Regional Impacts of the El Niño-Southern Oscillation on Hydrological Earth Rotation Excitation: A Cross-Correlation Approach

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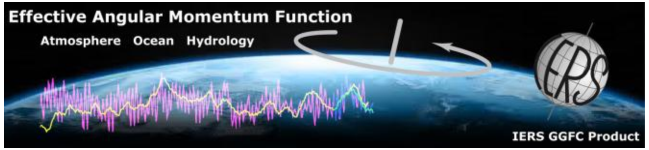
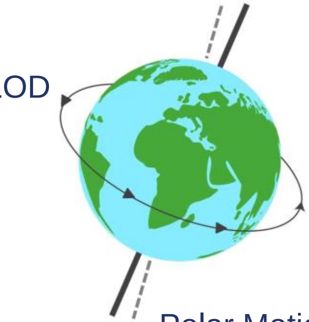
Interannual Earth Rotation Variability Driven by ENSO

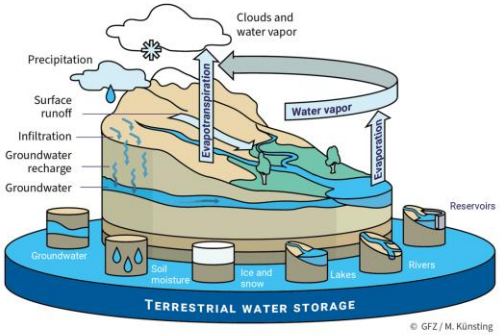



AAM

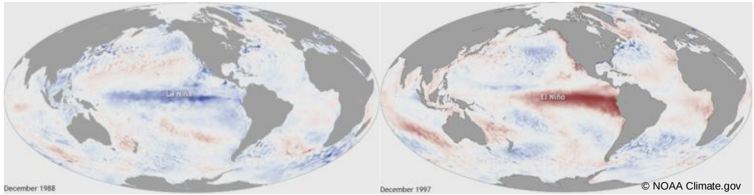

HAM


OAM





El Niño Southern Oscillation (ENSO)

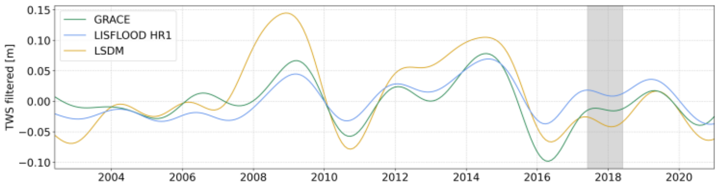


Methodology Flow Chart

TWS Anomalies Datasets

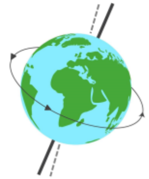
2002 - 2020			1960 - 2022			
GRACE/-FO[2] GFZ GravIS Level-3	**LISFLOOD HR1**[5]	**LSDM**[1]	**LISFLOOD XR0**[5]	**WGHM**[3]	**GTWS**[7] reconstruction	**LSDM**[1]

