Upper atmospheric high-order solar tides during SSW2018

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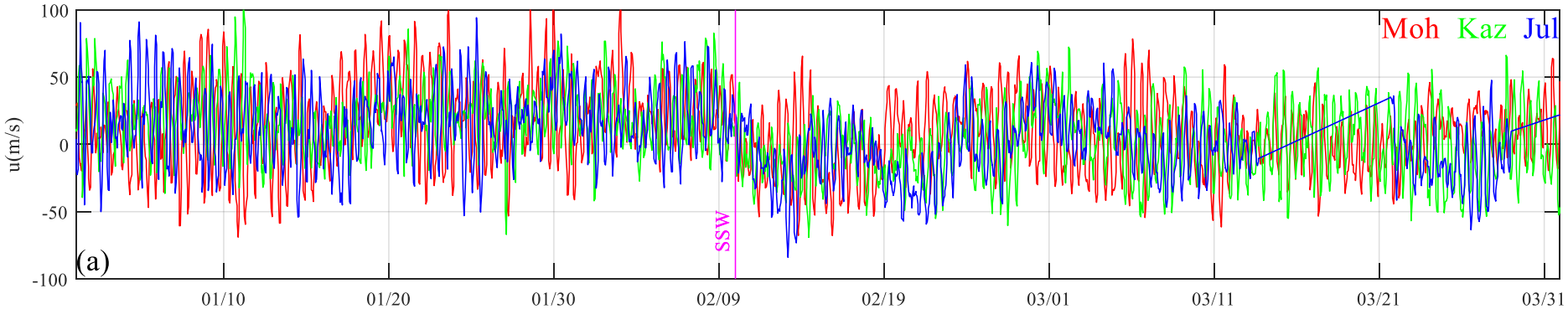
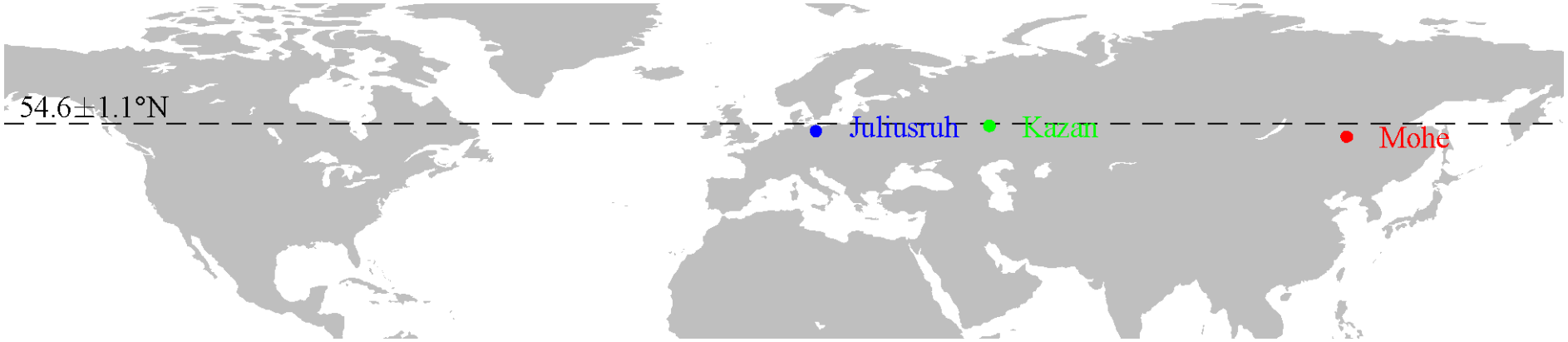
Observations

