



An update on activities at Météo-France

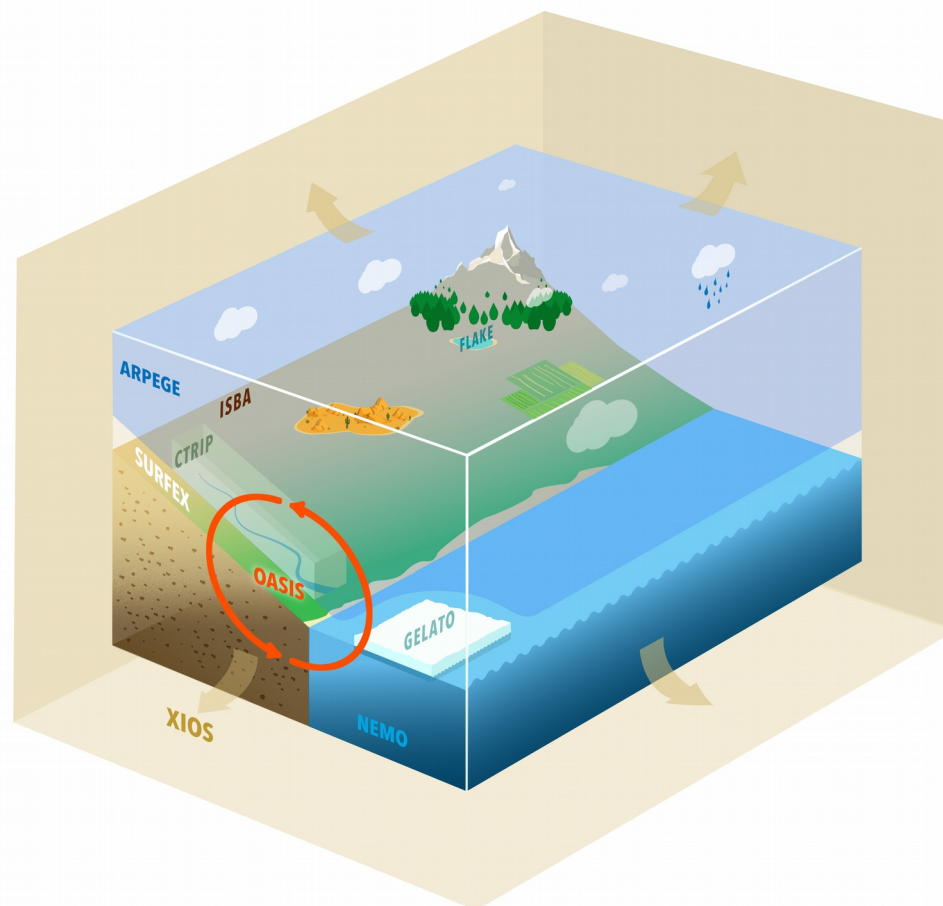
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21st WGSIP meeting, INM RAS (Moscow - May 2019)

Research on climate prediction at CNRM

- S2S and seasonal predictability research activities: small team! (3 researchers, 1 engineer, 1 post-doc, 1 PhD student, 1 Masters student)
- Also in charge of the Copernicus C3S seasonal forecast tender and MF S2S contribution
- We work closely with other teams at CNRM (e.g. development of CNRM-CM)
- Current projects: APPLICATE TRIATLAS, ERA4CS-MEDSCOPE, PROSNOW



CNRM-CM

Highlights from research activities (CNRM)

Impact of **soil moisture** on seasonal prediction skill (C. Ardilouze)

