THE INFLUENCE OF MONSOON SUB-SEASONAL VARIABILITY ON THE OCCURRENCE OF SUB-VISIBLE CIRRUS CLOUDS OVER THE ASIAN MONSOON REGION

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https://aura.gsfc.nasa.gov/science/top10_cirrus.html

Subvisible Cirrus Clouds

- Cirrus clouds with optical thickness $\tau < 0.03$
- More frequent in the tropics
- **Moisture Transport**: Play a role in the transport of moisture and ice particles in the UTLS.
- **Stratosphere-Troposphere Exchange**: Influence the exchange of gases and particles between the stratosphere and troposphere.

BSISO and the Indian monsoon

Boreal Summer Intraseasonal Oscillation: A prominent climate phenomenon characterized by large-scale atmospheric variability in the tropics during the boreal summer (June to September).

- **Intraseasonal Timescale**: Operates on a period of 30-60 days.
- **Spatial Pattern**: northward/northeastward propagating Oscillation and is divided into 8 Phases.
- **Monsoon Influence**: Linked to active and break cycles of the Indian monsoon.

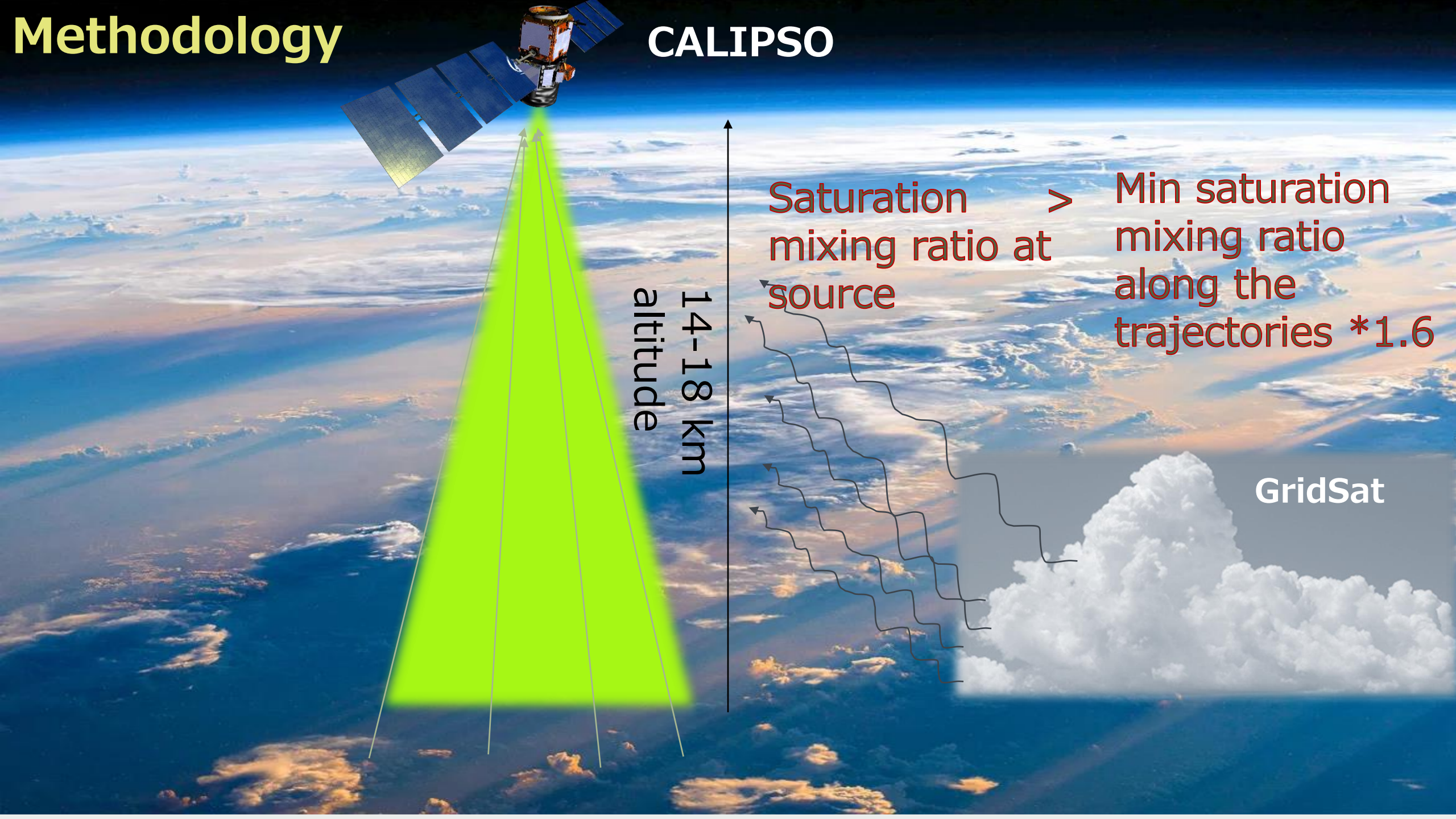
Data and Model

- CALIPSO observations of SVC during June to September for the years 2007-2010 (Martin et. al. 2017)
- Gridded Satellite (GridSat-BI) dataset for the period,2007-2010. GridSat-B1 is a climate quality, long term dataset of global infrared window brightness temperature
- Lagrangian model TRACZILLA which is a modified version of FLEXPART that performs back trajectory analysis using reverse integration (Stohl et al. 2005; Pisso and Legras 2008) based on horizontal winds and all-sky radiative heating rates provided by the ERA5 reanalysis.

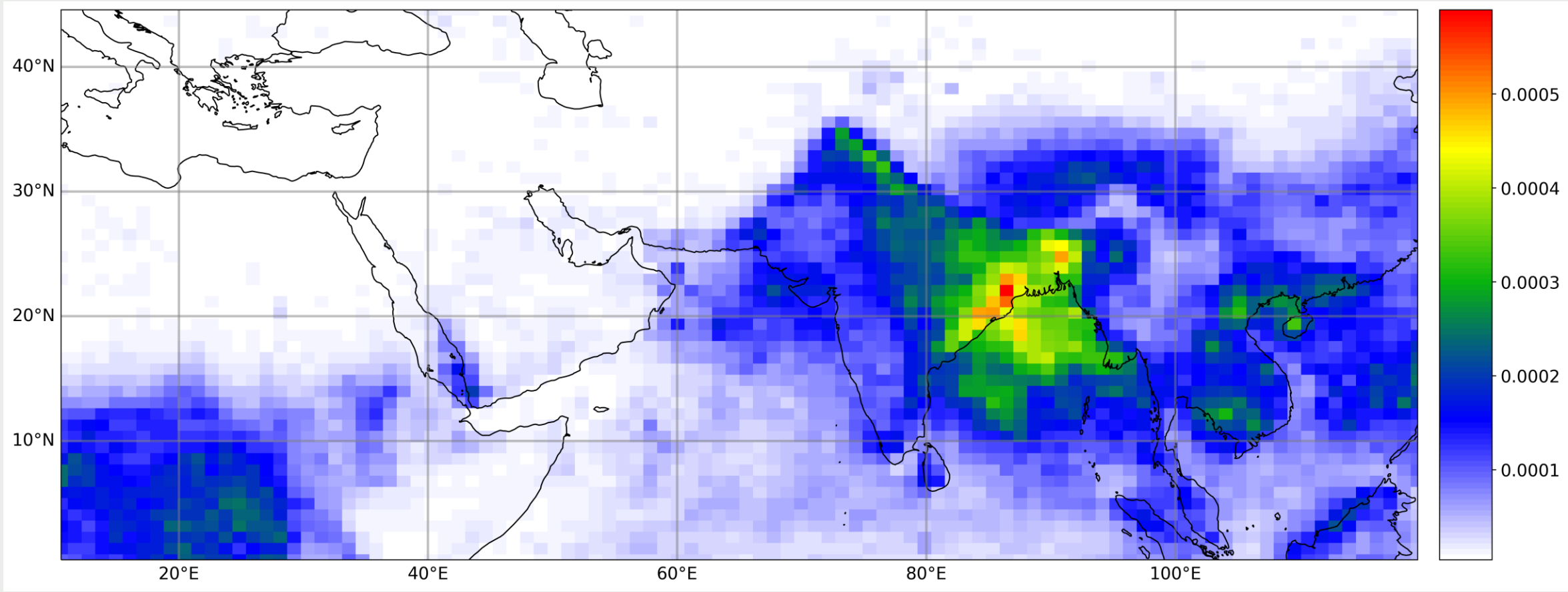
Methodology

- The air parcels were released from SVC altitudes detected by CALIPSO satellite (Legras and Bucci 2020). The trajectories are run backwards for 45 days.
- When the parcel temperature is larger than the brightness temperature measured by GridSat, the pixel is marked as the convective source for that parcel.

