SPECIAL PROJECT PROGRESS REPORT

Progress Reports should be 2 to 10 pages in length, depending on importance of the project. All the following mandatory information needs to be provided.

Reporting year	……2015…………………………………………
Project Title:	Interactions between the Atlantic Ocean, African monsoon, the Indian and Pacific Oceans using the EC-Earth and IFS modelling systems ………………… …………………………………………………….……
Computer Project Account:	………SPITDIPO……………………………………
Principal Investigator(s):	………………Fred Kucharski…………………………… …………………………………………………….……
Affiliation:	Abdus Salam International Centre for Theoretical Physics (ICTP)……………………………………………………. ……
Name of ECMWF scientist(s) collaborating to the project (if applicable)	……………………………………… …………………………………………………….……
Start date of the project:	……30.04.2013………………………………………
Expected end date:	……30.12.2015………………………………………

Computer resources allocated/used for the current year and the previous one
(if applicable)
Please answer for all project resources

		Previous year		Current year	
		Allocated	Used	Allocated	Used
High Performance Computing Facility	(units)	300	?	300	
Data storage capacity	(Gbytes)	1000	?	1000	

Summary of project objectives

(10 lines max)

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Previous work has shown the possibility that the tropical Atlantic has an unexpectedly strong Influence on the Indian Ocean, Indian Monsoon and Pacific Ocean.

Since most of these studies are based only on observational data and intermediate complexity model simulations, the aim of this project is to use the latest state-of-the-art modelling systems EC-Earth and/or the IFS to confirm and refine the various hypothesises that have been made previously. Relatively high-resolution and complex physics simulations are essential to increase confidence in the hypothesis that the tropical Atlantic may have a much stronger impact on the surrounding ocean and land masses than previously thought. However, also simulations with the intermediate complexity ICTPAGCM coupled to OPA/NEMO will be performed, because the efficiency of this model enables to assess and validate new techniques quickly.

Summary of problems encountered (if any)

(20 lines max)

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Summary of results of the current year (from July of previous year to June of current year)

This section should comprise 1 to 8 pages and can be replaced by a short summary plus an existing scientific report on the project

In 2015, SPEEDY-NEMO Atlantic Pacemaker experiments introduced in previous progress reports have been analyzed further to investigate the Atlantic Multidecadal Oscillation (AMO) influence on Pacific decadal climate variability and *climate shifts*. It has been found that the AMO has a substantial influence on Pacific Decadal variability, with the positive AMO phase leading to an overall warmer tropical Atlantic, modification of the Walker circulation that leads to rising motion in the tropical Atlantic, sinking motion in the central Pacific. This chain of events eventually lead to easterly wind anomalies in the central-western Pacific in the positive AMO phase that initiate upwelling oceanic Kelvin waves that ultimately cause the central-eastern Pacific to cool during the positive AMO phase. The opposite happens during the negative AMO phase. Fig. 1 shows a central equatorial Pacific wind index (CPWI) from observations (black curve), the Atlantic Pacemaker experiment (red curve), together with the AMO index (green curve), which clearly exhibit the expected anti-correlation between the AMO index and the CPWI. Fig. 2 shows the regression of the AMO index onto a) observed SSTs and low-level winds, b) model SSTs and low-level winds, c) model 200 hPa velocity potential and low-level winds. Finally Fig. 3 shows the regression of the AMO index onto the equatorial ocean temperature and zonal flow and indicates the indeed ocean dynamics plays a crucial role in the mechanisms described above. All the presented results are published in Kucharski et al. 2015.