Decomposition and filtering of time series



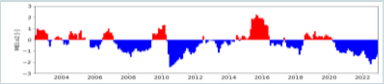
Influence on LOD and polar motion

X_1, X_2, X_3

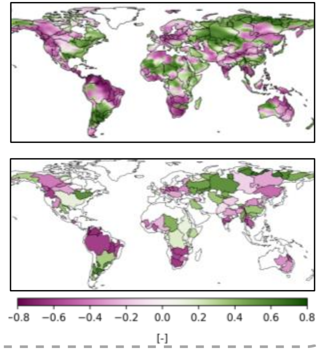


Lagged correlation and regression

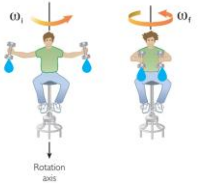
MEI.v2[6] 1979 – 2022



NINO 3.4[4] Index 1960 – 2022

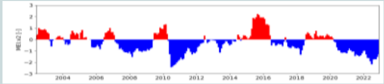


Global and regional HAM calculation



Correlation analysis and evaluation of regional HAM influence

MEI.v2[6] 1979 – 2022



NINO 3.4[4] Index 1960 – 2022

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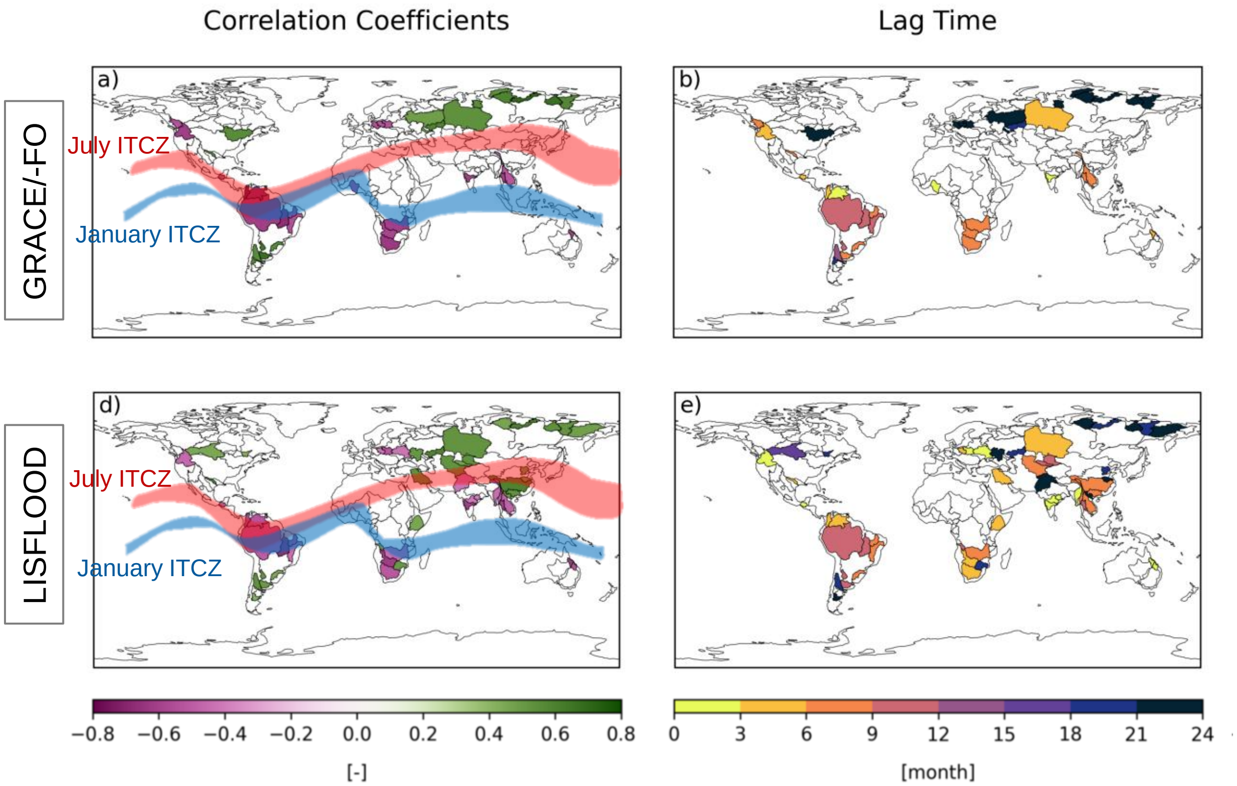
Max. Lagged Correlation and Lag Time Between ΔTWS and ENSO (2002 – 2020)