- Eastward wind (u) at h=90km in 2018





LS-spectra&PDA

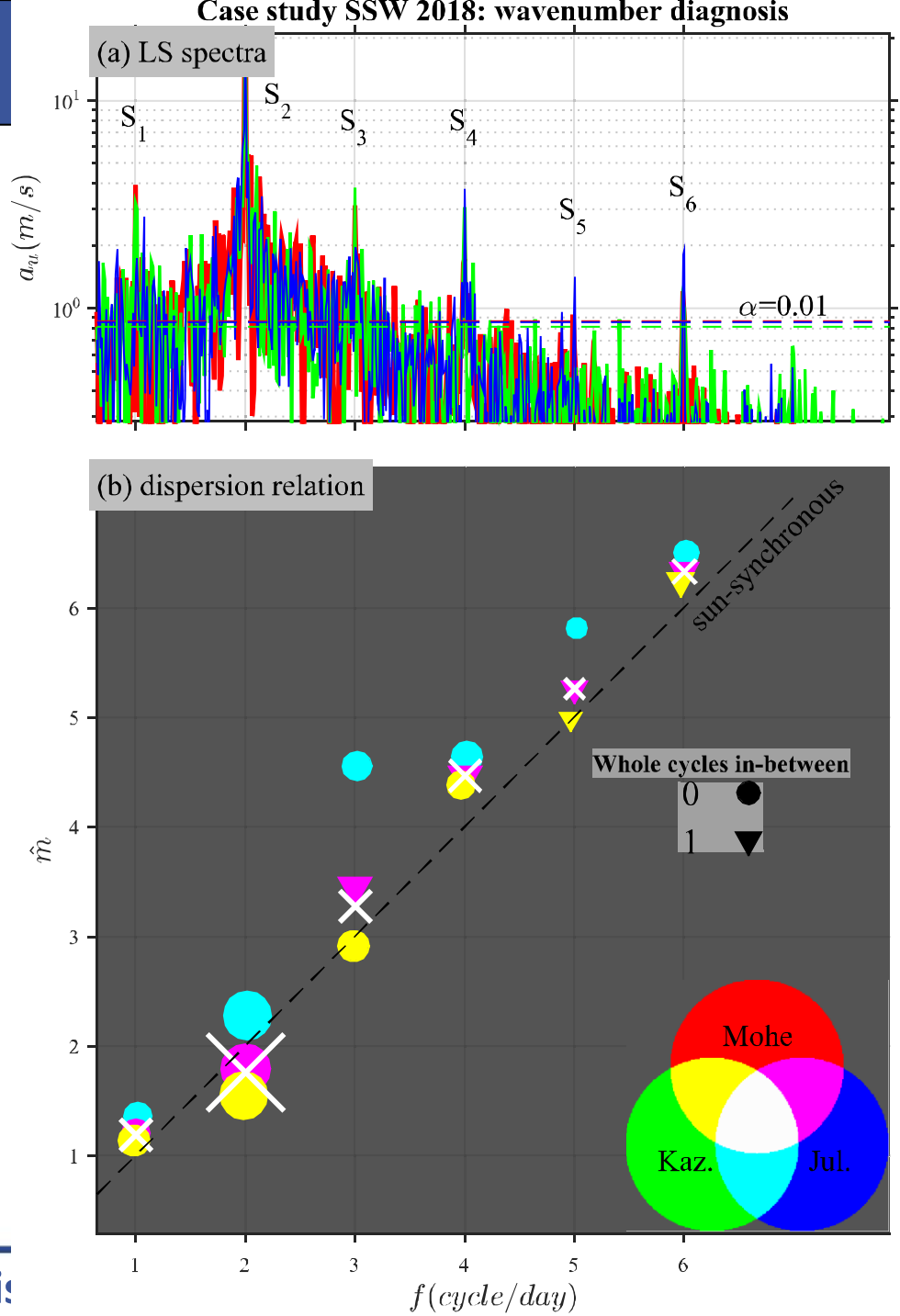
Tidal harmonics

- 24hr, 12hr, 8hr, 6hr, 4.8hr, 4hr