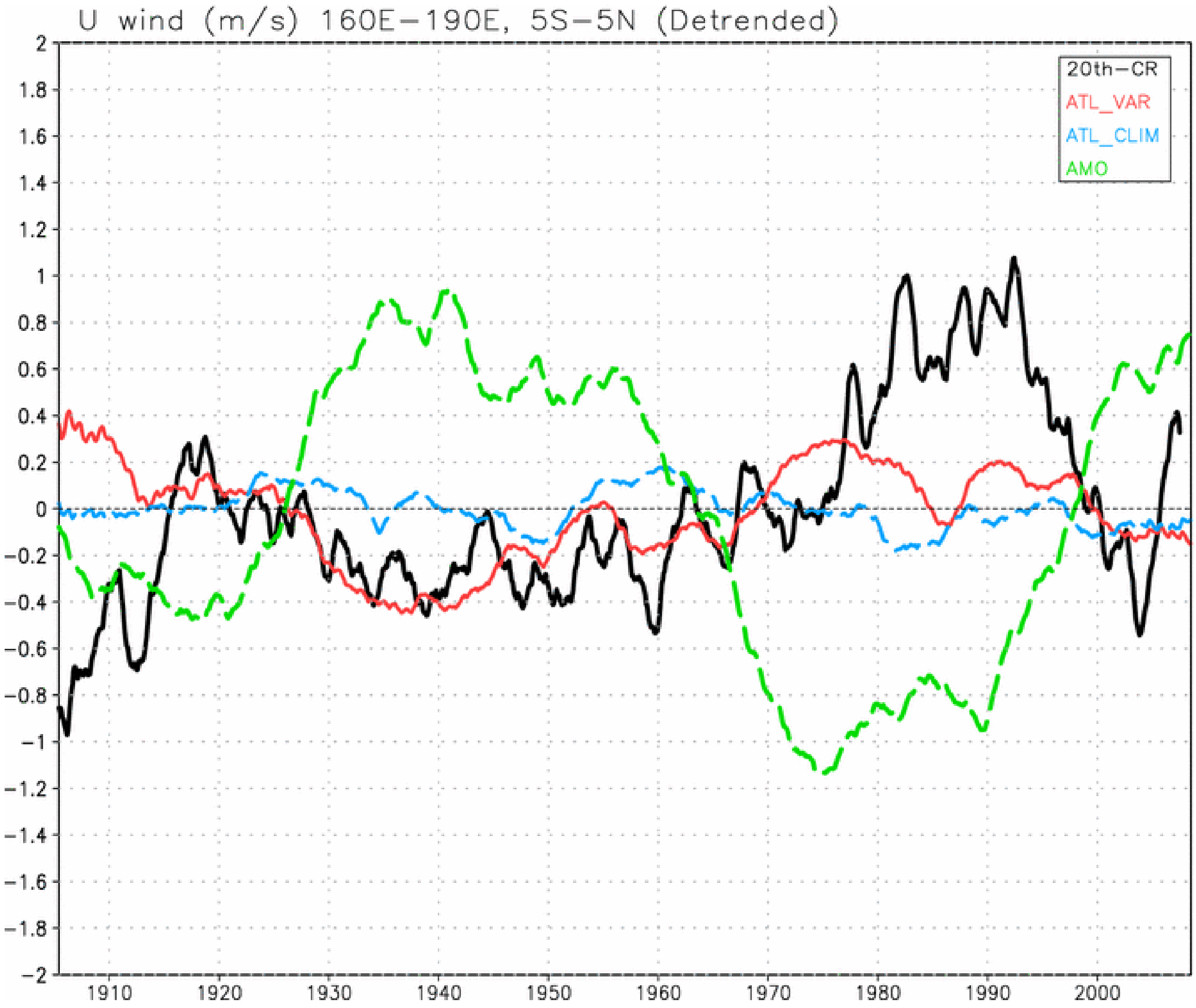

Figure 1: Central equatorial zonal near surface wind anomaly index (CPWI; averaged over area 160°E−190°E, 5°S–5°N). The anomaly time series have been filtered by a 10-year running mean. Shown are observations (black line), ATL_VAR ensemble mean (red line). The ATL_CLIM ensemble mean (dashed blue line). The AMO index is also plotted in the figure, multiplied by 4 as green dashed line. Units are m/s for all wind indexes, and K for the AMO index.

