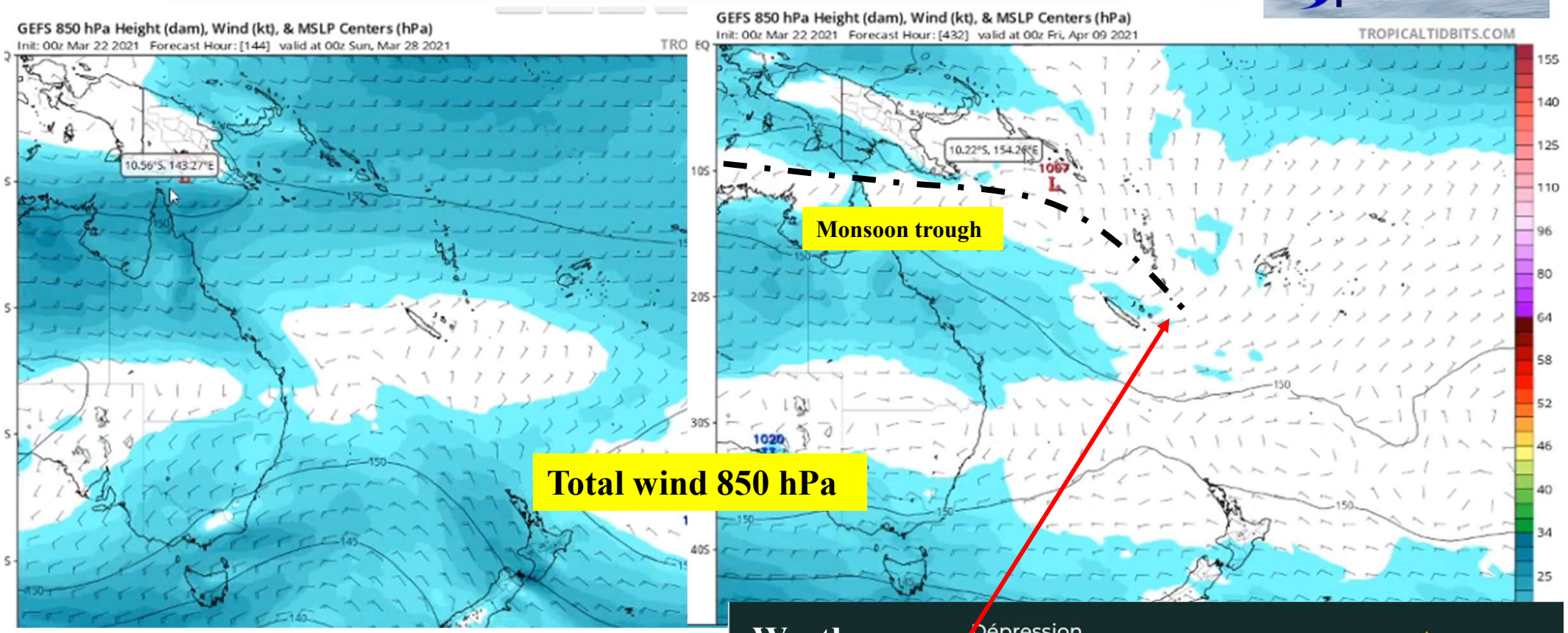
Total field is needed

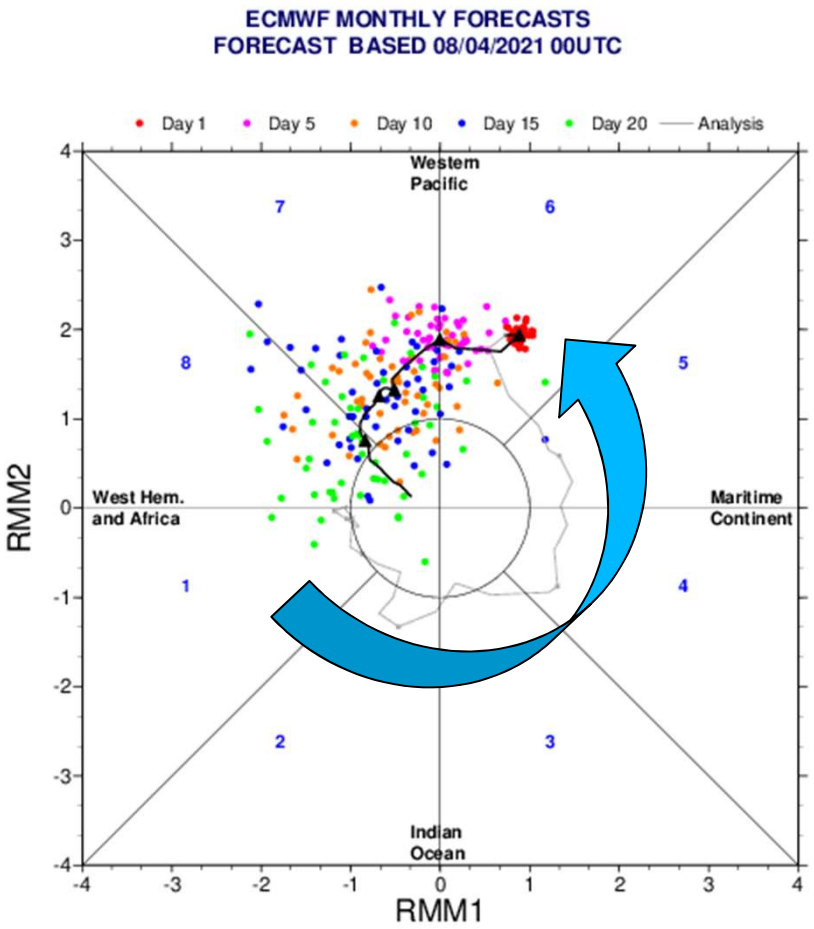


144h

Total field makes the link with the weather type approach and thus the synoptic scale