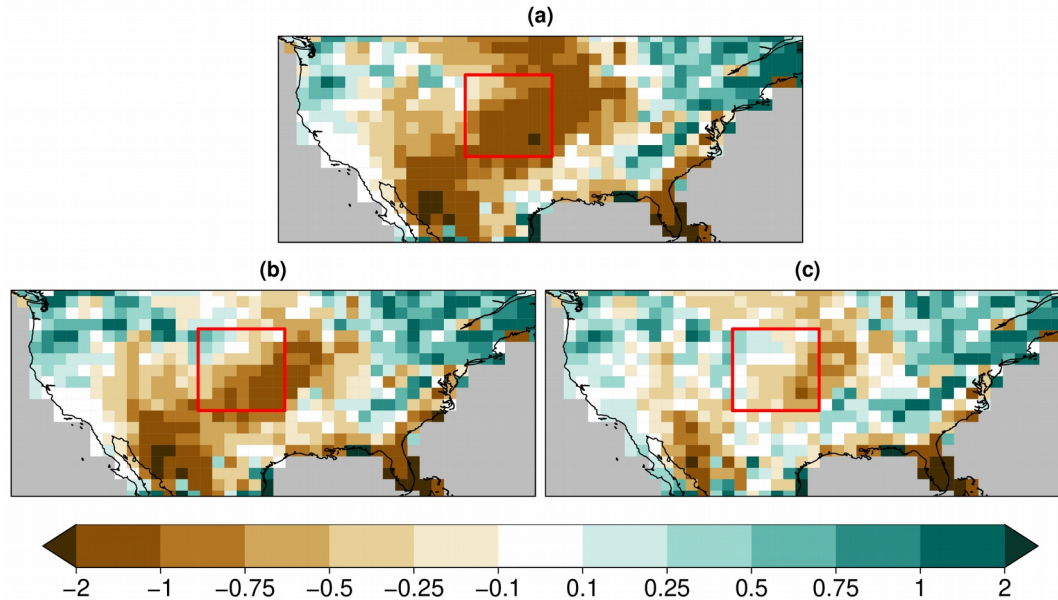


Fig.1 : Mean JJA bias in seasonal re-forecasts with (a) CTRL using offline SURFEX run ICs for land-surface, (b) INIT with initial corrections of soil moisture using ERA-Land, (c) PERT with in-run corrections of the precipitation inserted in the land surface model using a multiplicative factor.

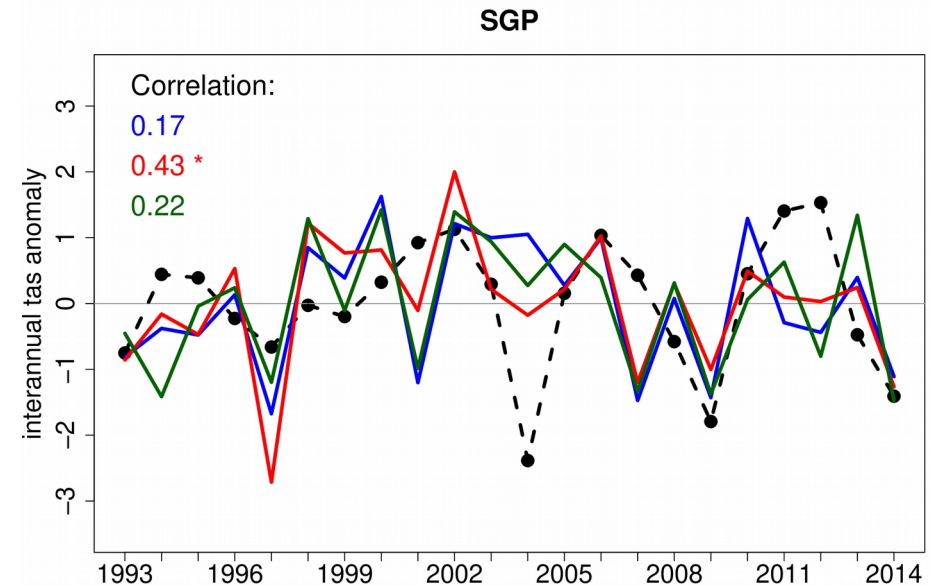


Fig.2 : Southern Great Plains near-surface temperature anomalies over the re-forecast period in CTRL (blue), PERT (red) and INIT (green).