wavenumber diagnosis through a Phase Differencing Approach

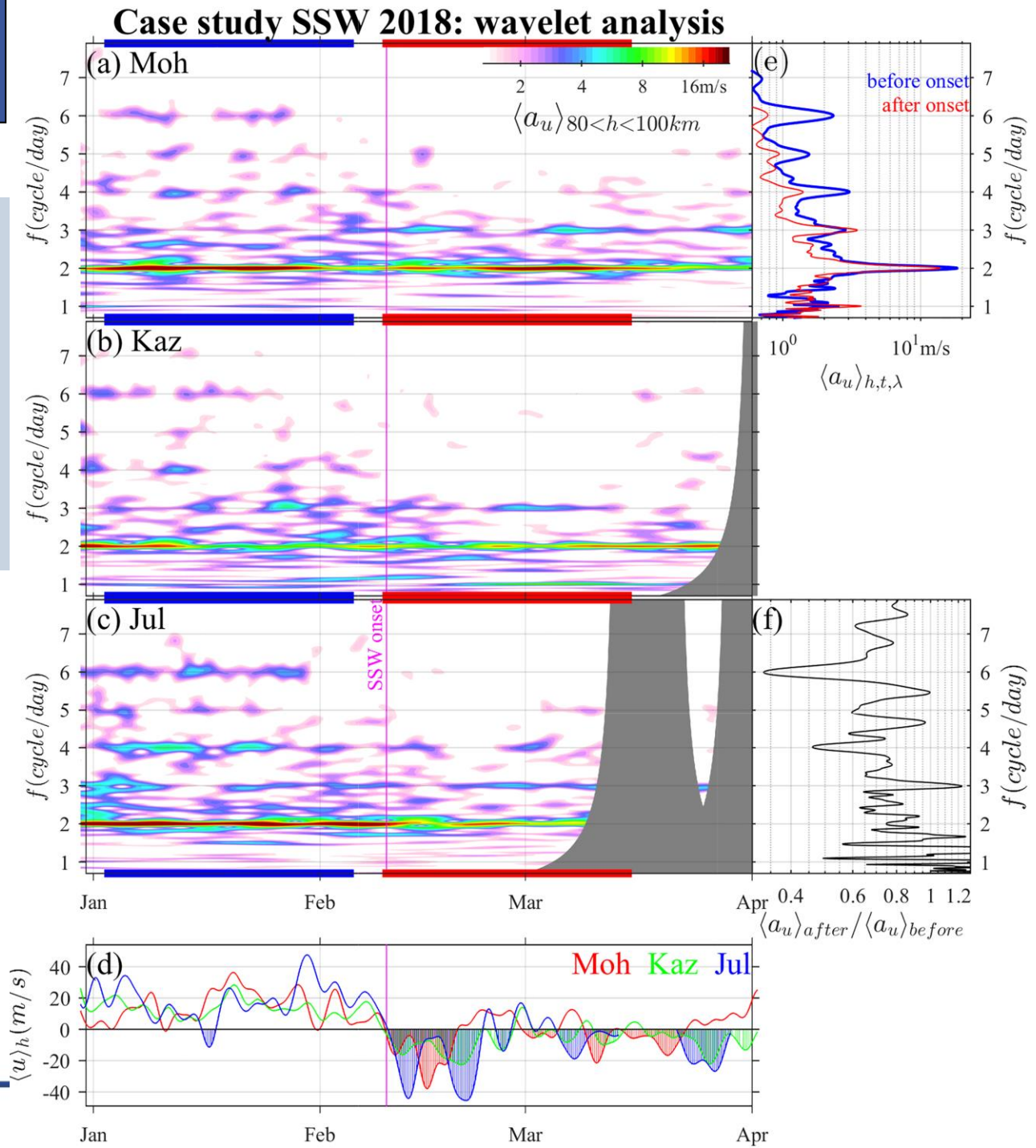
$$m = (\arg\{\tilde{a}_j^* \tilde{a}_i\} + 2\pi C)/\lambda_\Delta$$