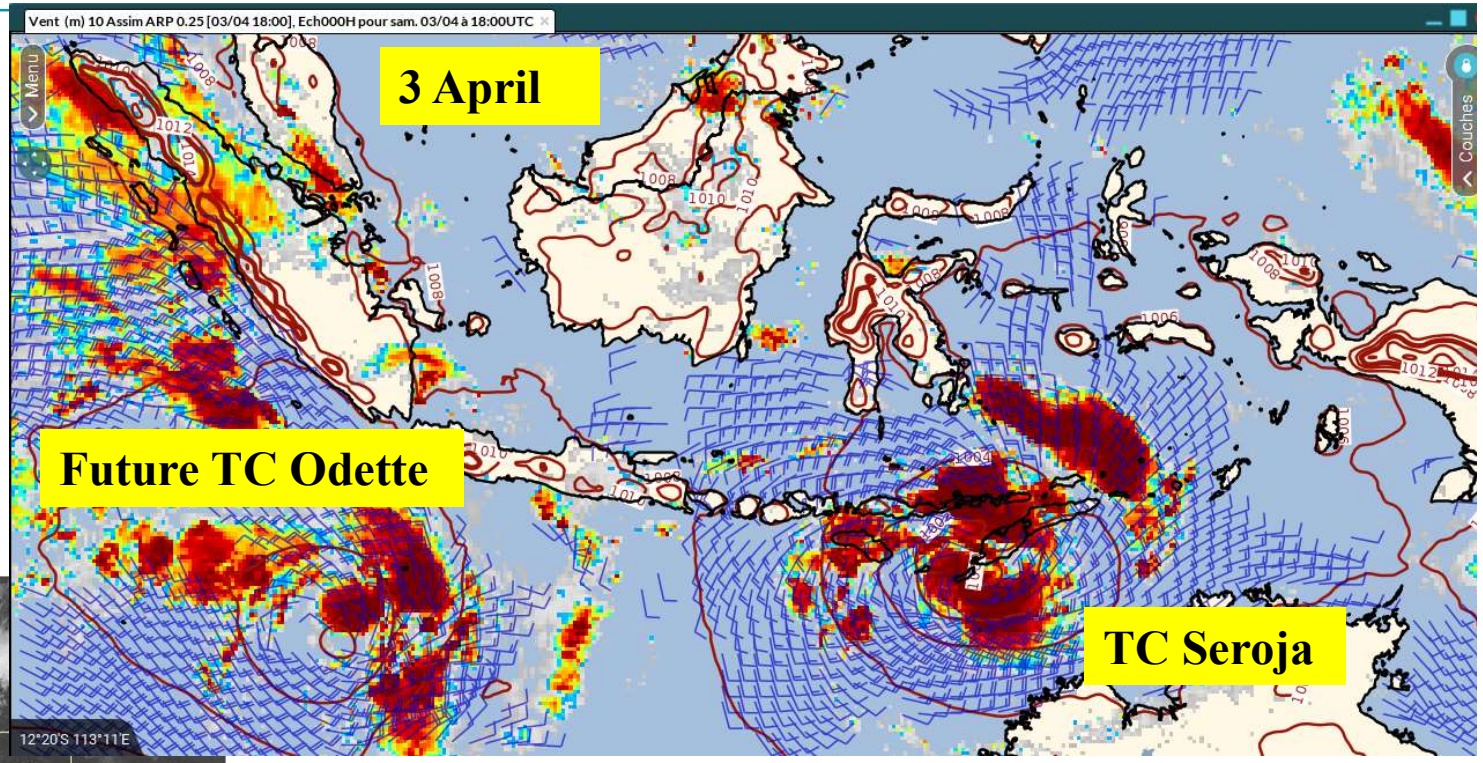
Weather type	Dépression tropicale ou cyclone	Coup d'ouest	Fortes pluies	Fortes chaleurs
Alizé stable	Exclu	Exclu	Exclu	/
Alizé instable	/	Exclu	Favorisé	Favorisé
Temps tropical	Favorisé	/	Favorisé	Favorisé
Perturbation australe	Exclu	Favorisé	/	Exclu
Anticyclonique faible	Exclu	Exclu	Exclu	/

