WCRP
World Climate Research Programme

WGNE-WGSIP joint meeting
WGBE 39th Session
04-08 November 2024
Toulouse, France

ESMO
Earth System Modelling and Observations

WGNE-S2S-GAW project: Quantifying the impact of aerosols on the predictive skill of subseasonal global atmospheric and air quality simulations

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Thanks to Angela Benedetti[2], Andrea Molod[3], Georg Grell[4], Shan Sun[4], Donifan Barahona[3], Li Zhao[3], Beomcheol Shin[5]

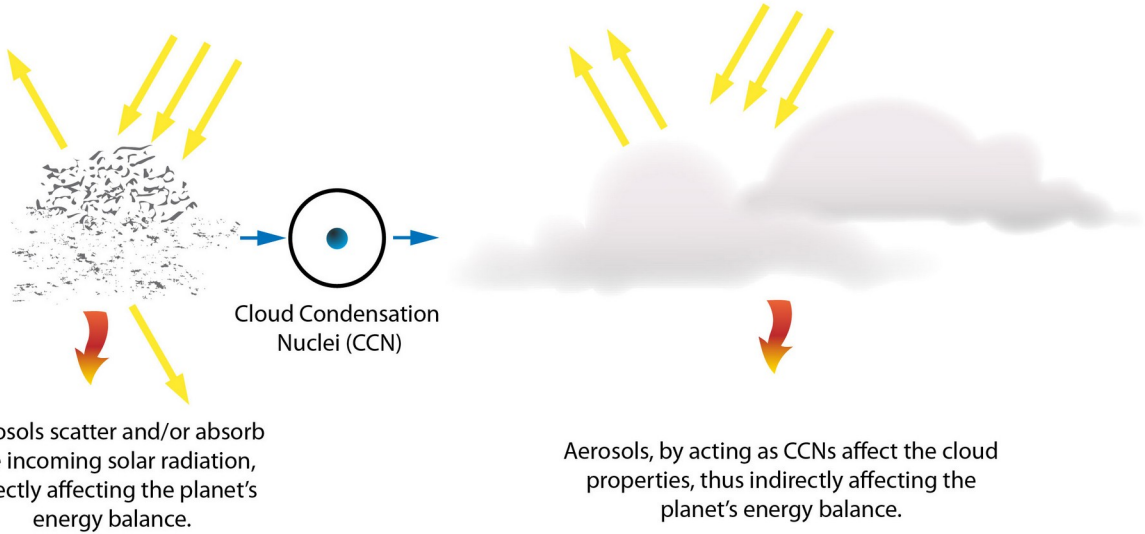
1-Center for Weather Forecasting and Climate Studies, National Institute for Space Research, WGNE; 2-European Centre for Medium-Range Weather Forecasts, S2S; 3-NASA/Goddard Global Modeling and Assimilation Office, S2S; 4- Earth Prediction Advancement Division, National Oceanic and Atmospheric Administration, GAW/SAG-APPs; 5-Korea Meteorological Administration (KMA)

