ATMOSPHERIC MOISTURE TRANSPORTS TO THE ARCTIC

from different reanalyses : comparative assessement and analysis of source terms

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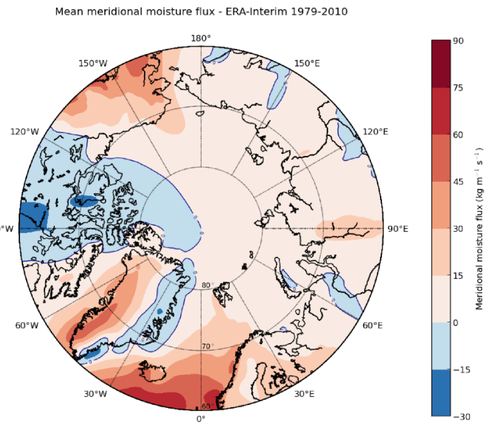
Motivation

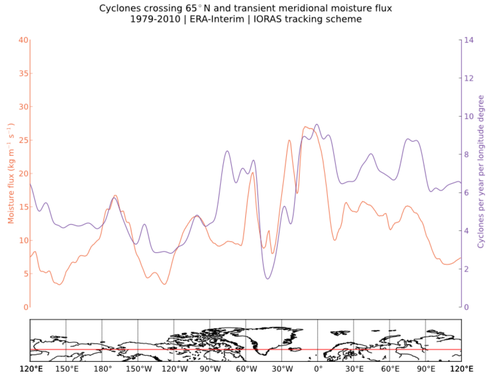
As the Arctic is a region where moisture fluxes converge, water vapour imports from the mid-latitudes play an important role in its water budget e.g. as a source of freshwater for the Arctic ocean. They also contribute to the heat budget, directly and indirectly through the formation of clouds.

In a warmer climate, the water-holding capacity of the atmosphere increases and the storm tracks are expected to move poleward which will probably affect the moisture fluxes to the Arctic.

Climatology from ERA-I



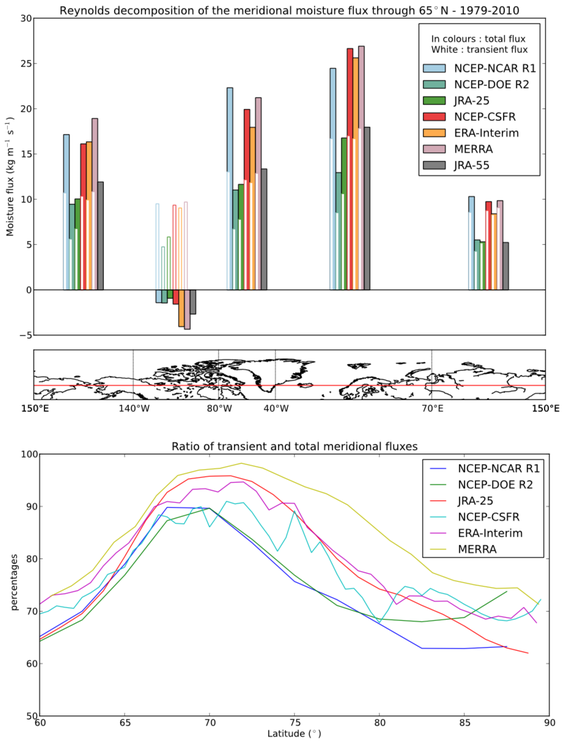
Link with cyclones



Reanalyses compared

	NCEP-NCAR R1	NCEP-DOE R2	JRA-25	ERA-Interim	NCEP-CSFR	MERRA	JRA-55
Model vintage	1995	2001	2004	2006	2009	2009	2009
Span	1948-2013	1979-2012	1979-2012	1979-2013	1979-2010	1979-2013	1958-2012
Model resolution	T62 L28	T62 L28	T106 L40	T255 L60	T382 L64	1/2° * 2/3° L72	T319 L60
Available resolution	2.5°	2.5°	1.125°	0.75°	0.5°	1/2° * 2/3°	0.5°
Data assimilation	3D-Var	3D-Var	3D-Var	4D-Var	3D-Var	3D-Var + IAU	4D-Var