Ardilouze et al. (2019), in revision for Weather and Forecasting

Highlights from research activities (CNRM)

Ongoing work on S2S

Evaluation of a S2S multimodel with 6 models (BoM, CMA, ECCC, ECMWF, Météo-France, UKMO) over SW Pacific (Specq et al., submitted to JGR-Atmospheres)

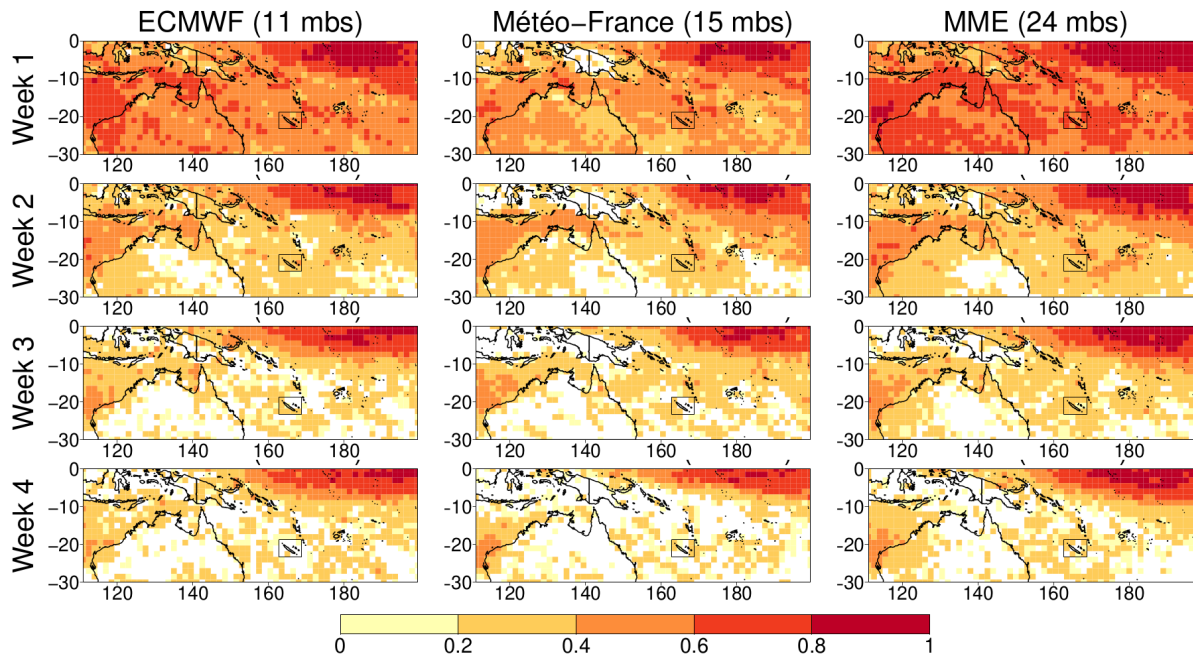


Fig.1 : ROC skill score for the probabilistic prediction of the upper quintile of weekly precipitation in ECMWF, Météo-France and the multimodel ensemble (MME) during austral summer (DJF).