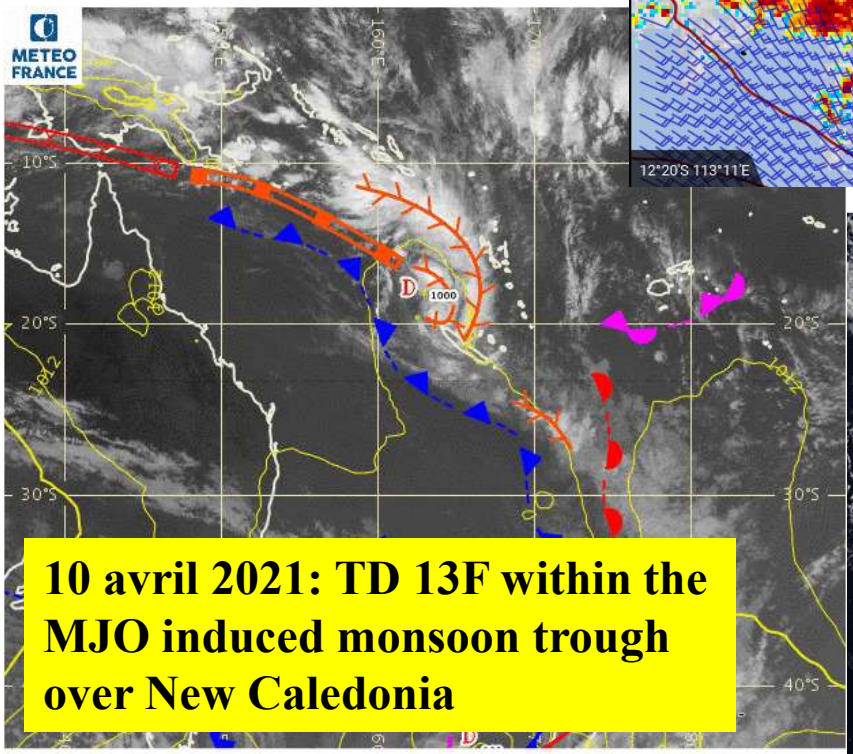
Observed MJO

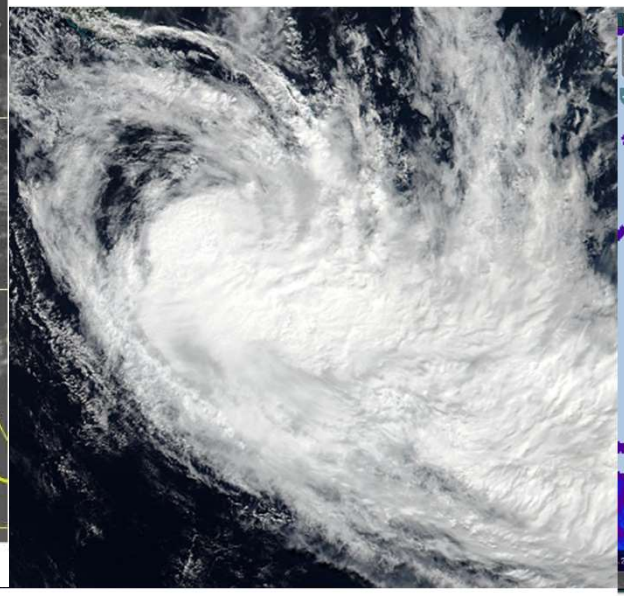


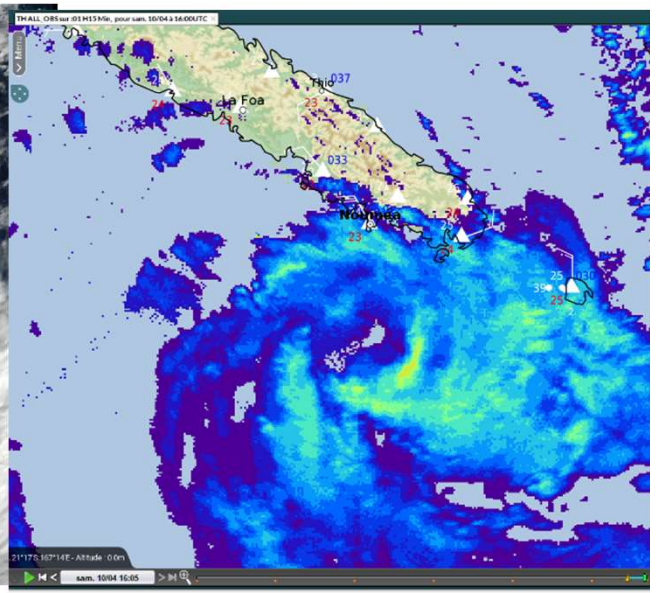
What happened during the first decade of April ?

Solomon islands, Vanuatu, Fiji, New Caledonia, Samoa have a « Part-time monsoonal climate »

