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Sea surface height signals as indicators for oceanic meridional mass transports

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A numerical model is used to test if the sea surface height (SSH) can be used as an indicator for the variability of Atlantic meridional oceanic mass transports. Our results suggest that if the transports over the western boundary current region and those in the eastern part of the basin are considered separately, high correlations are found between zonal SSH differences and the meridional transports in the top 1000m. A much weaker correlation is found for the basin-wide transport which corresponds to the surface branch of the meridional overturning circulation (MOC). For the eastern and western branches of the meridional transport combining the SSH signal with the baroclinic structure obtained from Rossby wave theory allows us to calculate a quantitative estimate of the transport variability in the top 1000m. The results of the method are less convincing for the variability of the MOC. The reason for this is that even small relative errors in the variability estimates of the eastern and western branches can be large compared with the MOC variability. These errors project onto the sum of the eastern and western transports and therefore onto the estimate of the surface MOC branch. Nevertheless, being able to infer transport anomalies from SSH signals in the eastern and western parts of the Atlantic might prove useful in interpreting observations from the RAPID mooring array at 26°N which show a large subannual variability that is mainly due to changes at the western boundary. Transports inferred from the SSH could help to identify the origin of this variability and whether transport anomalies propagate into the western boundary region from the basin interior or from other latitudes.