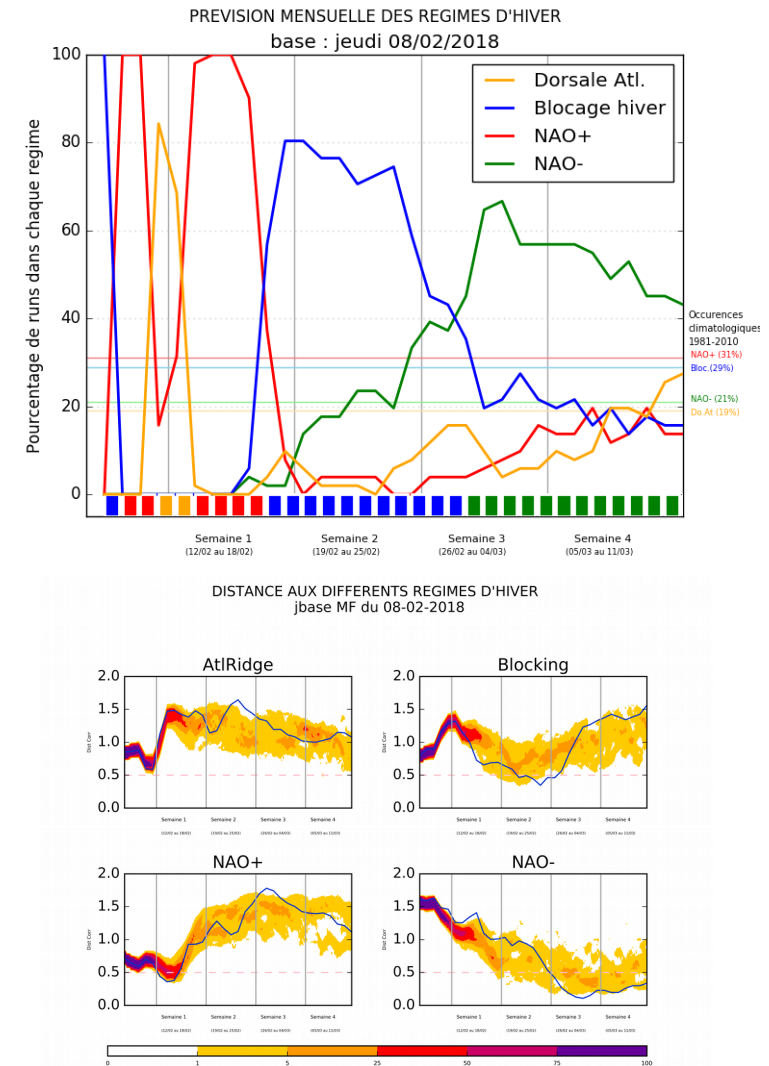


Fig.2 : Probability of each North Atlantic weather regime in the Météo-France S2S forecast initialized on Feb. 8 2018.

S. Antoine's Masters thesis work

Highlights from R2O activities (CNRM)

- Development of System 6 in 2017 and uptake in Copernicus C3S multi-model last November
- Now working on System 7! Hindcasts are currently running, should be operational in October (depending on C3S availability).