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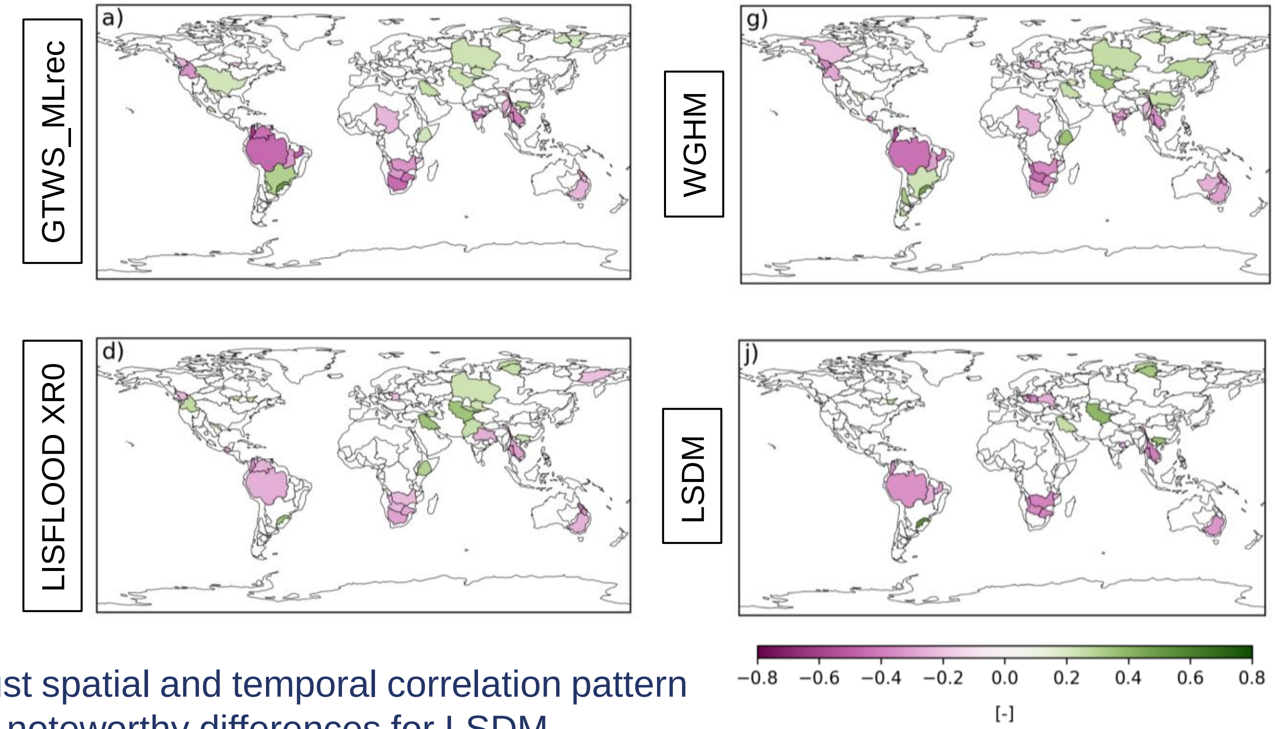
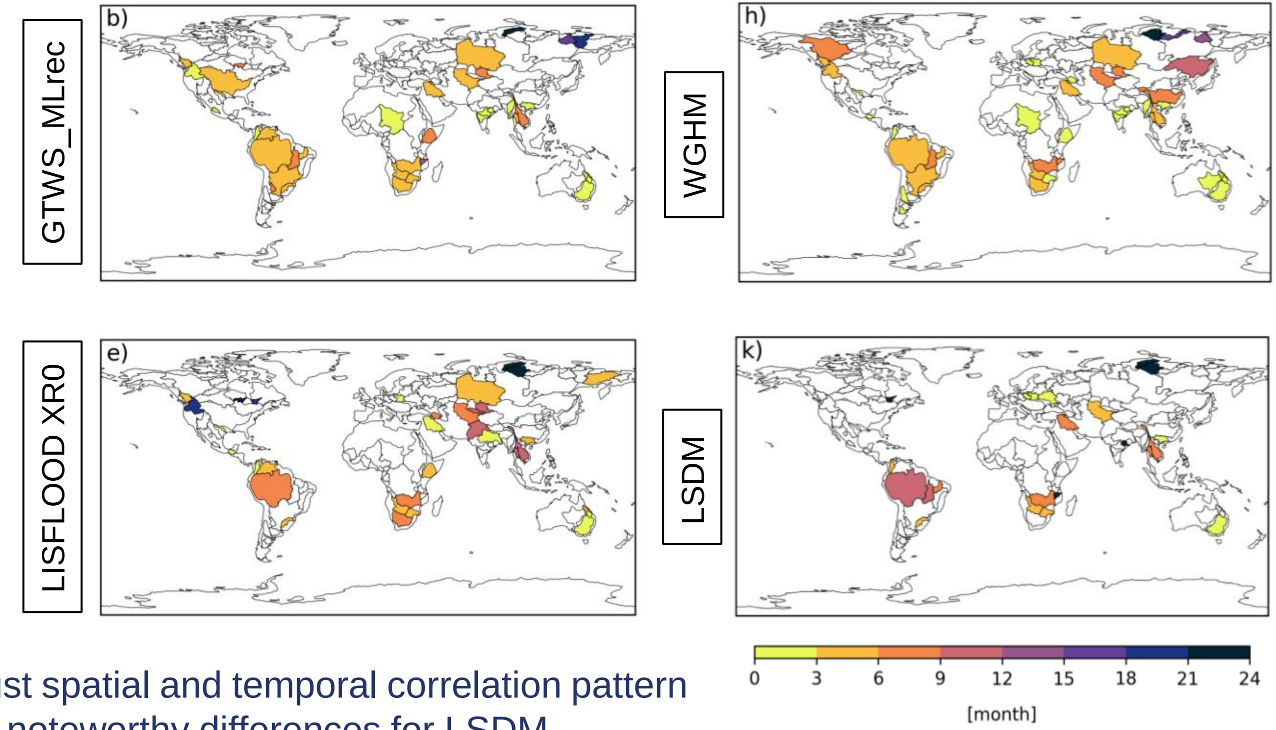
Max. Lagged Correlation ΔTWS and ENSO (1960 – 2022)