- All sun-synchronous
- $v_p \equiv f/m = \Omega := 1\text{cpd}$



Wavelet

- tidal signatures
- before vs. after onset
- mean u



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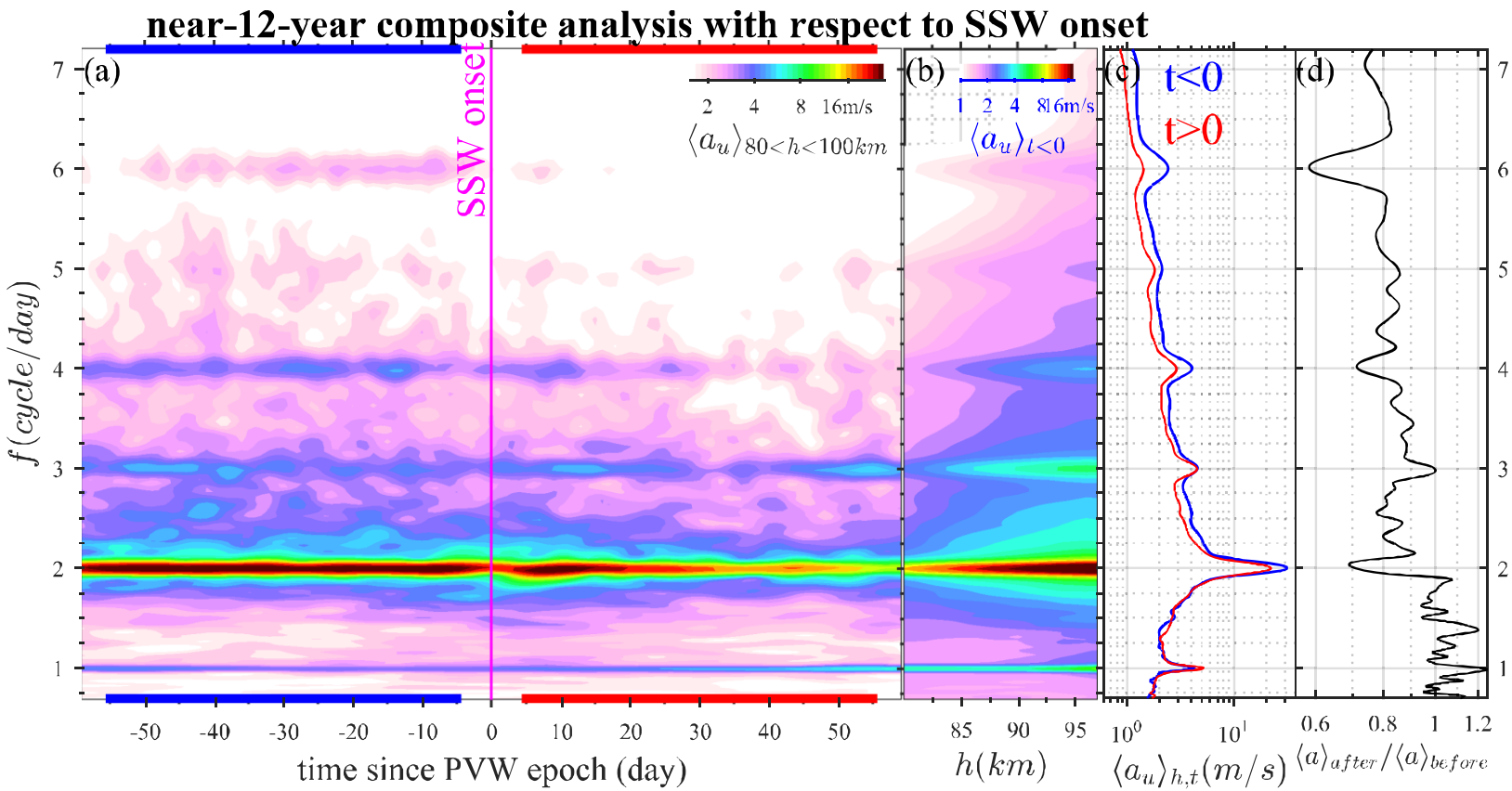
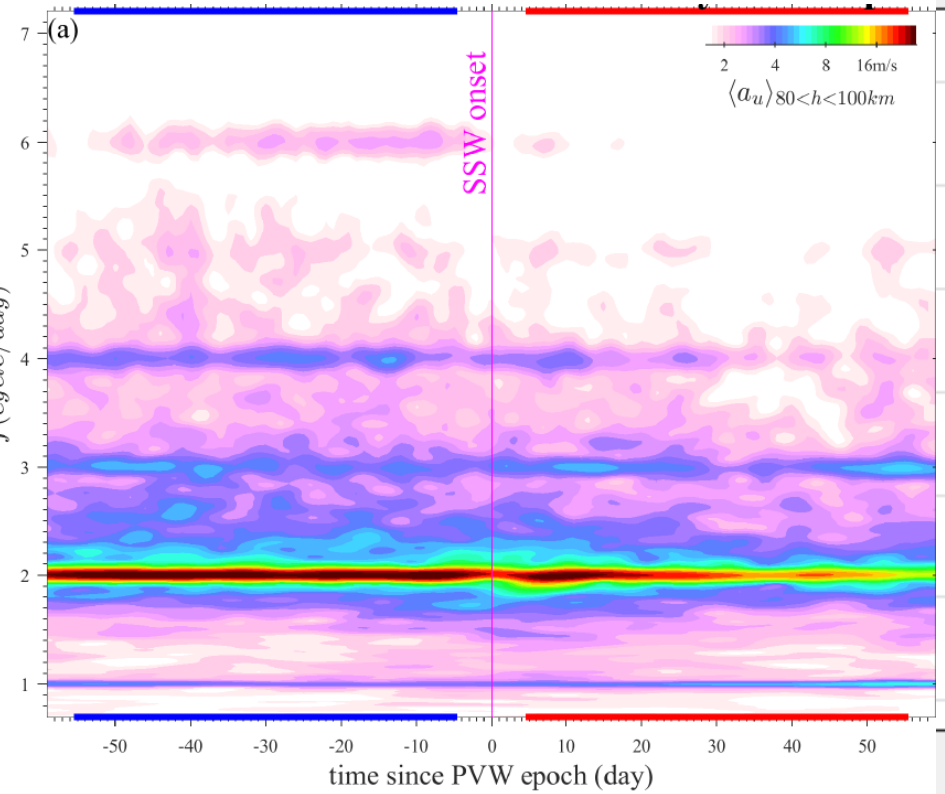
Composite