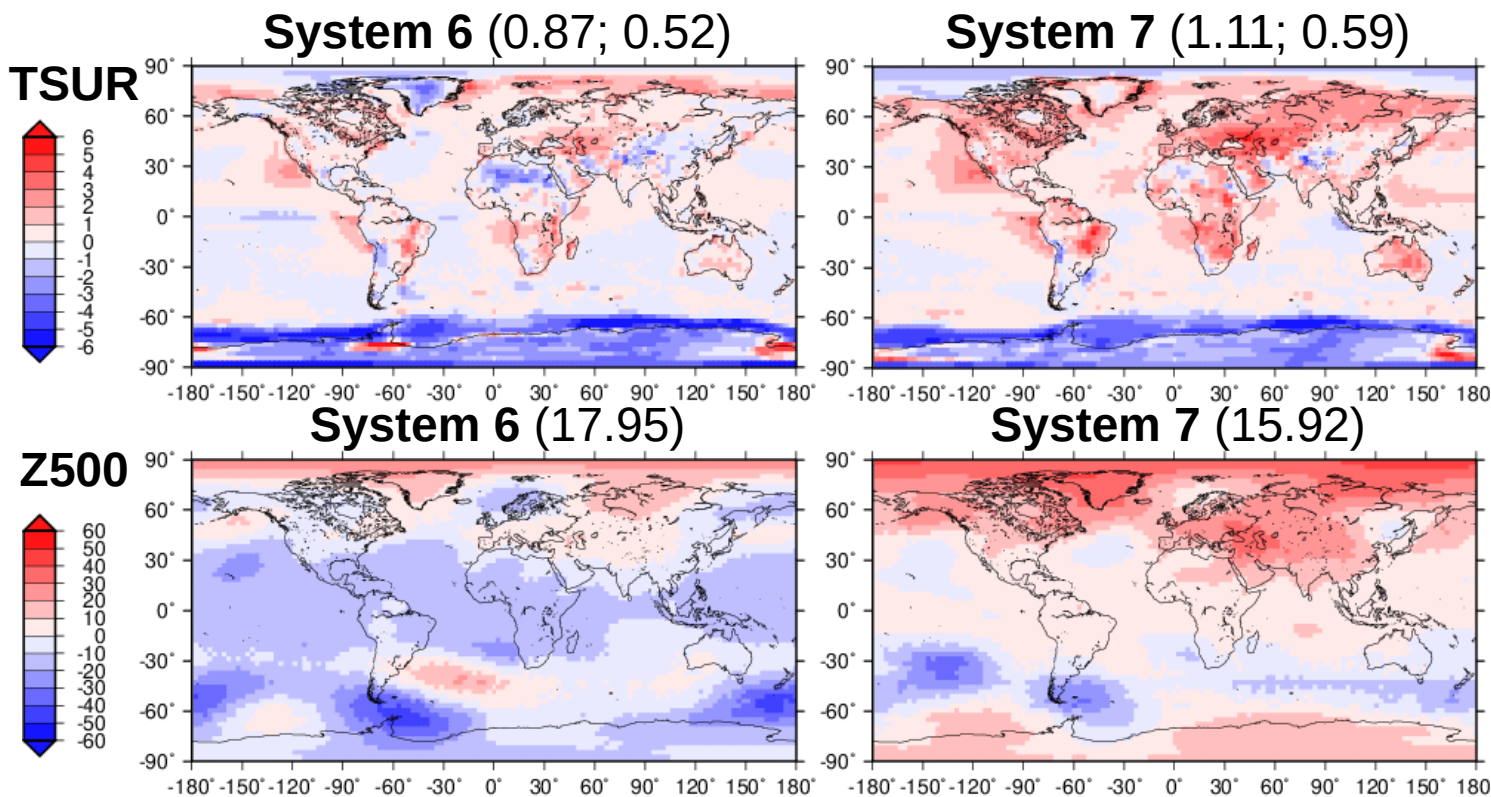


Fig.: ASO 1993-2016 hindcast biases with ERA5 for surface temperature (top) and Z500 (bottom) in System 6 and System 7, initialized end of June.

Figure courtesy of J.-F. Guérémy

Highlights from operational activities (DCSC, ENM)

- New bulletin and products (heat waves, sea ice, potential evapo-transpiration...)

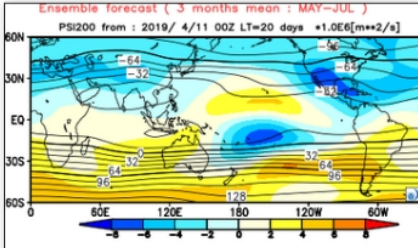
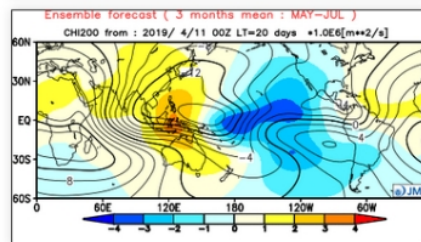
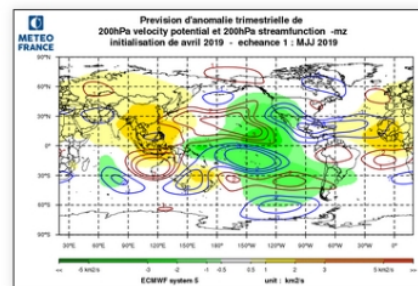
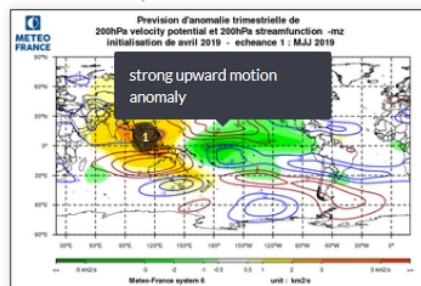


Atmospheric circulation forecasts : velocity potentiel and stream function at 200hPa



VP 200 hPa : good agreement between models; large area of positive velocities over the Tropical Pacific, and large subsiding anomalies over the Maritime Continent and SE Asia. Pattern are consistent with El Niño.