INPE

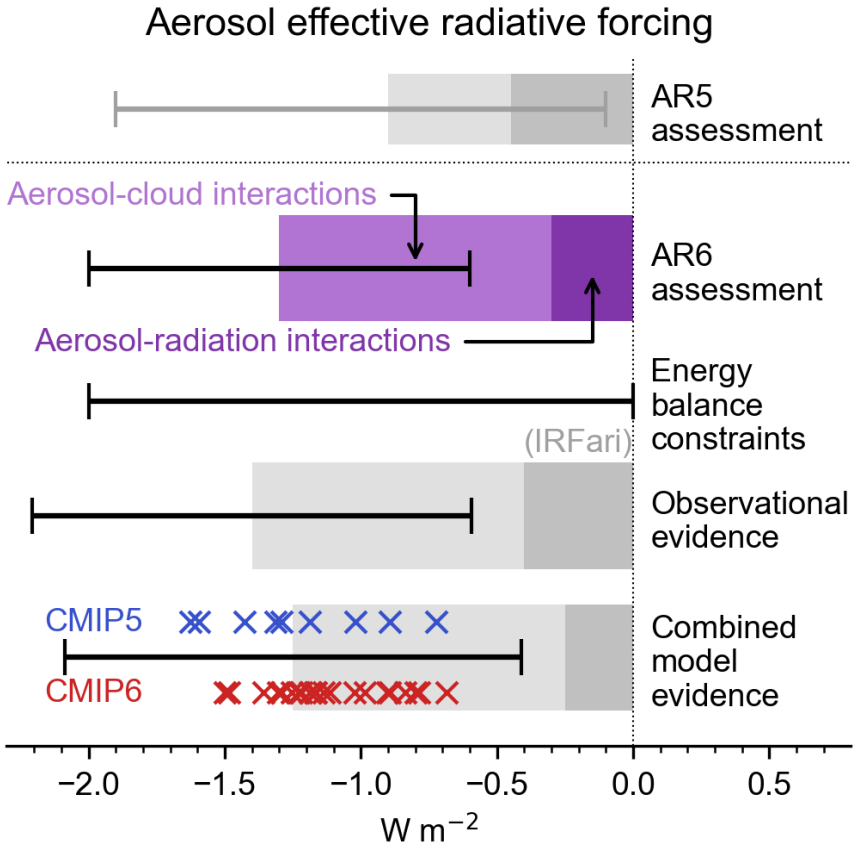
Outline

- Introduction
- Numerical experiments
- Selected results
- Conclusions and Next steps

Aerosols as climate forcing



Effective radiative forcing



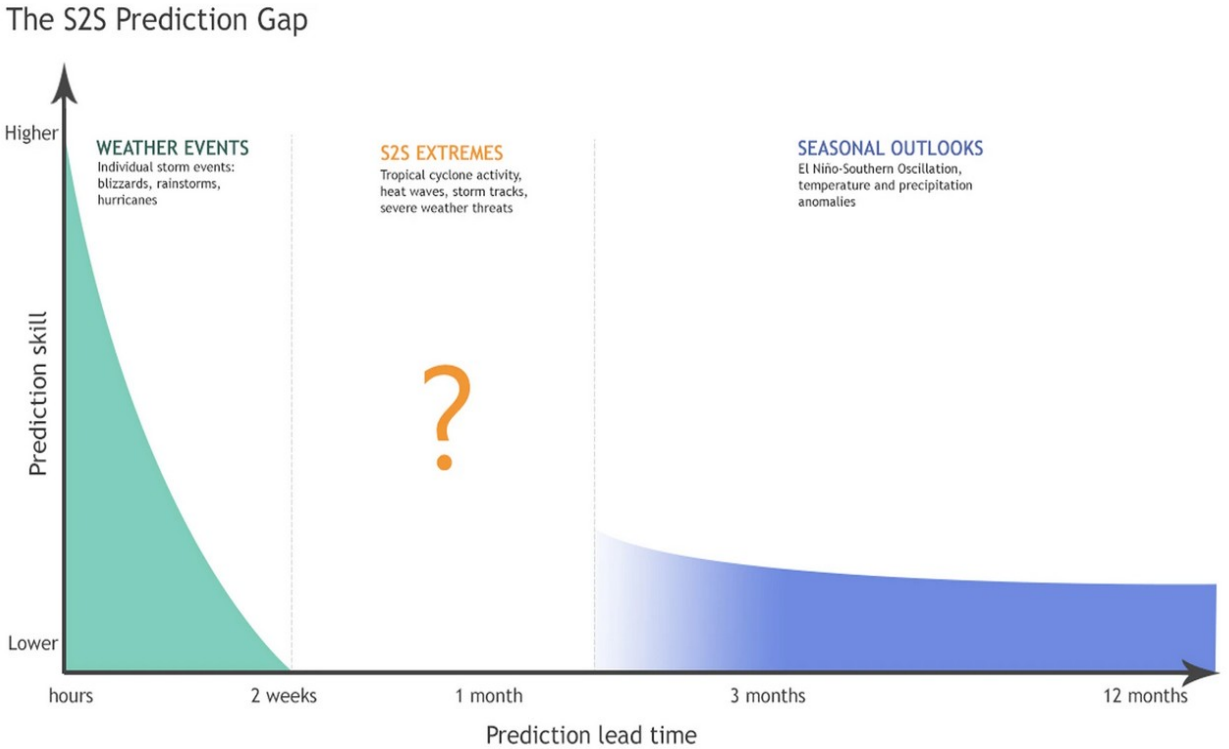
Increased confidence in the quantification of changes in the ERF -> improved observational records and closure of the sea level budget

ERF**aci** (aer-cloud interactions) contributes most (75–80%) to the total aerosol effect (high confidence)

Forster and co-authors, AR6 IPCC 2021

The S2S prediction gap

From: Progress in subseasonal to seasonal prediction through a joint weather and climate community effort