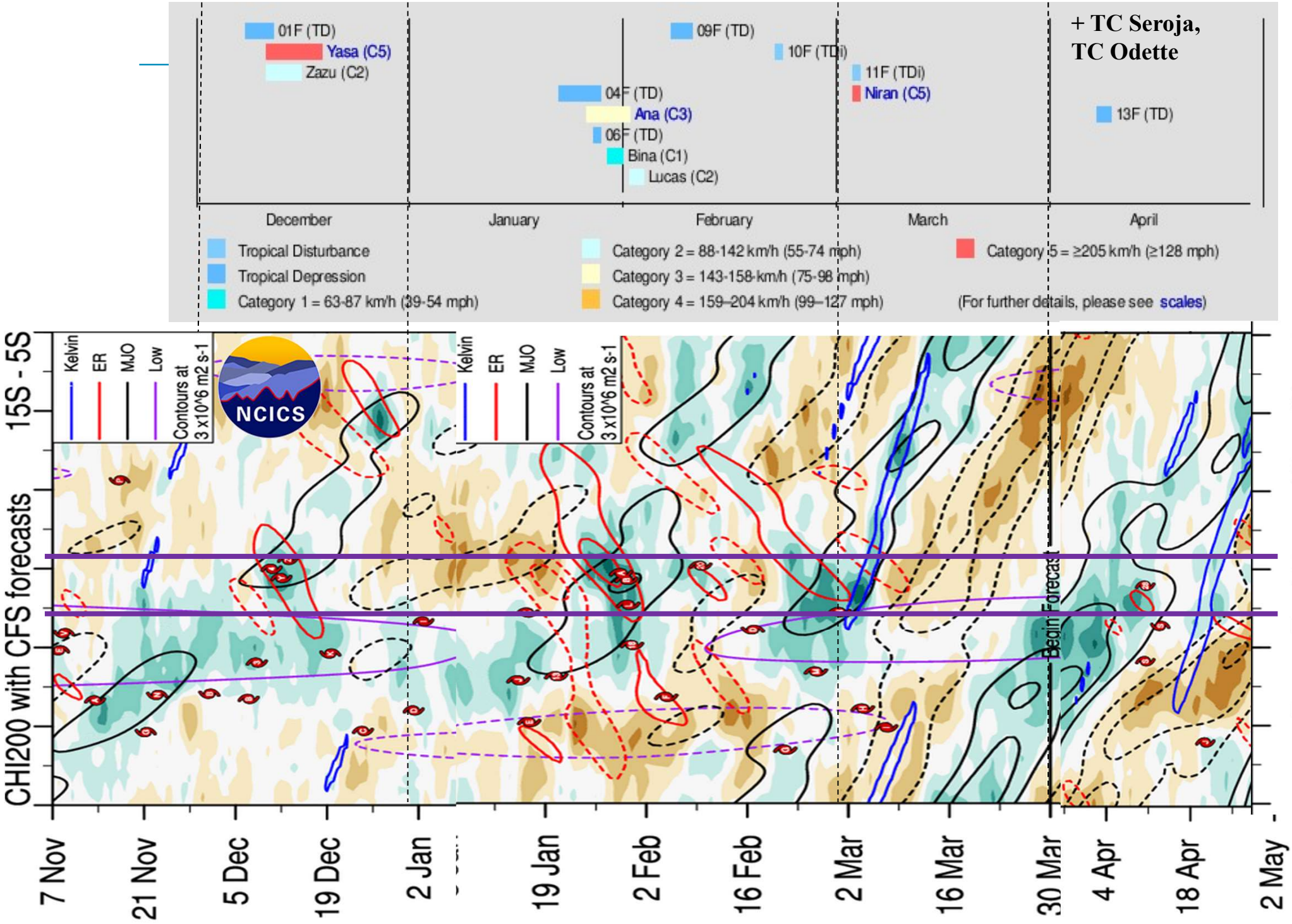




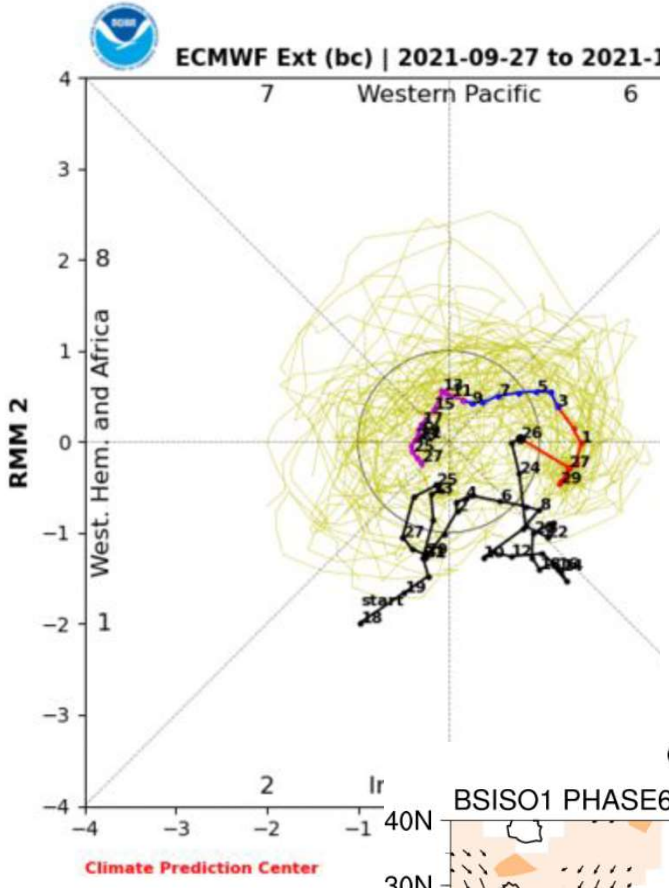


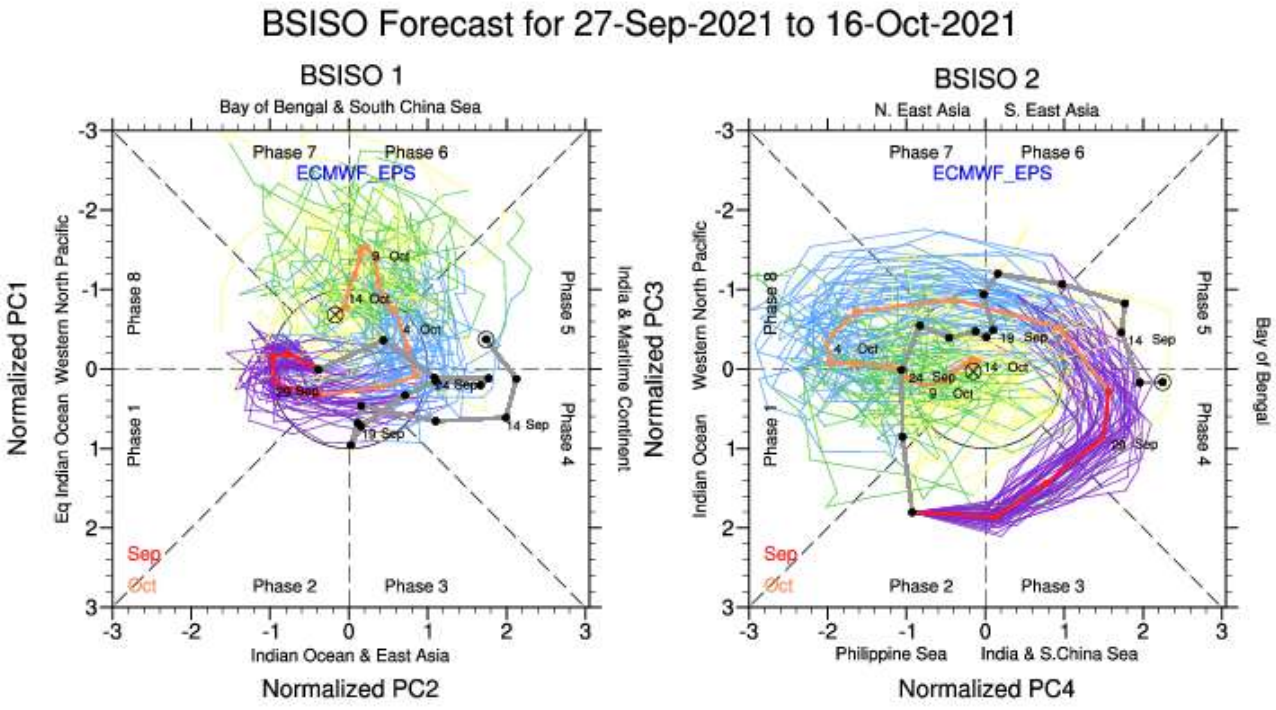


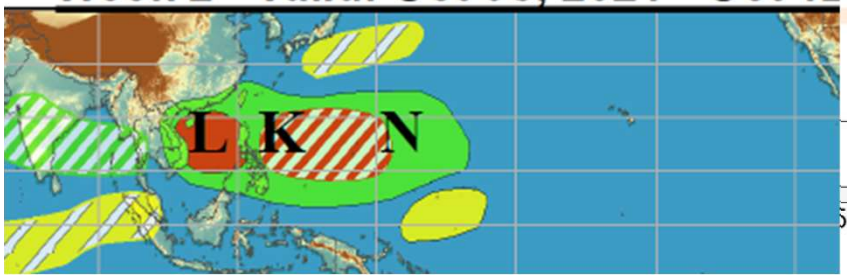
TC outbreaks versus PV200

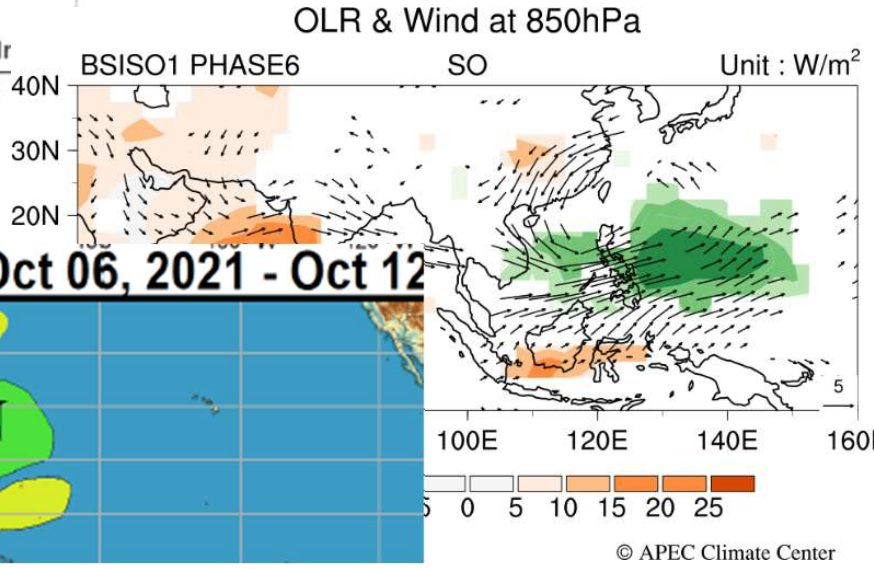


No active MJO ? Check BSISO









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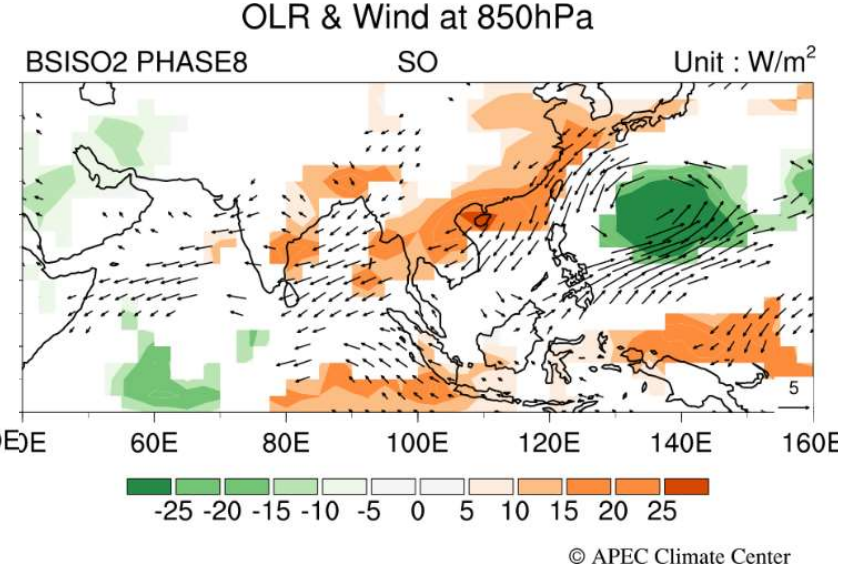

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SpectralWeather tool

Extending Cameron Beccario's earth.nullschool.net project, SpectralWeather focuses on spectral decomposition of meteorological and oceanic fields into equatorial waves.
SpectralWeather uses ECMWF ERA5 data, NASA GPM rainfall, OMI OLR index, NEMO SST, AVISO sea surface height, and OSCAR currents.

EGU General Assembly 2021

vEGU21: Gather Online | 19–30 April 2021

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EGU21-14574, updated on 04 Mar 2021
https://doi.org/10.5194/egusphere-egu21-14574
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Application of SpectralWeather to prediction of flood and extreme rain events in the Maritime Continent