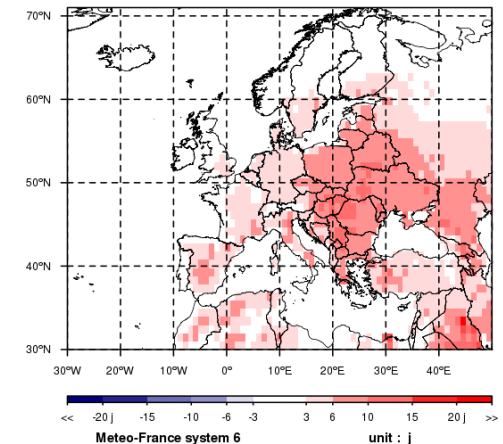
Streamfunction : Positive PNA teleconnection in both models. Only SEAS5 extends its teleconnection towards Europe, while MFS6 extends towards India / Middle East.



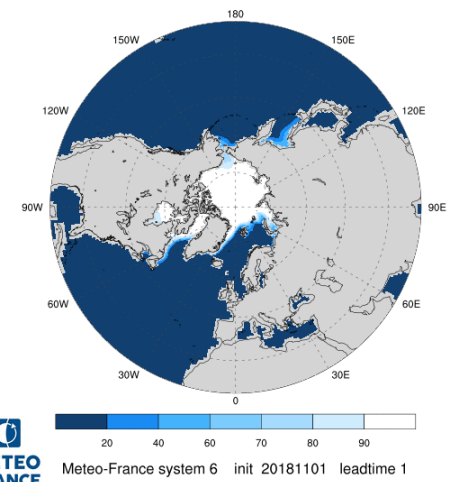
Top, MF6 and SEAS5: color range of velocity potential anomalies (green: ascending, orange: subsidence) and isolines of stream function anomalies (red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere). Bottom, JMA model, left potential velocity and anomalies, right stream function and anomalies.

<http://seasonal.meteo.fr>

Prevision d'anomalie trimestrielle de jours en vague de chaleur initialisation de mai 2019 - échéance 1 : JJA 2019



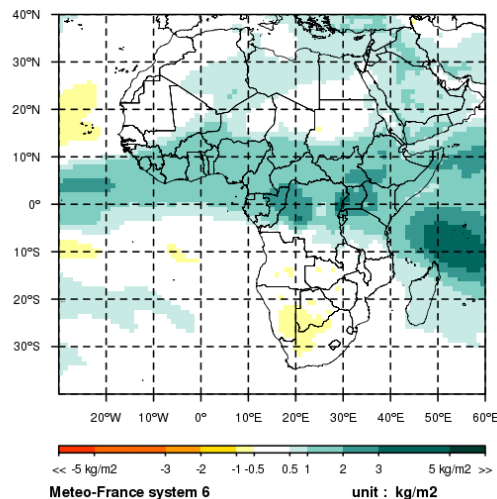
3 months forecast sea ice Area Fraction



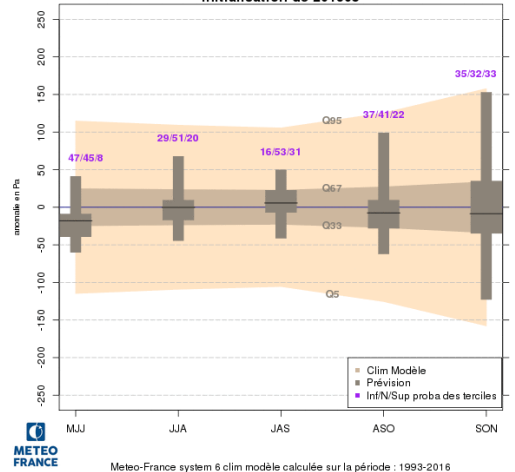
Highlights from operational activities (DCSC, ENM)

- CREWS Burkina (sub-seasonal to seasonal time scales)
SF products to identify precursors of the WA Monsoon
MISVA monthly outlook briefings → Kelvin waves, MJO...