Mariotti, A., Ruti, P.M. & Rixen, M. *npj Clim Atmos Sci* **1,** 4 (2018). https://doi.org/10.1038/s41612-018-0014-z

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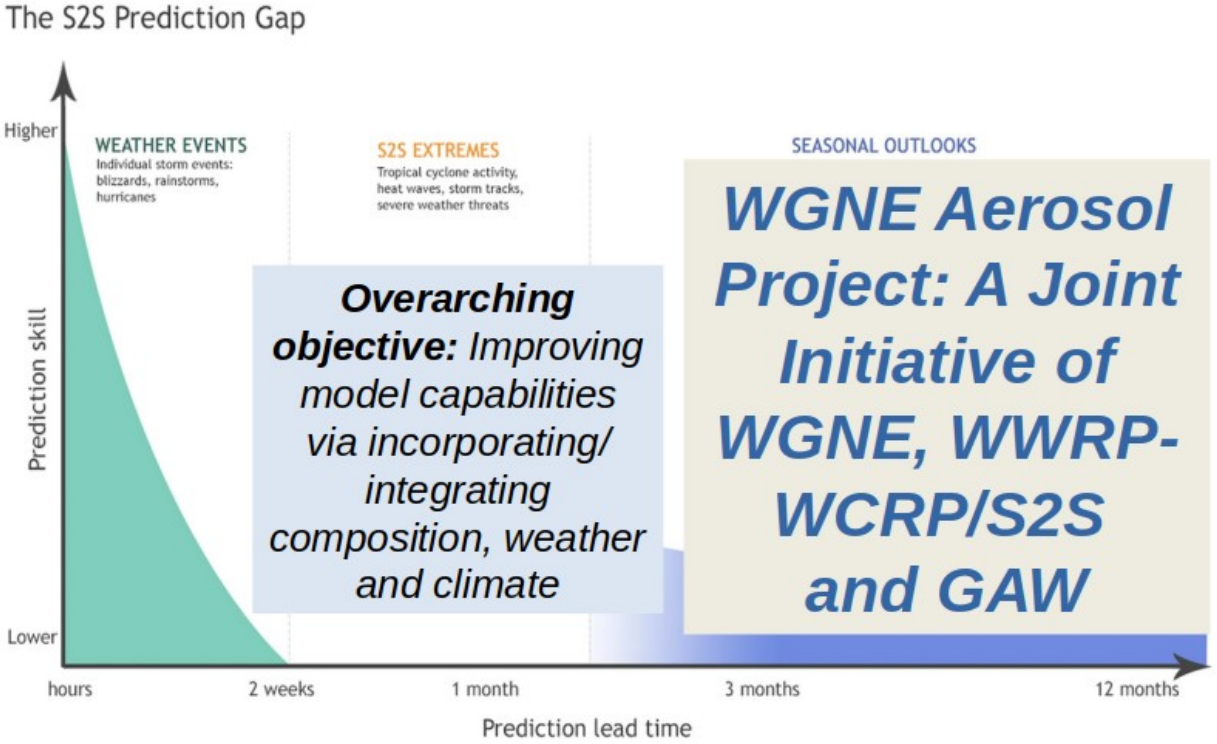


Adapted

Mariotti, A., Ruti, P.M. & Rixen, M. *npj Clim Atmos Sci* **1**, 4 (2018). https://doi.org/10.1038/s41612-018-0014-z

Adapted from: iri.columbia.edu/news/qa-subseasonal-prediction-project

WGNE Aerosol project

Evaluating the impact of aerosols on Numerical Weather and Subseasonal Prediction

S2S Re-forecast Experiments

Biomass Burning, Dust and Pollution

- Minimum 5-member ensemble
- At least 32-day long simulations

- Climatological emissions vs prescribed emissions
- Aerosol direct effect (indirect effect is optional)

