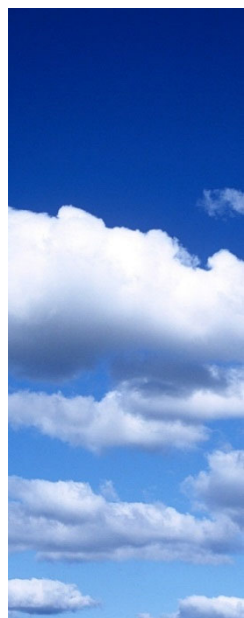




20th Annual Community Modeling and
Analysis System (CMAS) Conference

Estimation of the background
PM_{2.5} concentrations in
megacities in Iran



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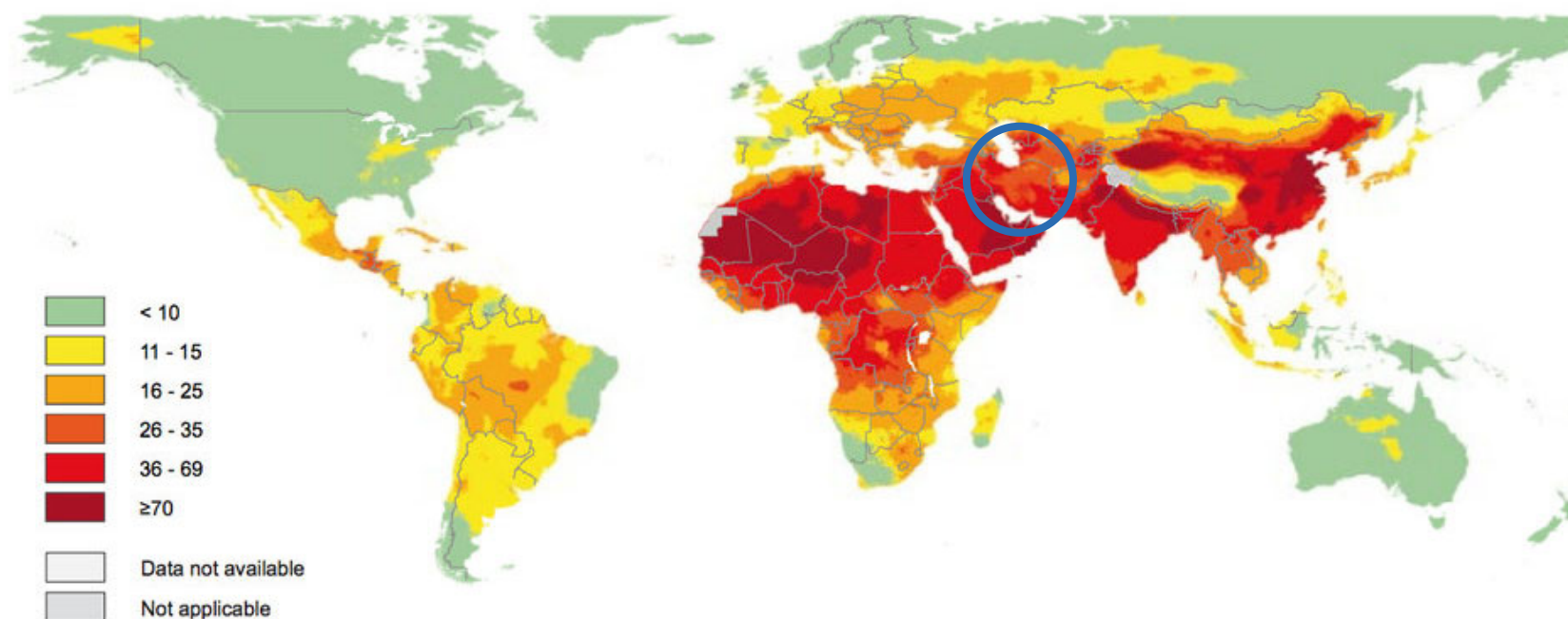