Reynolds decomposition

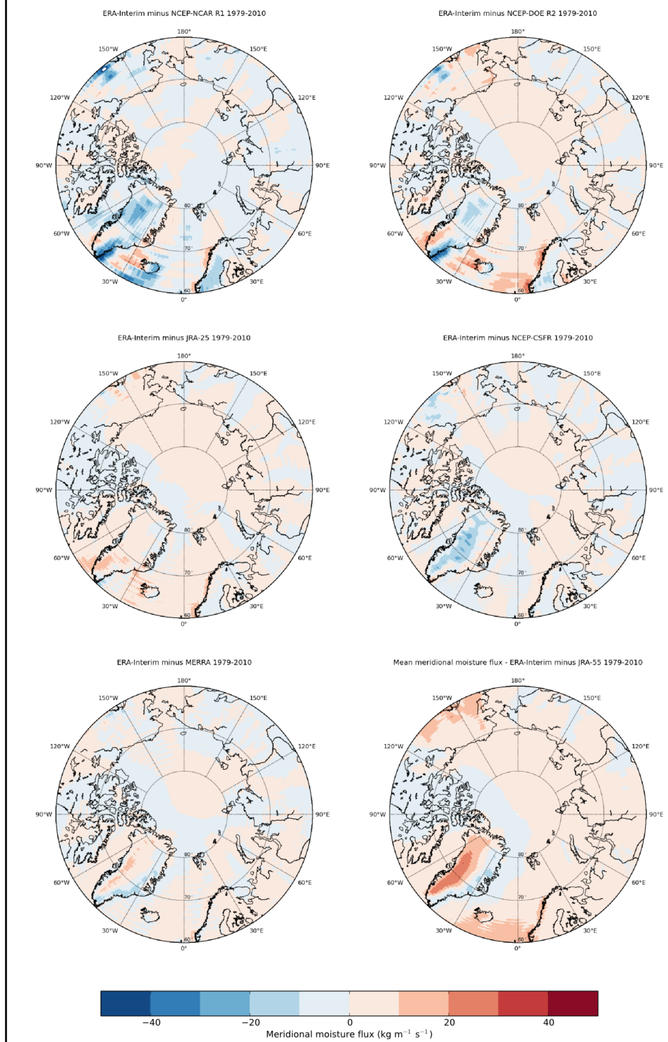


Trends per season

- all datasets except NCEP DOE R2 show a statistically significant positive trend in total column water vapour (averaged over 65°N), both on a yearly basis and season per season.

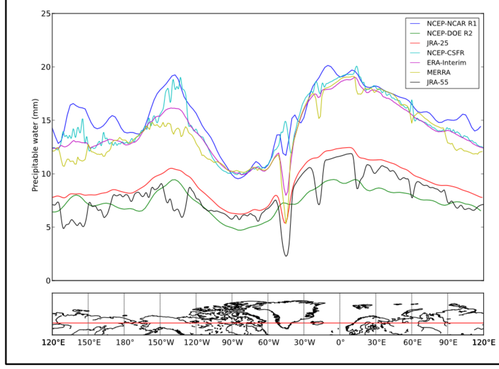
- There are no trends in total moisture flux into the region north of 65°N, in all reanalyses.

- MERRA and NCEP NCAR R1 show an increase in the equivalent transient fluxes, yearly and in Autumn.
This is the case for NCEP DOE R2 only in Autumn.

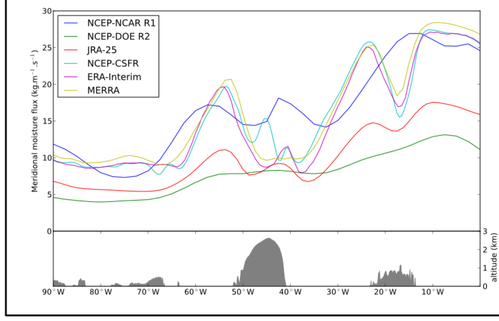


Differences with ERA-I

Total column water vapour



Effect of topography



Conclusions

Moisture transports to the Arctic occur mainly on timescales shorter than a month, with similar ratios of transient to total fluxes in all the reanalyses compared. From ERA-Interim, turbulent fluxes can be related more specifically to cyclones, with different behaviours over land and sea.

Nearly all datasets show significant positive trends in precipitable water but this rarely translates into similar increases in meridional moisture transports.

The magnitude of the transports and their spatial distribution is not consistent among the datasets. In particular, NCEP DOE R2 and the two JRAs estimate lower fluxes and lower precipitable water than the rest : this calls for a comparison with observations.