Prevision d'anomalie trimestrielle de
Total water content
initialisation de mai 2019 - echeance 1 : JJA 2019



Climagramme des anomalies trimestrielles
de pression dans la boîte Sahara
initialisation de 201905

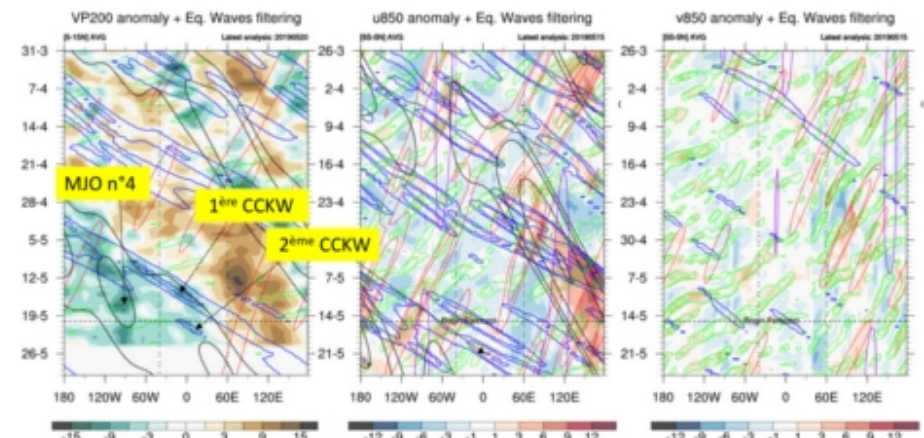


⇒ currently tested in
operational conditions with
Burkinabe forecasters



IV. Ondes équatoriales

Une deuxième onde de Kelvin est en train de traverser le golfe de Guinée, dans le sillage de la forte onde de Kelvin de la semaine dernière.



Example of the last monthly outlook briefing (prepared by F. Sangho and T. Lefort)

Prospects

- Work on coupled initialization techniques: higher consistency between atmosphere/land and ocean/ice components
- Seasonal re-forecasts with CNRM-ESM2 → H2020-TRIATLAS project, collaboration with CERFACS
- Climate services: in the framework of ERA4CS-MEDSCOPE, development of relevant indicators for hydrology and energy (hydropower) over the Mediterranean region → links with MedCOF

Thanks for your attention!

Recent and ongoing papers:

- Ardilouze et al. (2017): Multi-model assessment of the impact of soil moisture initialization on mid-latitude summer predictability. *Clim Dyn.* doi:10.1007/s00382-017-3555-7.
- Ardilouze et al. (2019): Impact of soil moisture on European summer climate in numerical experiments. *Clim Dyn.* doi:10.1007/s00382-018-4358-1
- Ardilouze et al. (2019): On the link between summer dry bias over the US Great Plains and seasonal temperature prediction skill in a dynamical forecast system, *in revision for Wea. Forecasting*
- Batté et al. (2018): Forecasting West African Heat Waves at Subseasonal and Seasonal Time Scales. *Monthly Weather Review*, Volume: 146, Issue: 3, Pages: 889-907, doi: 10.1175/ MWR-D-17-0211.1.
- Batté et al.: Summer predictions of Arctic sea ice edge in multi-model seasonal re-forecasts, *in prep for Clim. Dyn.*
- Specq et al.: Multimodel forecasting of precipitation at subseasonal timescales over the southwest tropical Pacific, *submitted to J. Geophys. Res. - Atm.*