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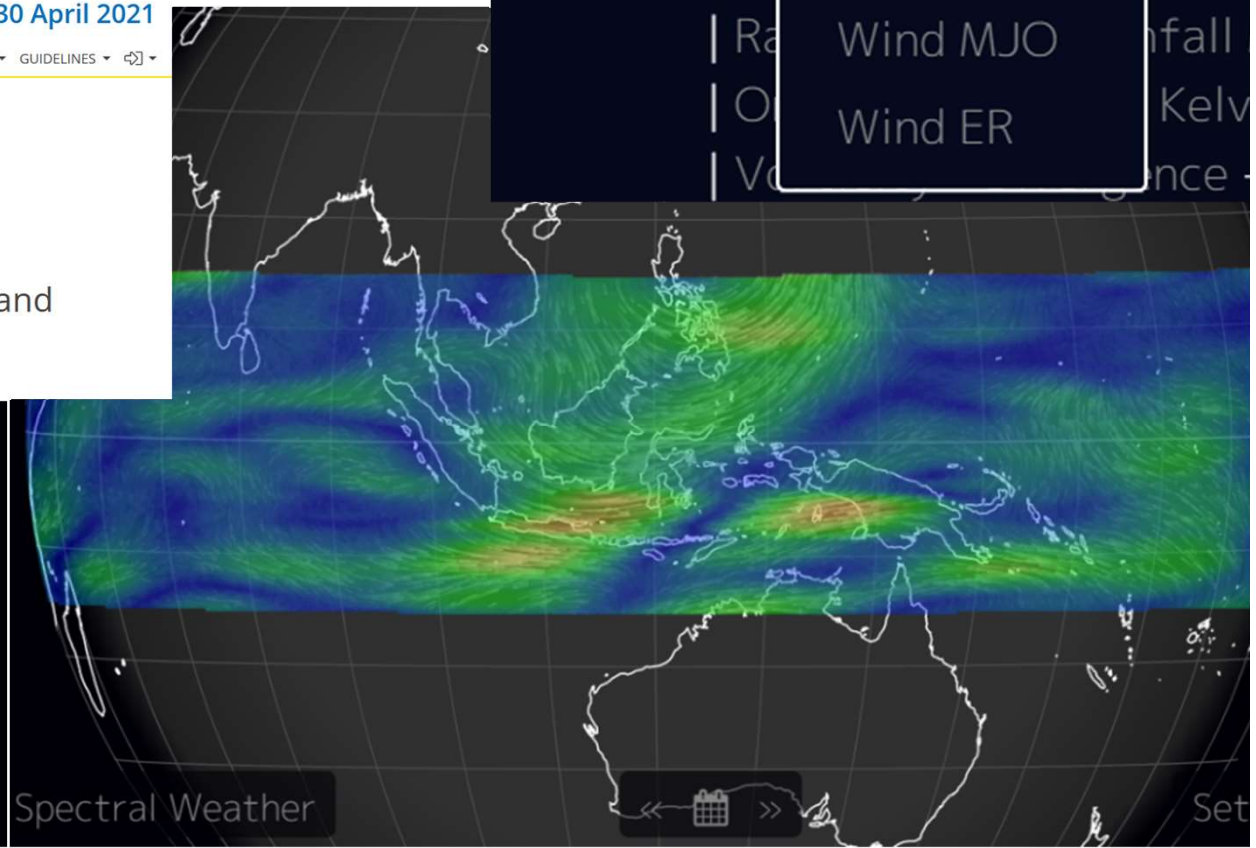
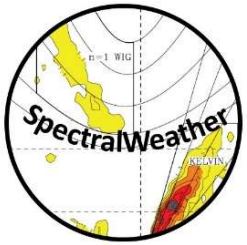
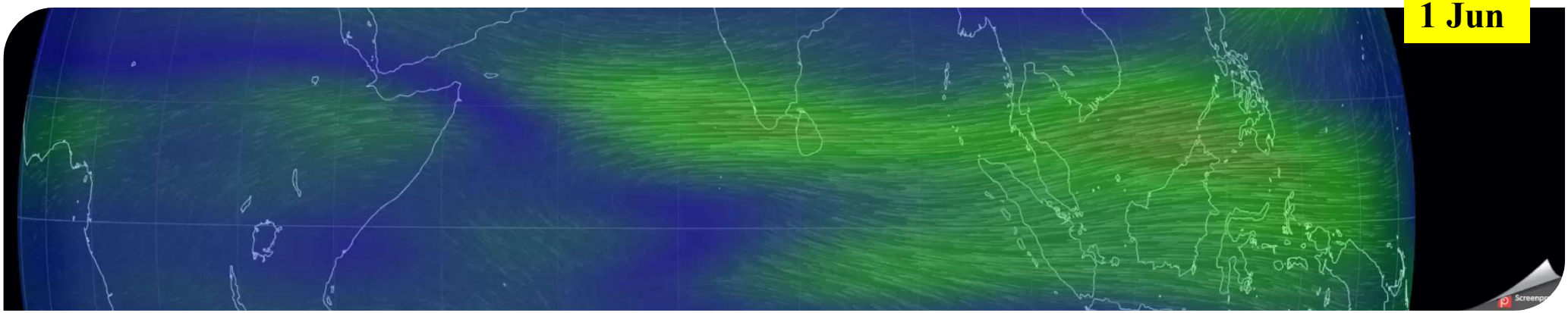
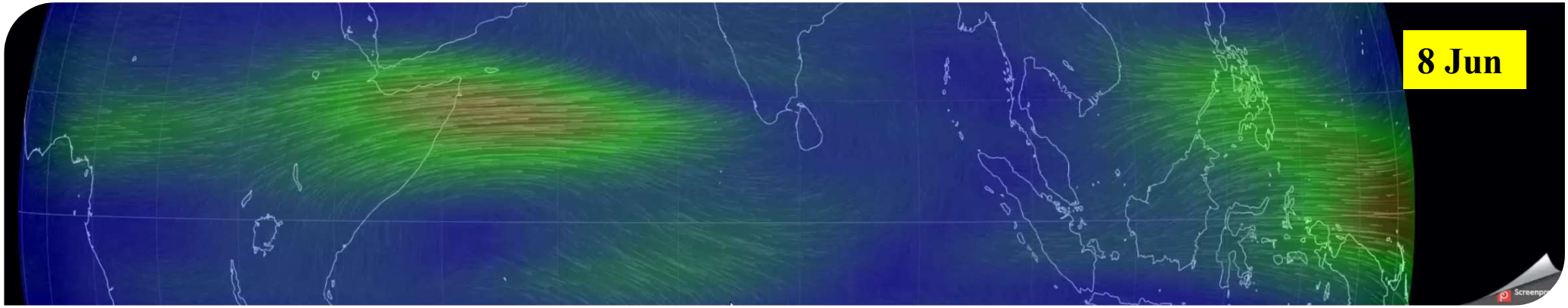
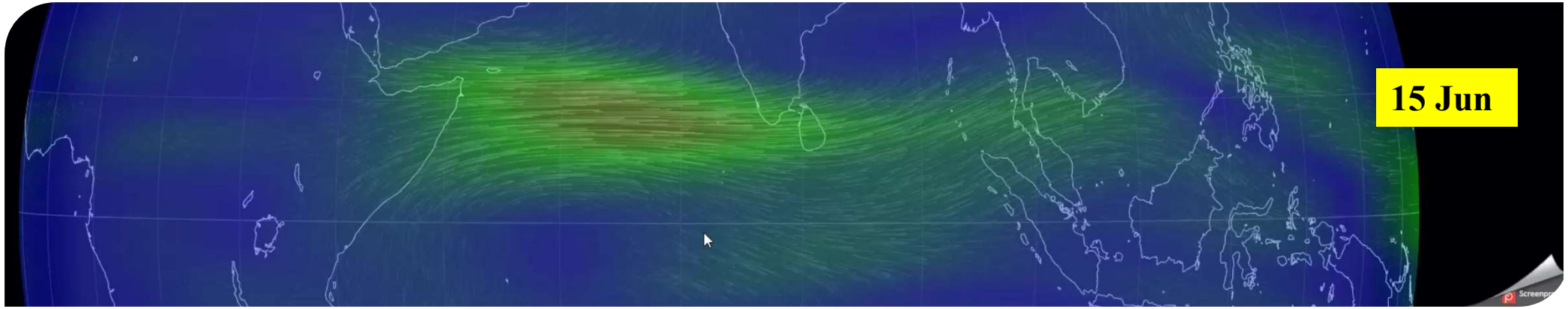