- ➢ robust spatial and temporal correlation pattern
- ➢ only noteworthy differences for LSDM

Lag Time Between ΔTWS and ENSO (1960 – 2022)



- robust spatial and temporal correlation pattern
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Global Hydrological Angular Momentum (2002 – 2020)

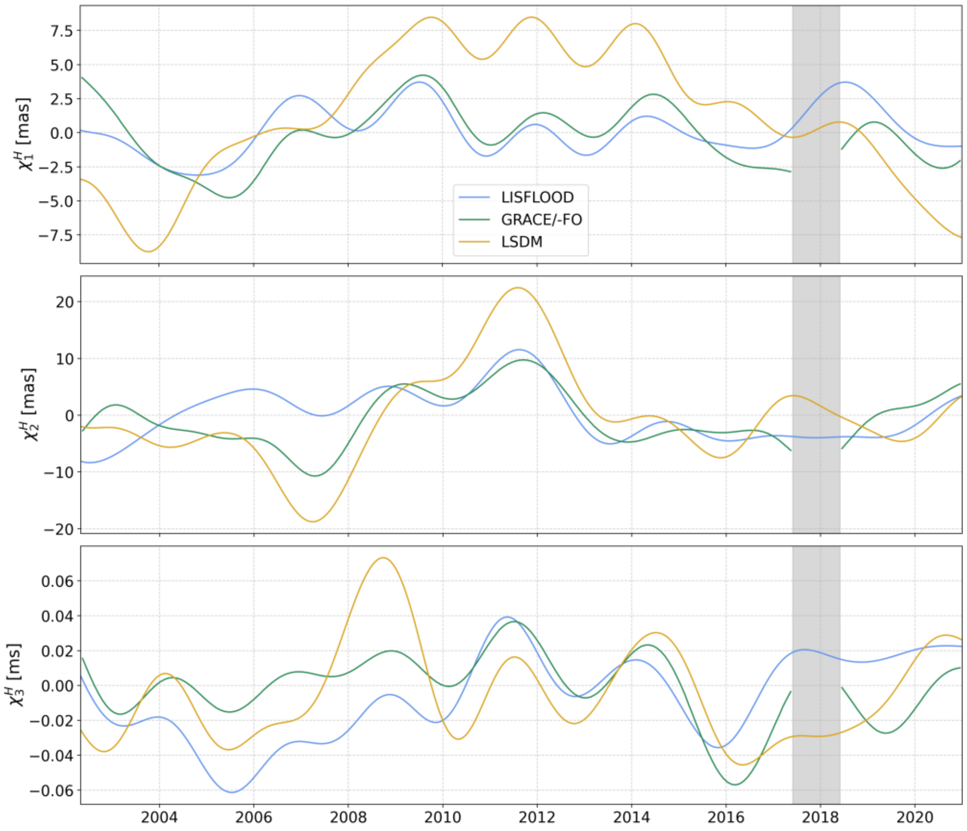

Table 1: Correlation analysis between global HAM componentes and ENSO

	Model	χ_1 CC [-]	χ_1 Lag [month]	χ_2 CC [-]	χ_2 Lag [month]	χ_3 CC [-]	χ_3 Lag [month]
Nino 3.4	LISFLOOD HR1	-0.45	12	-0.50	4	-0.34	3
Nino 3.4	GRACE	-0.56	15	-0.24	10	-0.71	5
Nino 3.4	LSDM	-0.42	12	-0.35	4	-0.48	6
MEI.v2	LISFLOOD HR1	-0.43	12	-0.55	5	-0.44	3