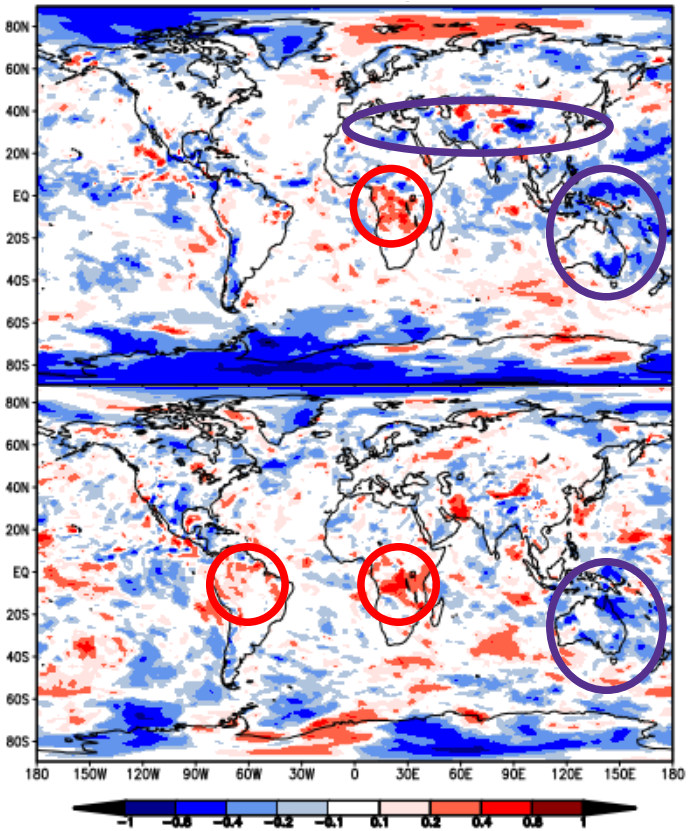
WGNE Aerosol project - experiments

Model	Experiment	Start date	Hindcasts	Ensemble members
*GEOS-S2S/NASA	Climatological aerosols	26, 29 Aug	2003-2019	4
	Direct + Indirect effect	26, 29 Aug	2003-2019	4
	Direct effect only	26, 29 Aug	2003-2019	4
IFS/ ECMWF	Climatological Direct effect only	20, 25 Aug 01, 05, 09 Sep	2003-2019	14 + 1
NOAA	Climatological Direct effect only	01 Sep	2004-2019	5
KMA	Direct + indirect effect**	1th, 9th, 17th, 25th of each month	2003-2016	10 (5 for stochastic * 2 for time varying)

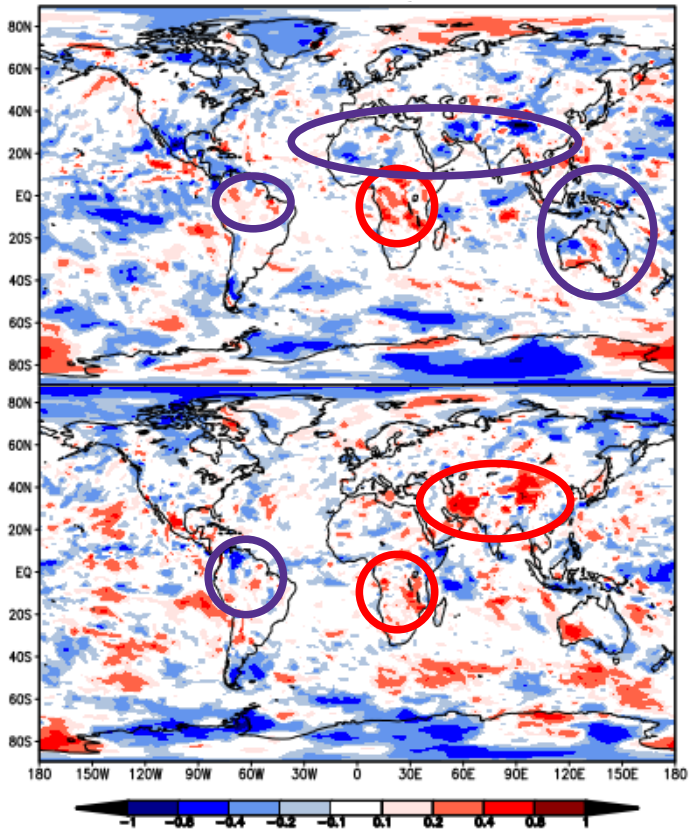
AOD weekly correlation maps – NOAA model