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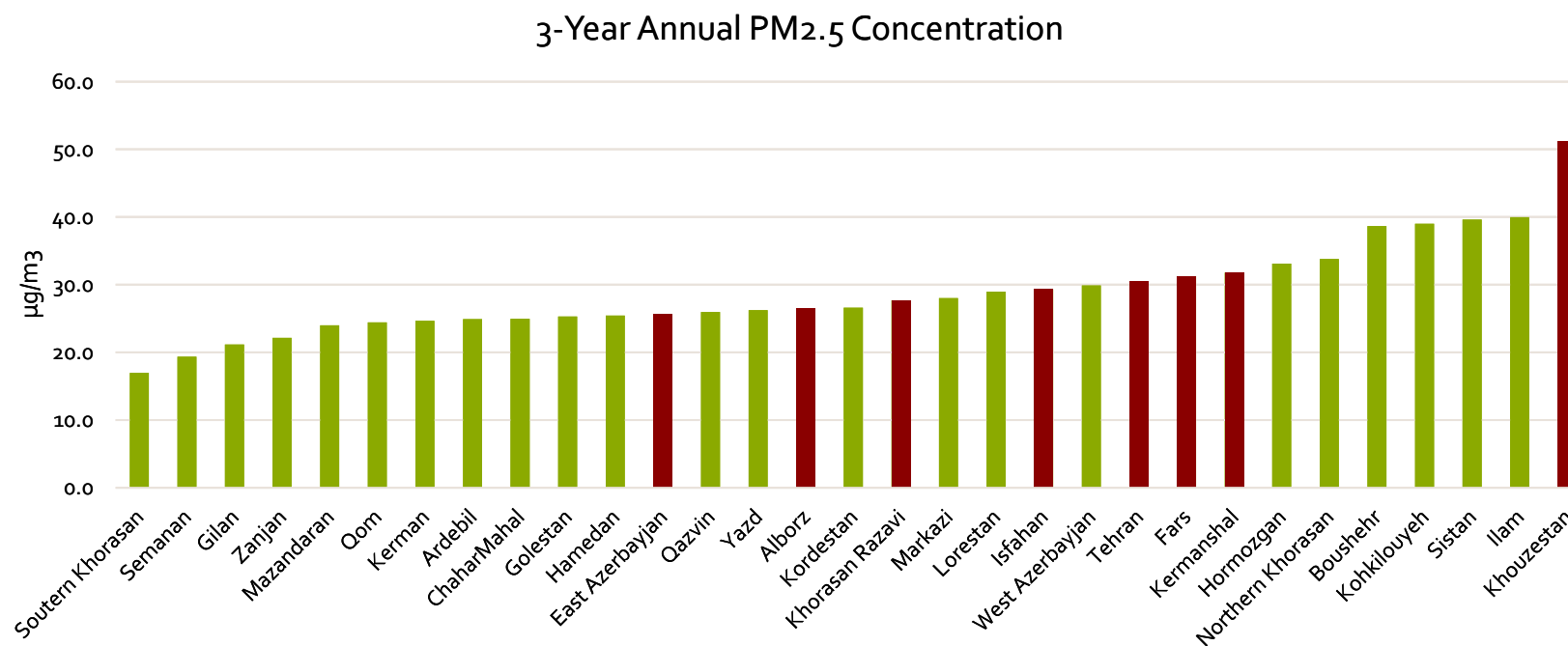
Introduction: Air Pollution in Iran



Reference: <http://maps.who.int/airpollution/>



Introduction: Air Pollution in Iran



Reference: Hassanvand M.S., et al., 2020



Selected Megacities





Methodology

- To estimate the monthly background PM_{2.5} concentrations in Megacities in Iran.
- Based on AOD data from satellite sensing and actual PM_{2.5} concentration records in the cities.
 - Correlations between inside-city AOD and reference point AODs.
 - Correlation between inside-city AOD and PM_{2.5} concentrations.
 - Calibrating the AOD-based PM_{2.5} with source apportionment results, were applicable.