Contribution from MJO to VIWVF





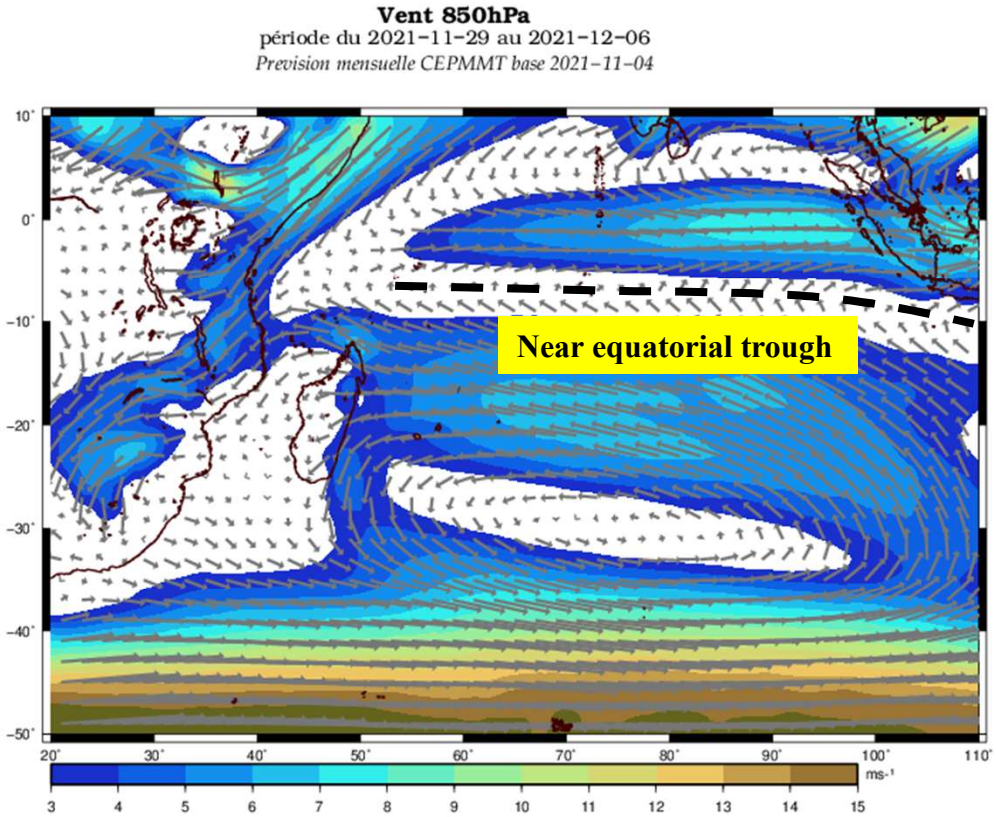




Needed products

- Total fields besides anomaly fields
- Decomposition of various fields showing the contributions from Low frequency, MJO, ER waves, Kelvin waves, etc
- …