MEI.v2	GRACE	-0.58	13	-0.35	11	-0.76	5
MEI.v2	LSDM	-0.48	13	-0.46	5	-0.50	5

= significant correlation

Global Hydrological Angular Momentum (1960 – 2022)

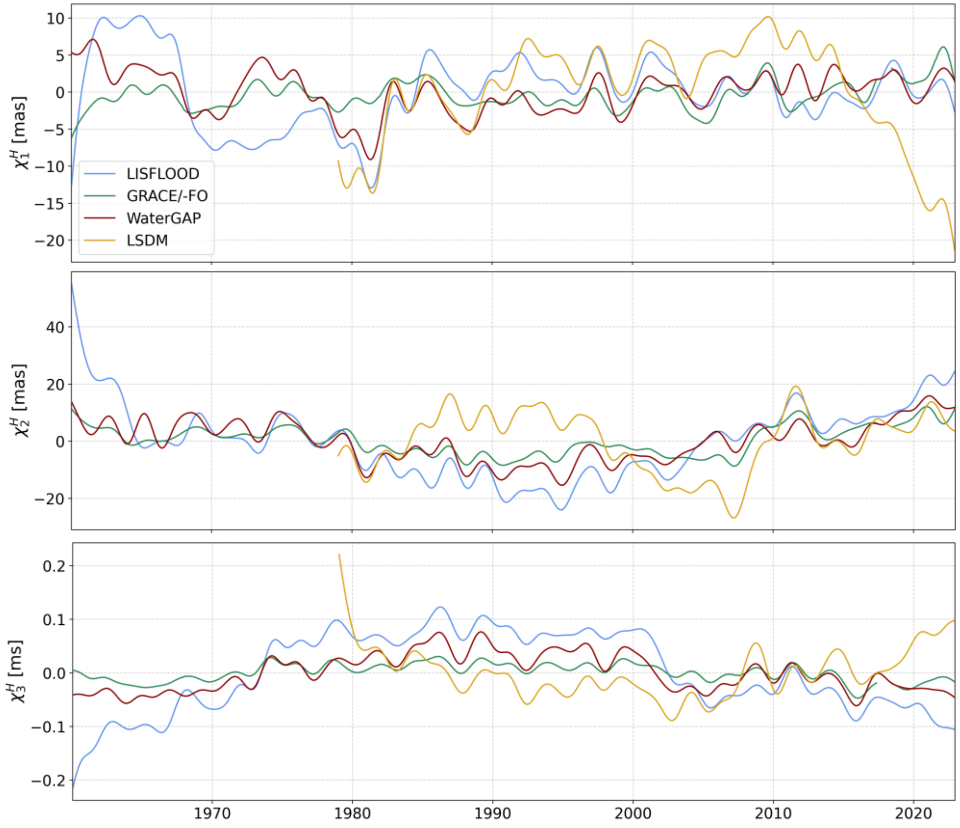

Table 2: Correlation analysis between global HAM componentes and ENSO

Index	Model	χ_1 CC [-]	χ_1 Lag [month]	χ_2 CC [-]	χ_2 Lag [month]	χ_3 CC [-]	χ_3 Lag [month]
Nino 3.4	LISFLOOD XR0	-0.30	14	-0.25	6	-0.34	4
	GTWS MLrec	-0.29	13	-0.13	5	-0.63	4
	WGHM	-0.42	13	-0.27	6	-0.57	3
	LSDM	-0.19	15	0.15	24	-0.27	5
MEI.v2	LISFLOOD XR0	-0.22	15	-0.31	7	-0.30	5
	GTWS MLrec	-0.30	13	-0.20	6	-0.56	4
	WGHM	-0.41	14	-0.29	3	-0.53	3
	LSDM	-0.16	17	0.16	24	-0.30	5