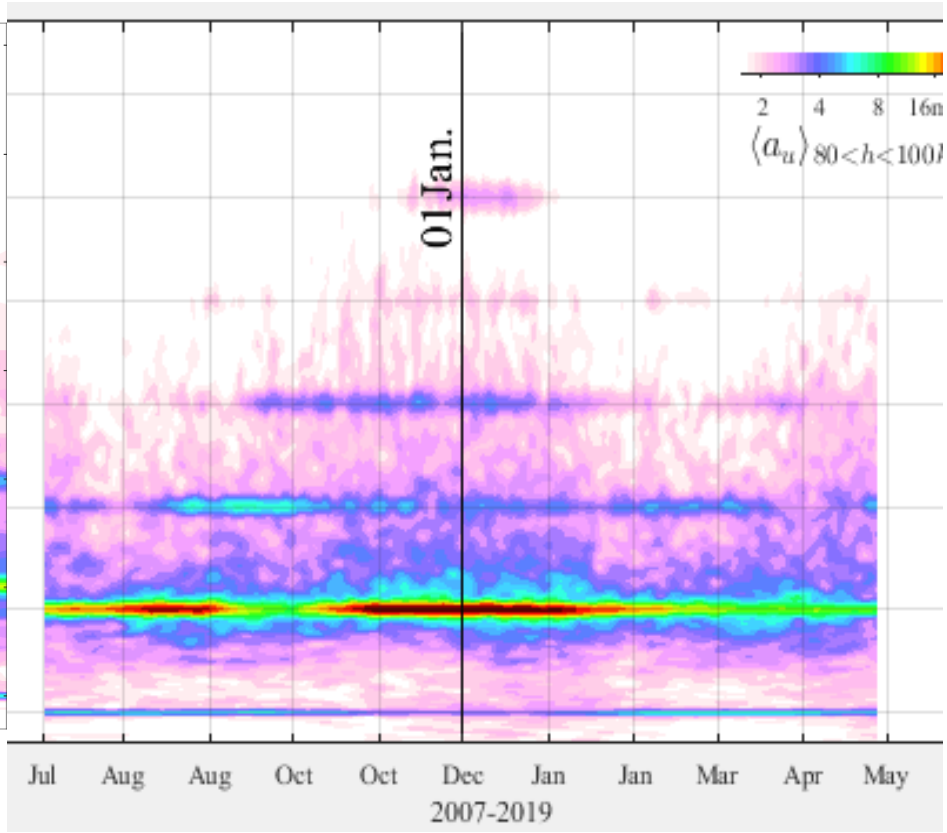
Date
24-01-2008
23-01-2009
29-01-2010
31-01-2011
17-01-2012
11-01-2013
05-01-2015
06-03-2016
02-02-2017
14-02-2018
31-12-2018



- near-12-near composite
- before vs. after onset

SSW response vs.seasonal variations





Summary

- six harmonics in SSW 2018, all migrating tides
- the 4th, 5th, 6th quench at the onset, in both SSW 2018 and a near-12-year composite

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RESEARCH LETTER
10.1029/2019GL086778

Key Points:

- First six solar tidal harmonics occur in the mesospheric wind during SSW 2018 among which the fourth, fifth, and sixth harmonics quench at the SSW onset
- Wave number diagnosis using multistation techniques suggests that all six harmonics are dominated by migrating tides
- In a near-12-year statistics, the six harmonics and quenching also occur