Methodology

- Procedure:
 1. Identification of a reference point around the city.
 2. AOD data collection and manipulation at the reference point and the city average.
 3. PM_{2.5} data collection and manipulation at the city average.
 4. Estimation of the non-anthropogenic PM_{2.5} concentration in the city.
 5. Calibrating the estimated background PM_{2.5} concentration with source apportionment results in a reference city (Tehran).
 6. Applying the calibration factors on estimated background PM_{2.5} concentration in other cities.
 7. Cross-check of the estimated background concentrations with annually averaged simulated PM_{2.5} and surface observations over Iran.



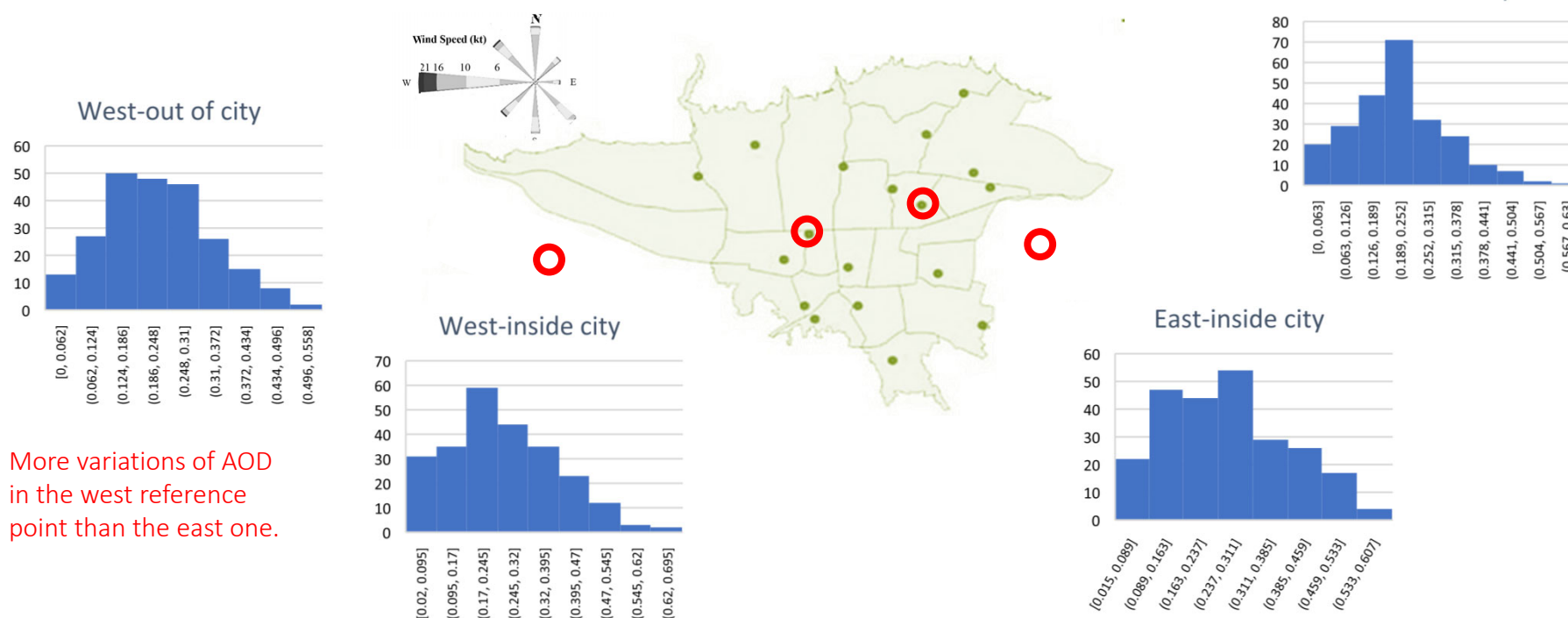
Methodology

- Identification of reference points is based on the below criteria:
 - Upstream of wind
 - Far from anthropogenic emission sources
 - Enough near to the cities
- ⇒ More variations with meteorological variations
- Comparing the histograms of the AOD of the selected reference point



Results and Discussions

- Selection of reference points: e.g., histograms of case of Tehran



More variations of AOD
in the west reference
point than the east one.