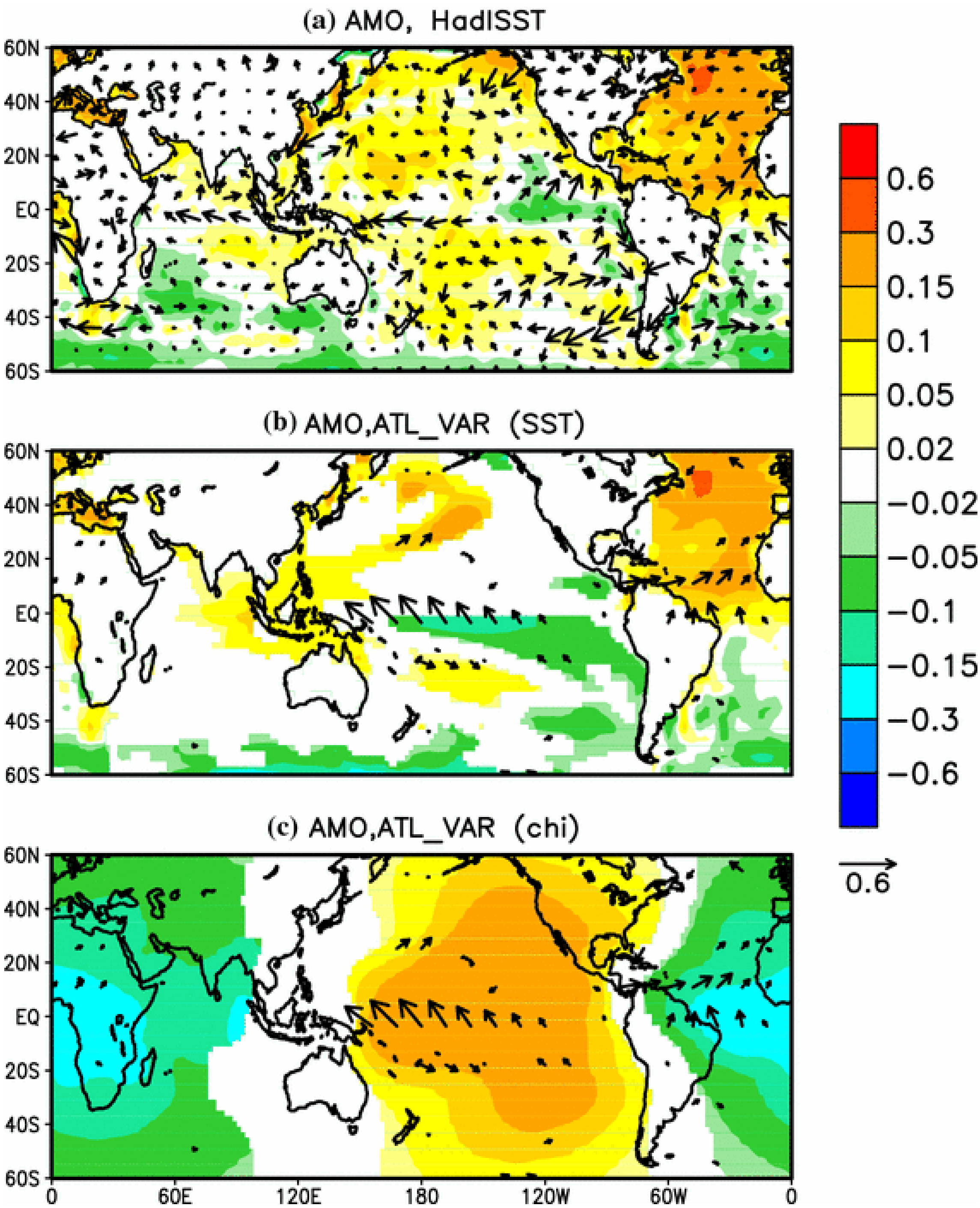

Figure 2: Regression of a observed SSTs and near surface winds, b ATL_VAR ensemble mean SSTs and near surface winds, c ATL_VAR ensemble mean 200 hPa velocity potential and near surface winds onto the AMO index for the period 1910–2008. In b and c only values that are

significant at the 95 % significance level are shown. Units are K for SSTs, m/s for wind and 106 m2/s for velocity potential