High-Order Solar Migrating Tides Quench at SSW Onsets

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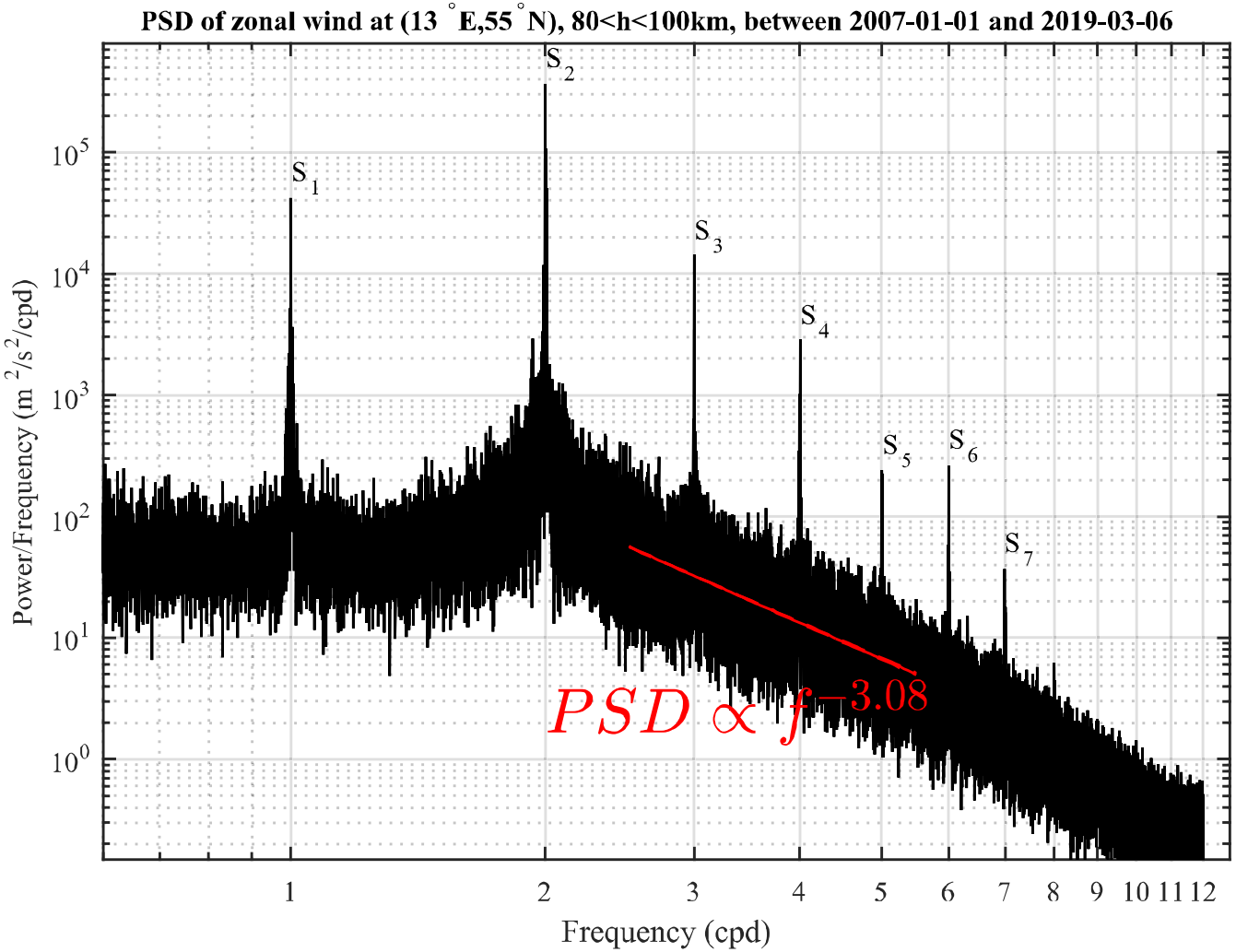
Abstract Sudden stratospheric warming events (SSWs) are the most spectacular atmospheric vertical coupling processes, well-known for being associated with diverse wave activities in the upper atmosphere and ionosphere. The first four solar tidal harmonics have been reported as being engaged. Here, combining

Thanks

Mesospheric tidal signatures

- Near-12-year zonal wind (u) over Juliusruh



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