CAMS - MERRA2

W 1



W 2

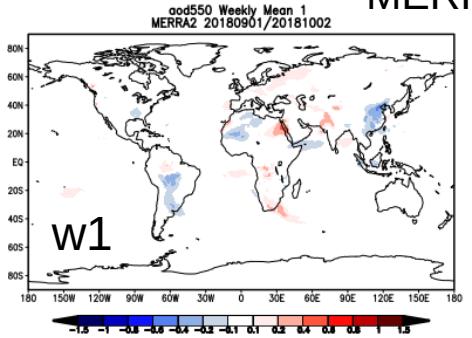


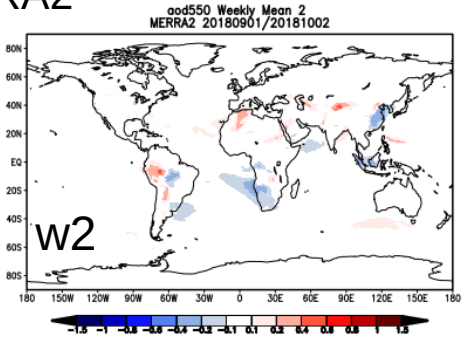
W 3

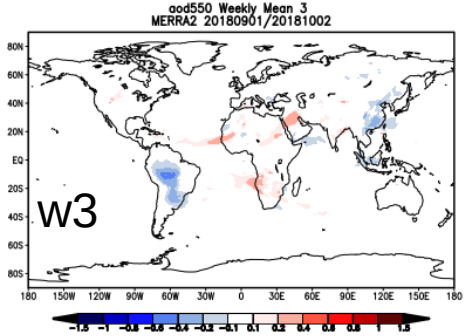
W 4

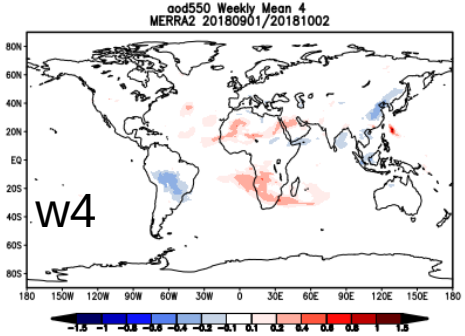
Case study September 2018

MERRA2

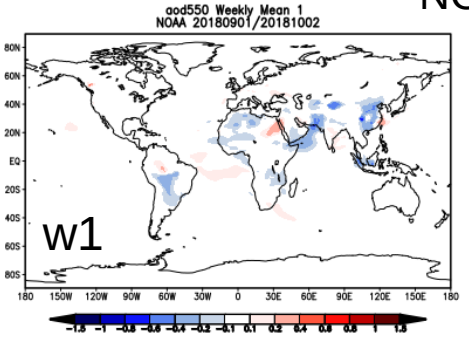


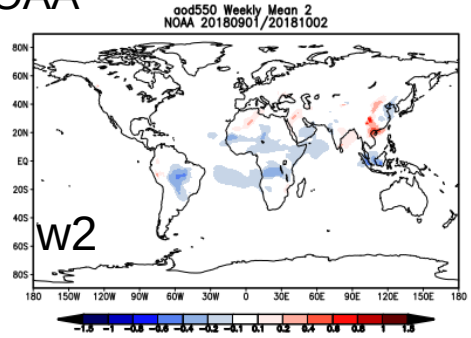


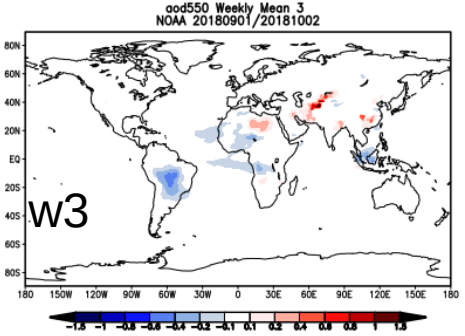


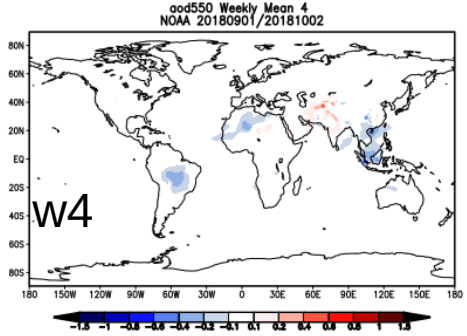


NOAA









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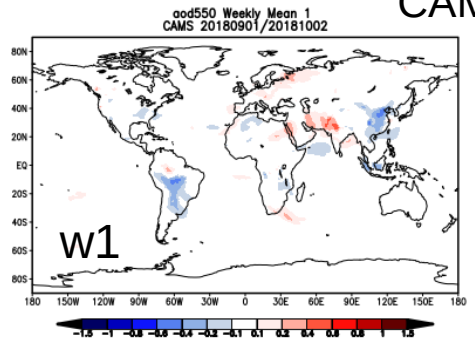