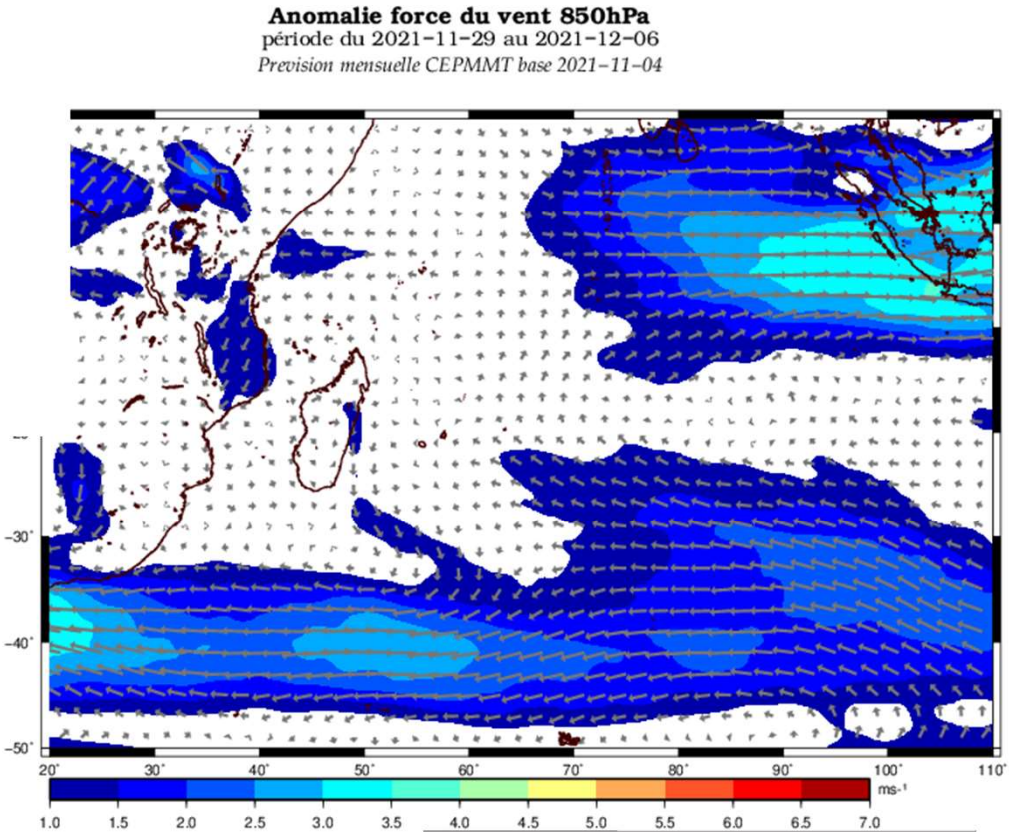
Total field is needed



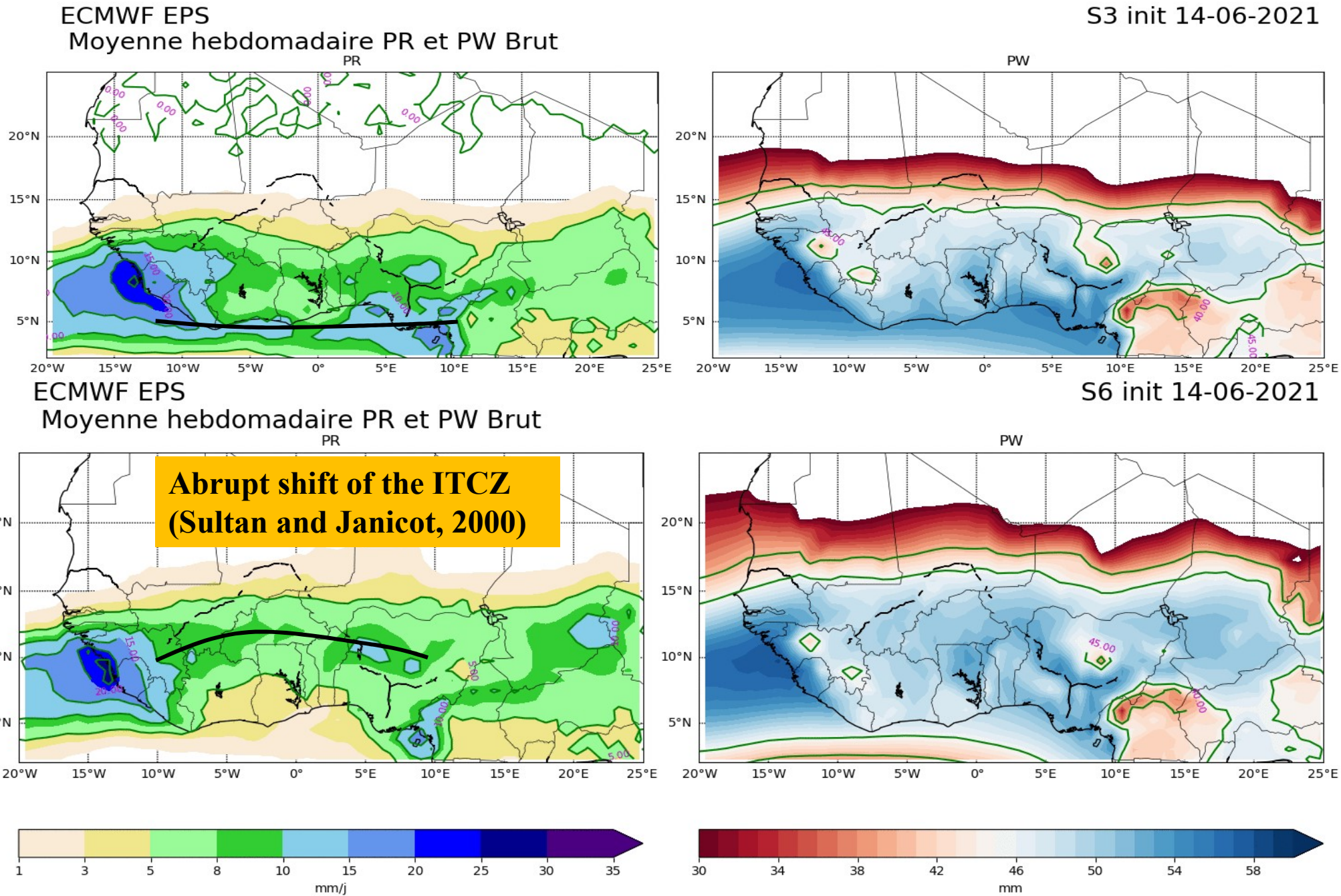
Total wind 850 hPa

In order to recognize seasonal flow patterns such as monsoon trough, near equatorial trough

Wind anomaly 850 hPa



Total field is needed



Take away messages

- There is a place for human analysis and prediction in subseasonal range too.
- VP200, VP850, SF850 often show a more persistent/propagative behaviour than the MJO RMM index
- But check if VP200 and PW (Precipitable Water) are in phase or out of phase
- Monitoring the envelopes of PW is a powerful tool
- In boreal summer, think BSISO
- Propagation can be seen outside 15S-15N (for example in SPCZ)
  Classical Hovmöller diagrams might hide it
- A week 4/5 outlook may be very valuable.
  Do not limit yourself to Week 2/3.
- Remember to examine the model skill in your region (Harry, next presentations)
- Don’t oversell synoptic details (Harry)

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Questions

- If MJO is predicted, until what week are current model outputs more valuable than the MJO composite charts ?
- How to distinguish longer low frequency (la Nina) from shorter low frequency events ?
- How to show the influence from large extratropical Rossby wave trains/regimes on tropical latitudes (often appear within the Kelvin filtering) ?

Thank You