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Respective forcing role of the Indian Ocean and Western Pacific warming on the Northern Atlantic atmospheric circulation

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The impact of the Indo-Pacific warming from the mid-XXth century onwards is investigated through coordinated experiments using 5 atmospheric global circulation models within the EU-DYNAMITE project. Sea Surface Temperature monthly trends diagnosed from observations are prescribed in the models, the oceanic forcing domain either covering the entire Indo-Pacific warmpool (hereafter IP experiments) or being restricted to the limited geographical Indian Ocean (hereafter IO experiments). In winter, IP warming leads to North Atlantic atmospheric changes projecting onto the positive phase North Atlantic Oscillation in all the models. Even if the mean reponses of each model are close enough, the associated mechanisms appear to be different. Some models favor an hemispheric route via the North Pacific through the propagation of Rossby waves along the upper-level jet wave guide. Others suggest a more indirect path via the tropical Atlantic. The difference between models reponses is attributed to the discrepencies between their mean climatological states and in particular the respective weight of their climatological transients/stationary waves activity. In summer, IP warming leads to large-scale northern hemisphere warming with maximum loadings over Europe, projecting onto the so-called Blocking pattern. In the IO experiments, double amplitude responses are found in winter in all the models. Comparing to observational changes, the strength of the response is unrealistic suggesting a critical oversensitivity of the models to the western Pacific oceanic conditions. The IO-Northern Atlantic connection is sustained in all models via the overly dominant

Pacific route. By contrast, summer IO responses are significantly reduced in all the models and cannot explain the observed trends. Such coordinated experiments suggest that the mean climatological states of the models are crucial to understand the individual responses to a similar oceanic forcing. IP and IO comparisons point out the extreme sensibility of the models responses to the change in the tropical forcing domain. This suggests to be cautious and precise enough in what is commonly referred to as "Indian Ocean" and related remote impacts.