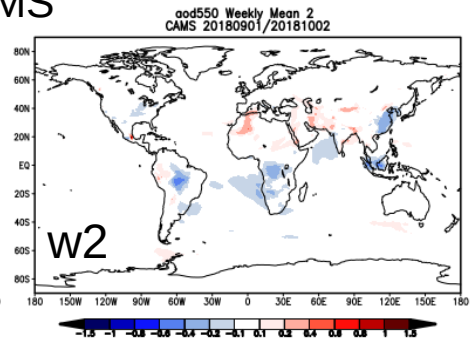

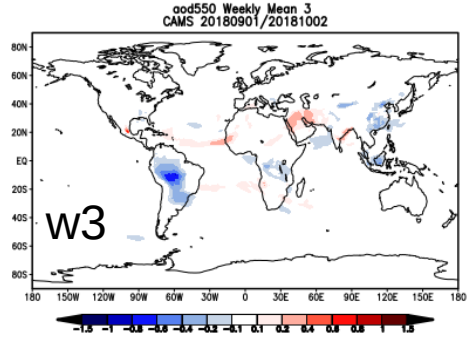

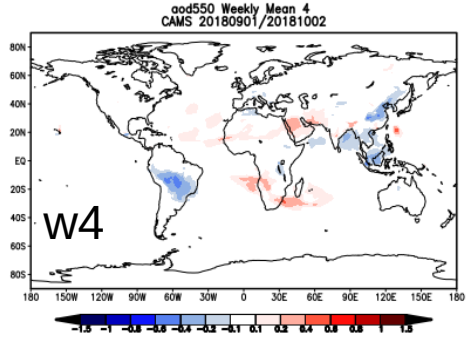

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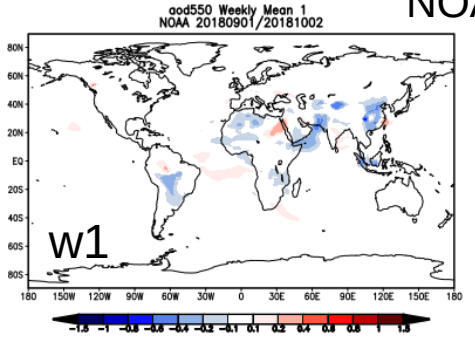

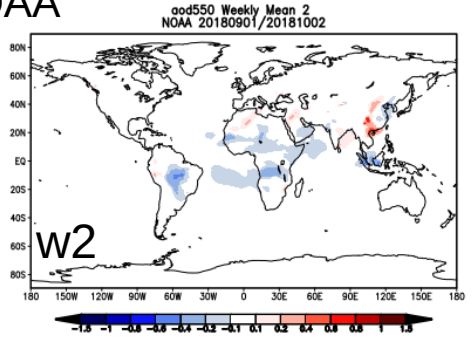

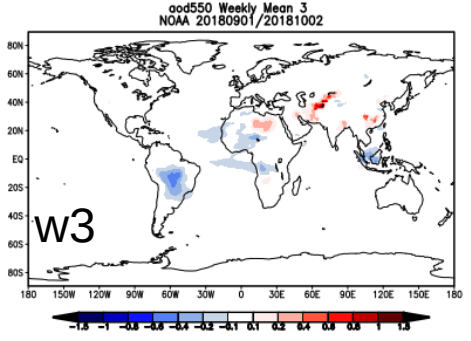

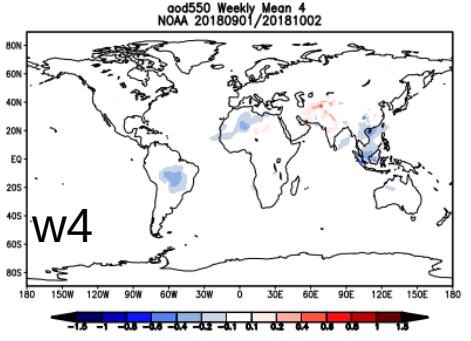

Conclusions and Next steps

Differences in reanalysis impact correlation/biases results
=> The ICAP reanalysis consensus (aerosols) will be considered

Number of ensemble members differ - probabilistic analysis might be impacted

Models have mixed improvement and degradation over the globe, however, important improvement was observed in key-regions, like USA, Canada, South America (NOAA model)


Thanks!
BBS in the Amazon