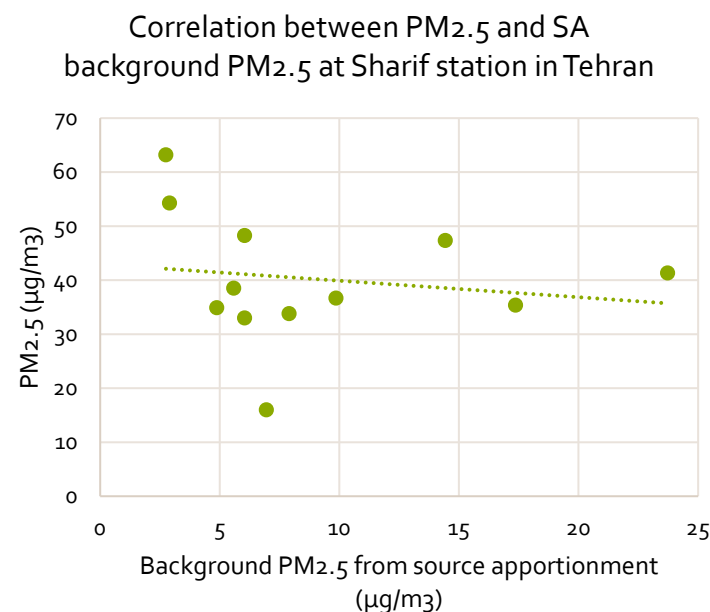
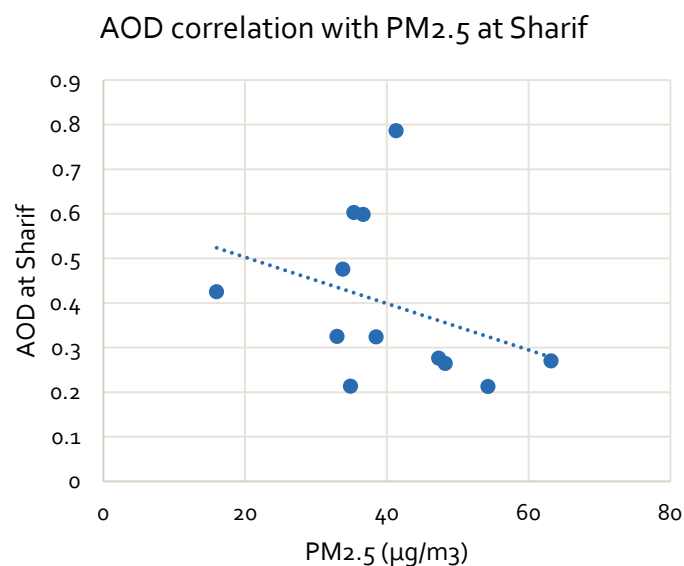
Results and Discussions

- AOD was not available for most of the cloudy days in cold months.
- Also, the PM_{2.5} background concentrations from SA studies are available for monthly averaged values.
- Therefore, the monthly averaged AOD and PM_{2.5} data were used to avoid monthly biased correlations.



Results and Discussions

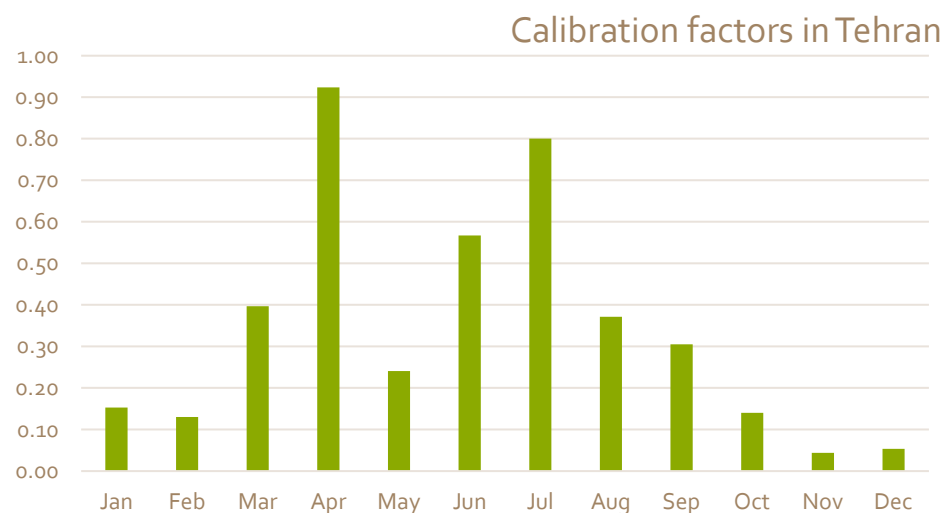
PM_{2.5} concentrations at concentrated points are not correlated with AOD and background PM_{2.5} concentrations from Source Apportionment results