From System 5 to System 6

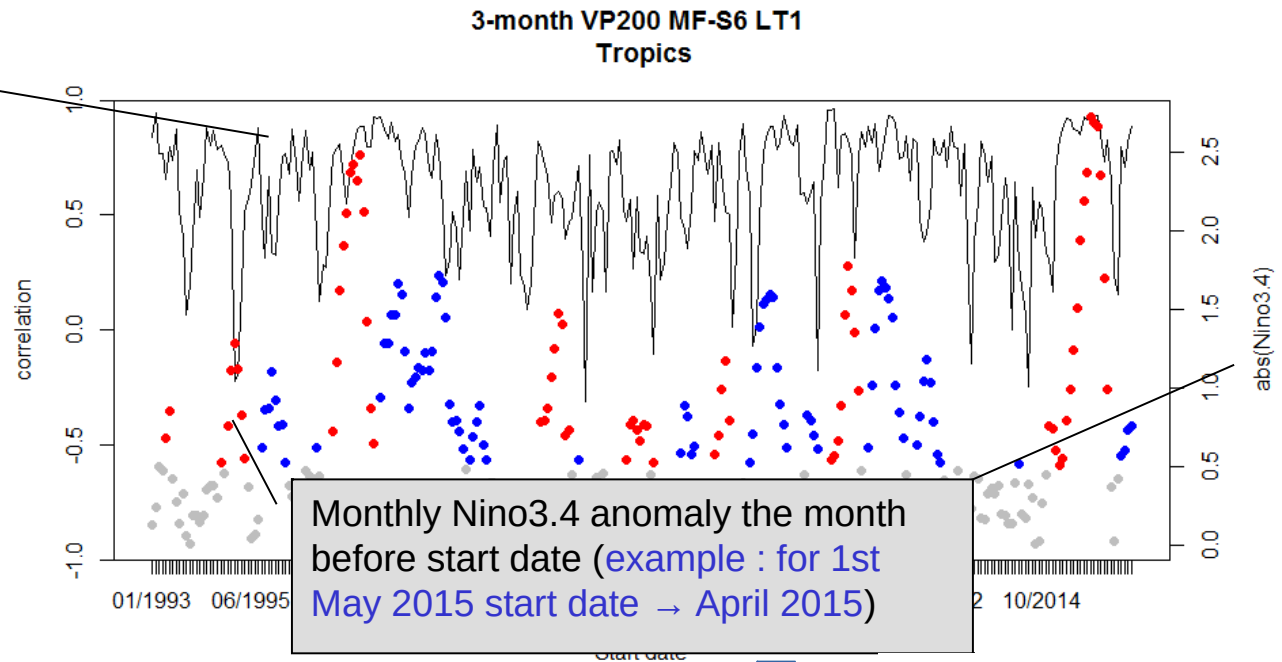
- ARPEGE-Climate component: new prognostic atmospheric physics scheme, higher resolution (tl255l91r → tl359l91r)
- SURFEX v8 land surface component
- NEMO ocean component: v3.2 → v3.6, both at 1° resolution
- GELATO sea ice model
- 3h ocean/atmosphere coupling instead of 24h
- New set of upscaled GLORYS ocean / sea ice reanalyses provided by Mercator Ocean International

From System 6 to System 7

- CNRM-CM6 HR version → ORCA 1/4° grid with NEMO3.6
- Changes in atmospheric physics: turbulence in presence of convection and turbulent orographic form drag (TOFD, Beljaars et al. 2004)
- Re-forecasts initialized from ERA5 in the atmosphere
- New ocean/sea ice GLORYS reanalyses and real-time analyses provided by Mercator Ocean International (upscaled from 1/12° analysis)

Recent study on Seasonal predictability, using MF-S6 and SEAS5 hindcast data (C. Viel, DCSC)

Score : spatial anomaly correlation (here : over Tropics) of 3-month mean field (here 200mb Velocity Potential), between a model (here : MF-S6) and a reference.
1-month lead-time (example : for 1st May 2015 start date → JJA 2015)



Main results :

- during ENSO events, one can measure a significant enhancement in MF-S6 and SEAS5 scores in the tropics and in mid-latitudes (compared to neutral ENSO phase)
- in case of strong spatial correlation between MF-S6 and SEAS5, both models show better scores than when the correlation is weak.

==> by analyzing the global context, it is possible to identify windows of opportunity for SF predictability