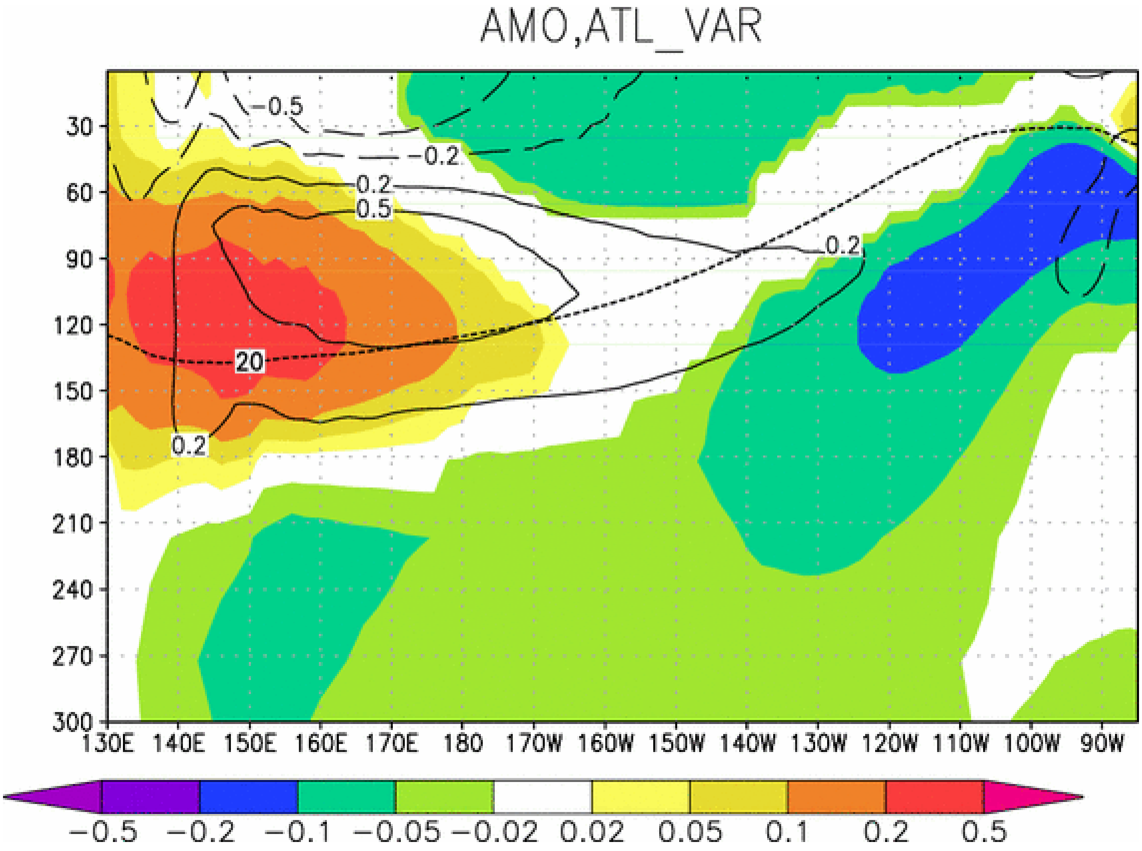

Figure 3: Regression of temperature (shading) and zonal current (contours) near the equator (averaged from 5°S to 5°N) onto the AMO index for the period 1910–2008. Only values that are significant at the 95 % significance level are shown. Units are K for temperature and cm/s for zonal current

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List of publications/reports from the project with complete references

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Kucharski F., F. Ikram, F. Molteni, R. Farneti, I.-S. Kang, H.-H. No, M. P. King, G. Giuliani and K. Mogensen, 2015: Atlantic forcing of Pacific decadal variability. *Climate Dynamics*, DOI: 10.1007/s00382-015-2705-z

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Summary of plans for the continuation of the project

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…………The Pacemaker experiments further analysed, including other forcings such as greenhouse gases, with the aim of at least another scientific publication.

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In the long-term, we plan to confirm the intermediate complexity model results with idealized EC-EARTH simulations.

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