Results and Discussions

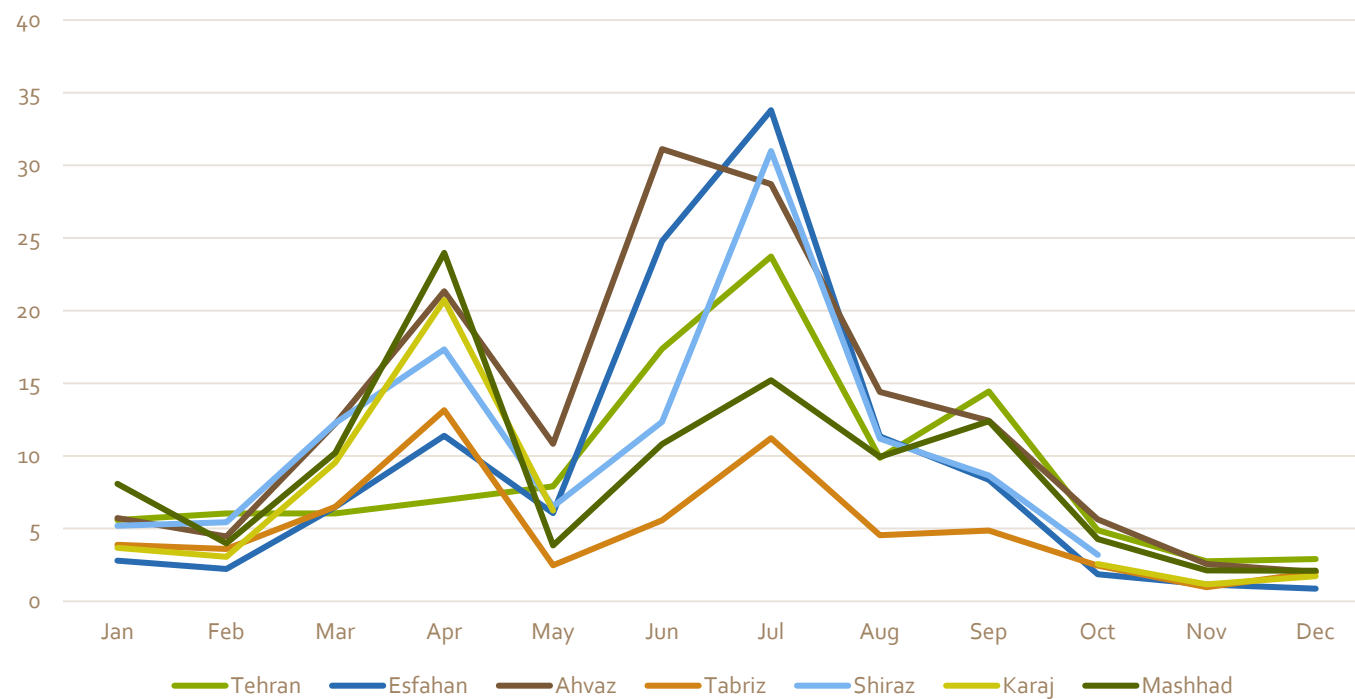
- Variation of calibration factors between warm and cold months.
- AOD-based background PM_{2.5} estimates are more accurate in warm months, in which sand and dust storms are more frequent.





