Anmeldung eines Themas für ein/e

Forschungsseminar	**X**	
Methodenseminar	**X**	
Masterarbeit	**X**	(bitte eines oder mehrere ankreuzen)

Thema Datum	**Stratospheric influence on ICON-NWP sub-seasonal forecast skill for extreme weather events** **11 August 2021**
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Kurzbeschreibung:	Given the relatively low mass and density of the stratosphere compared to the troposphere and because it is highly stratified, dryer and more stable than the troposphere, the weather systems in the troposphere are not directly affected by events in the stratosphere. However, this does not mean that the stratosphere is only a passive layer above the troposphere. Nowadays, it is recognized that the stratosphere exert a significant downward influence and affects the surface weather with a wide range of variability of timescale of the downward influence. The downward influence of the stratosphere on troposphere has been observed both in the tropics and extra-tropics. The downward influence of the stratosphere on tropospheric circulation maximizes during winter and spring in both hemispheres, when considerable stratospheric variability occurs. While the stratospheric downward influence on surface climate on different timescales is relatively well studied, it is less well recognized that stratosphere can potentially contribute to tropospheric extreme weather events such as flooding, drought and cold air outbreaks. First we will identify different states of the stratospheric polar vortex regimes (weak and strong) between November-March months for 1980-2021 period in ERA5 reanalysis. Afterwards, ICON-NWP simulations will be conducted at sub-seasonal to seasonal timescales following the initial date of identified periods for each stratospheric event. The length of each simulation will be 45 days and we will have 9 ensemble members for each stratospheric event. While it is impossible to predict a small-scale specific extreme weather event (e.g. tropical cyclones, heavy precipitation, tornado, windstorms etc) a few week in advance, however, due to extended predictability of large-scale dynamics, it may be possible to predict the changes in the statistics of large-scale events in the coming few weeks or months compared to climatology. Therefore, in the current master thesis, we only focus on large-scale (e.g. 1000 km), long-lasting (at least two week) extreme events such as heat waves, cold spells and droughts on sub-seasonal forecasts of ICON-NWP. For displaying and verification of S2S forecasts with ICON-NWP, two common approach will be adapted: (i): the probability of relevant parameter (e.g., the daily precipitation for drought and the daily maximum and minimum of 2-m temperature for heat waves and cold spells) will be in top quintile or decile in the coming weeks. (ii): the number of days with extreme weather events expressed as the probability of having more than the usual number of days of extreme events (compared to climatology).
Literatur:	King, A. D., et al. (2019).Observed Relationships Between Sudden Stratospheric Warmings and European Climate Extremes. J. Geophys. Res.: Atmospheres, 124, 2019JD030480. http://doi.org/10.1029/2019JD030480. Lehtonen, I., Karpechko, A.Y., 2016. Observed and modeled tropospheric cold anomalies associated with sudden stratospheric warmings. J. Geophys. Res. Atmos. 121, 1591–1610. https://doi.org/10.1002/2015JD023860. Leith, C.E., 1965. Theoretical skill of Monte Carlo forecasts. Mon. Weather Rev. 102, 409–418.