= significant correlation

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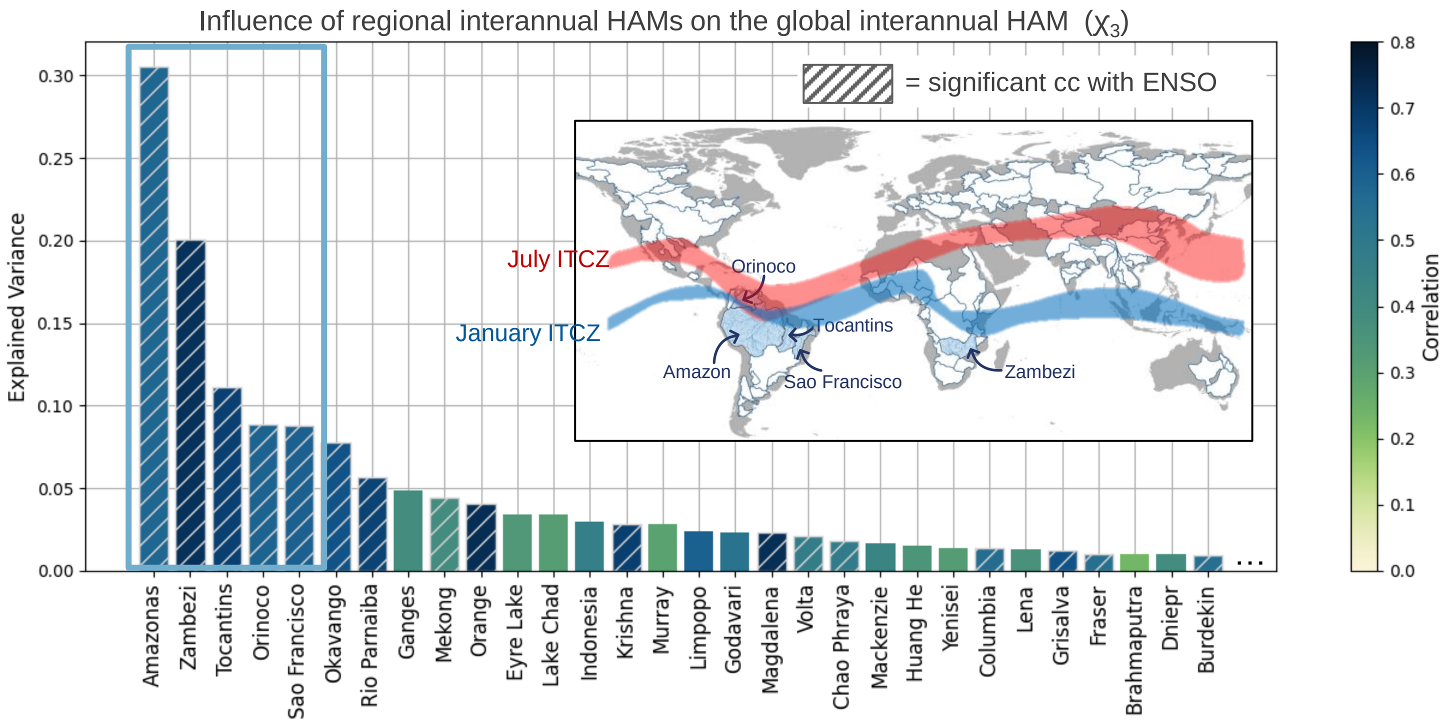
Regional Hydrological Angular Momentum (2002 – 2020)



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Thank you!

Key Messages

- **LISFLOOD** model run (2002 – 2020 and 1960 - 2022) and **GRACE TWS** data show **good agreement** on interannual periods
- The **direct influence of ENSO on the TWS variability** along the Intertropical Convergence Zone is evident, teleconnection effects to subpolar latitudes are less obvious
- ENSO has a **strong imprint on interannual HAM variations** in the ΔLOD (χ_3)
- new HAM time series, based on LISFLOOD from 1960 onwards are planed
- Ongoing evaluation of **longer times series**

Modeling high-resolution land water storage with OS LISFLOOD for global Geodesy
→ **Talk by Laura Jensen Fri, 02 May, 09:05 – 09:15**

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