Results and Discussions

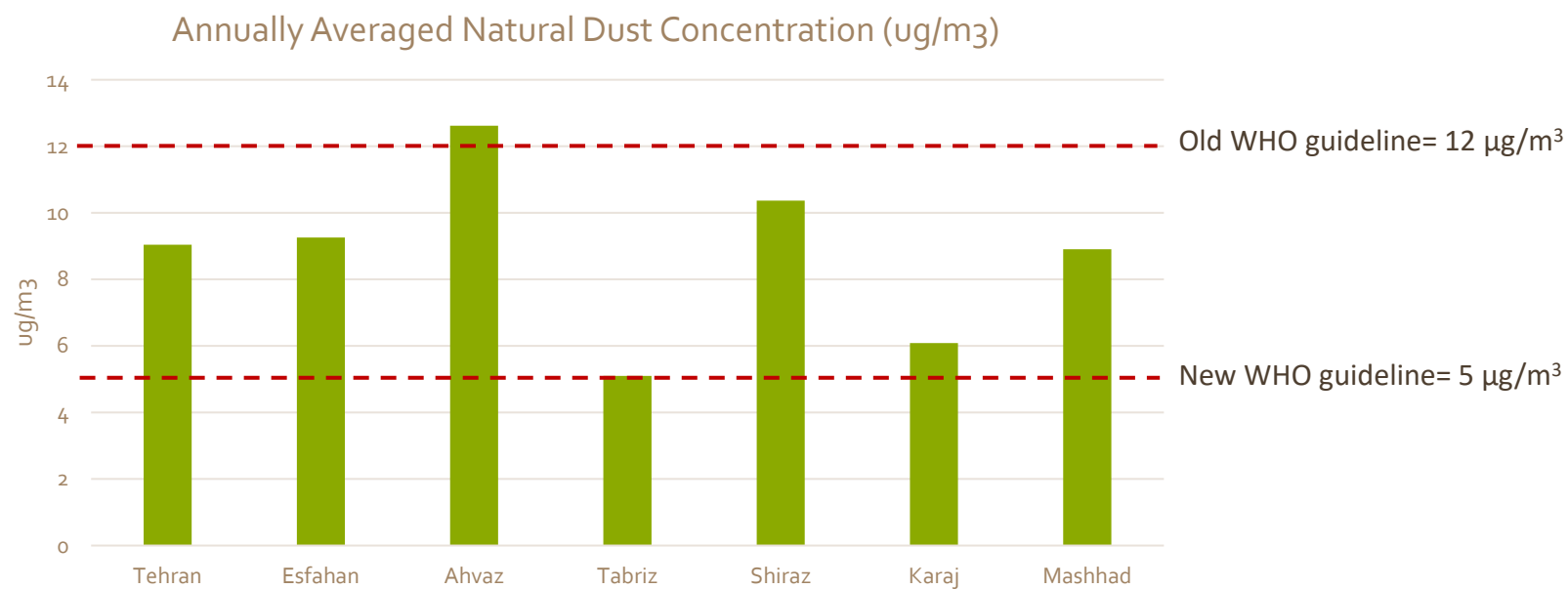
Variations of monthly averaged background PM_{2.5} concentrations during 2018





Results and Discussions

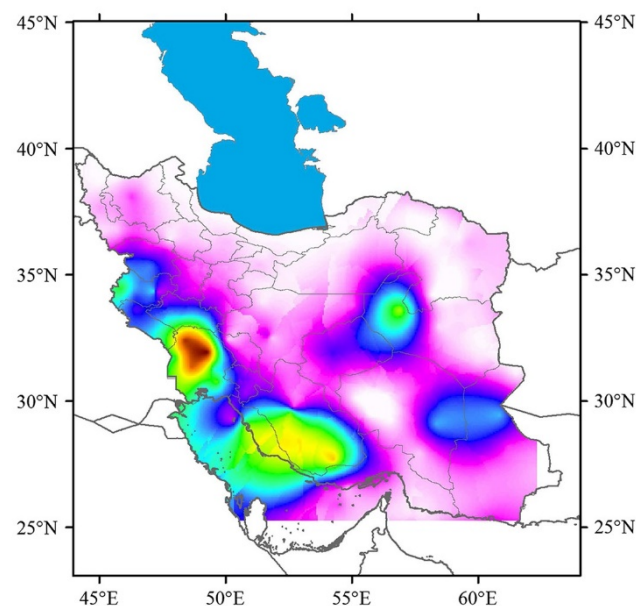
- Most of the cities do not meet WHO PM_{2.5} guidelines, even without any anthropogenic emissions.





Results and Discussions

Simulated natural PM_{2.5} concentrations over Iran, agrees with the estimated values



Reference: Alizadeh-Choobari, O., Ghafarian, P. and Oulad, E. (2016), Temporal variations in the frequency and concentration of dust events over Iran based on surface observations. *Int. J. Climatol.*, 36: 2050-2062.

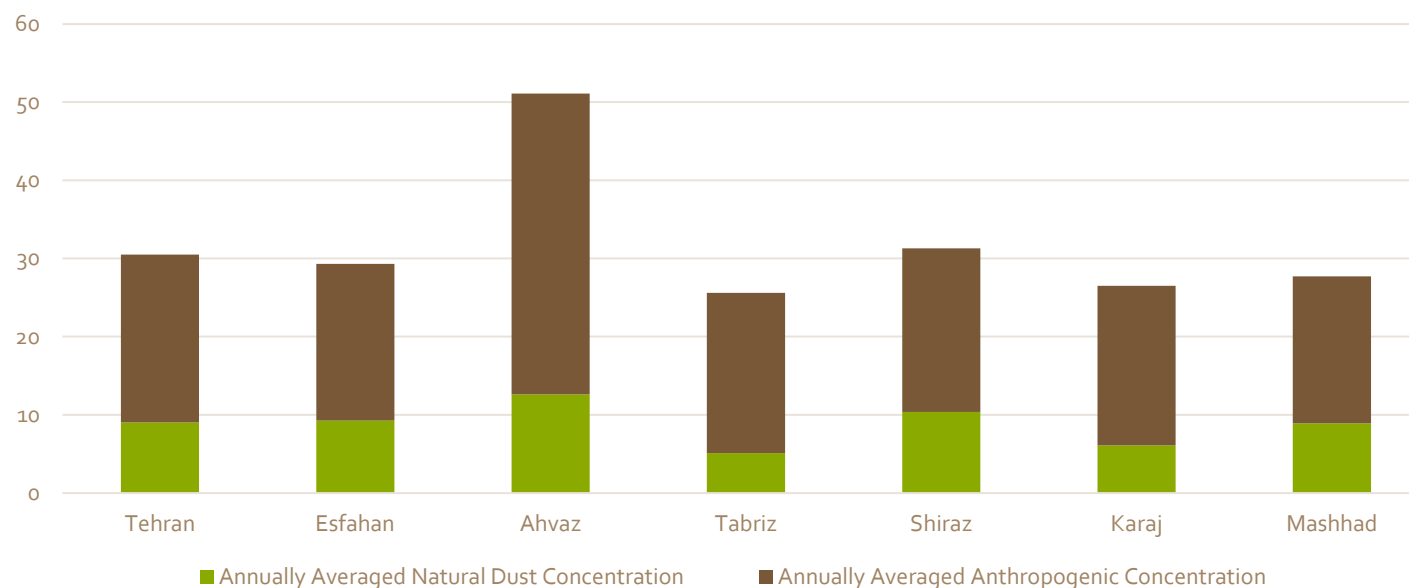
doi:10.1002/joc.4479



Results and Discussions

- Derived background PM_{2.5} confirms that natural sources have more shares in dry regions than the wet climates.

Share of Annually Averaged Natural Dust Concentration





Conclusions and recommendations

- This research work, for the first time, used RS data to estimate the background PM_{2.5} concentrations over the main Megacities in Iran.
- Lack of access to real-time background PM_{2.5} measurements and SA results.
- Regression of the AOD for background PM_{2.5} needs validation with SA observations.
- PM_{2.5} modeling is needed to assess precise relationship with AOD.
- In highly polluted cities, the PM_{2.5} and AOD are not correlated.
- First guess estimates may be helpful, but need further modeling of relationship



Thank you for your attention!

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