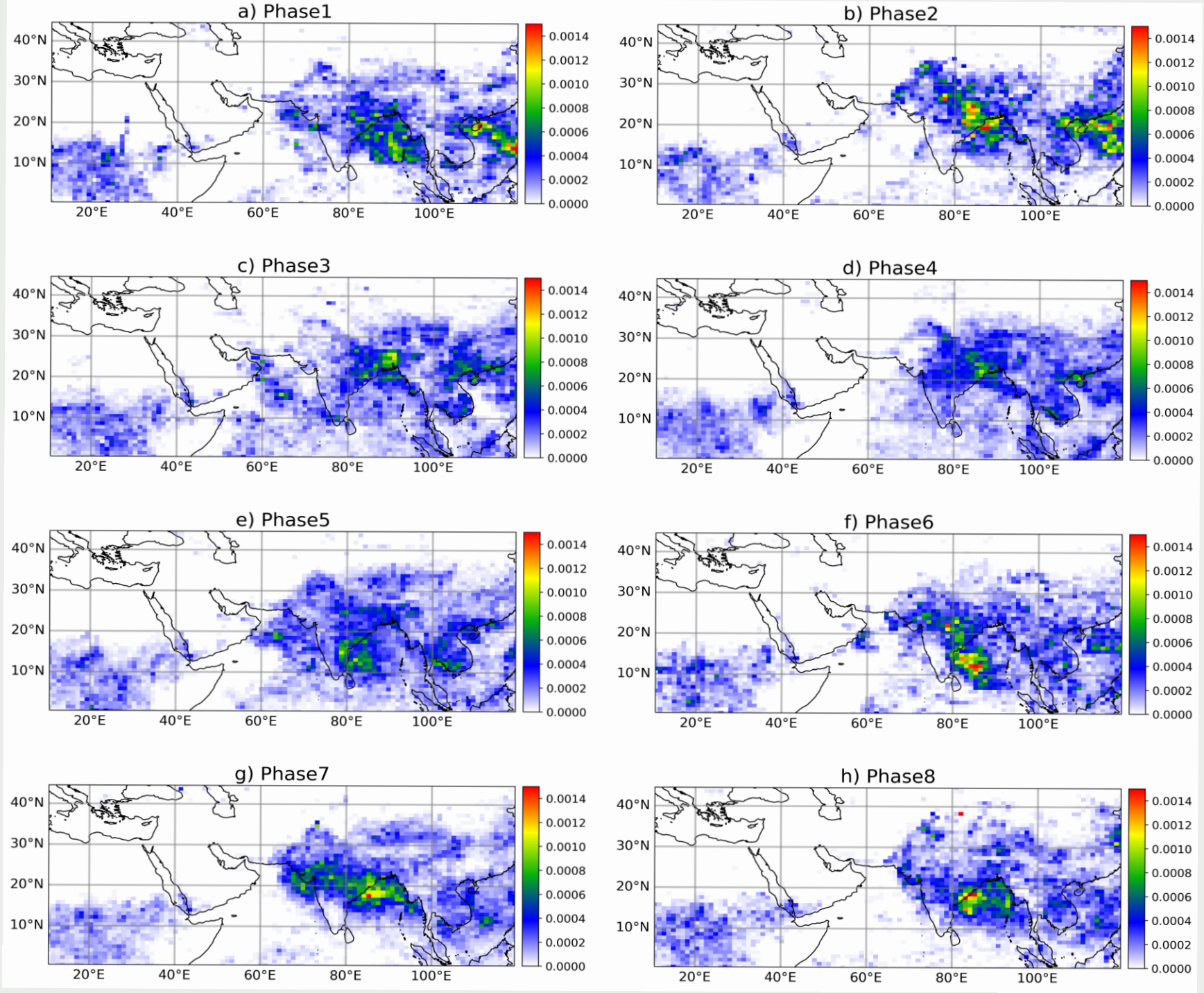
Methodology



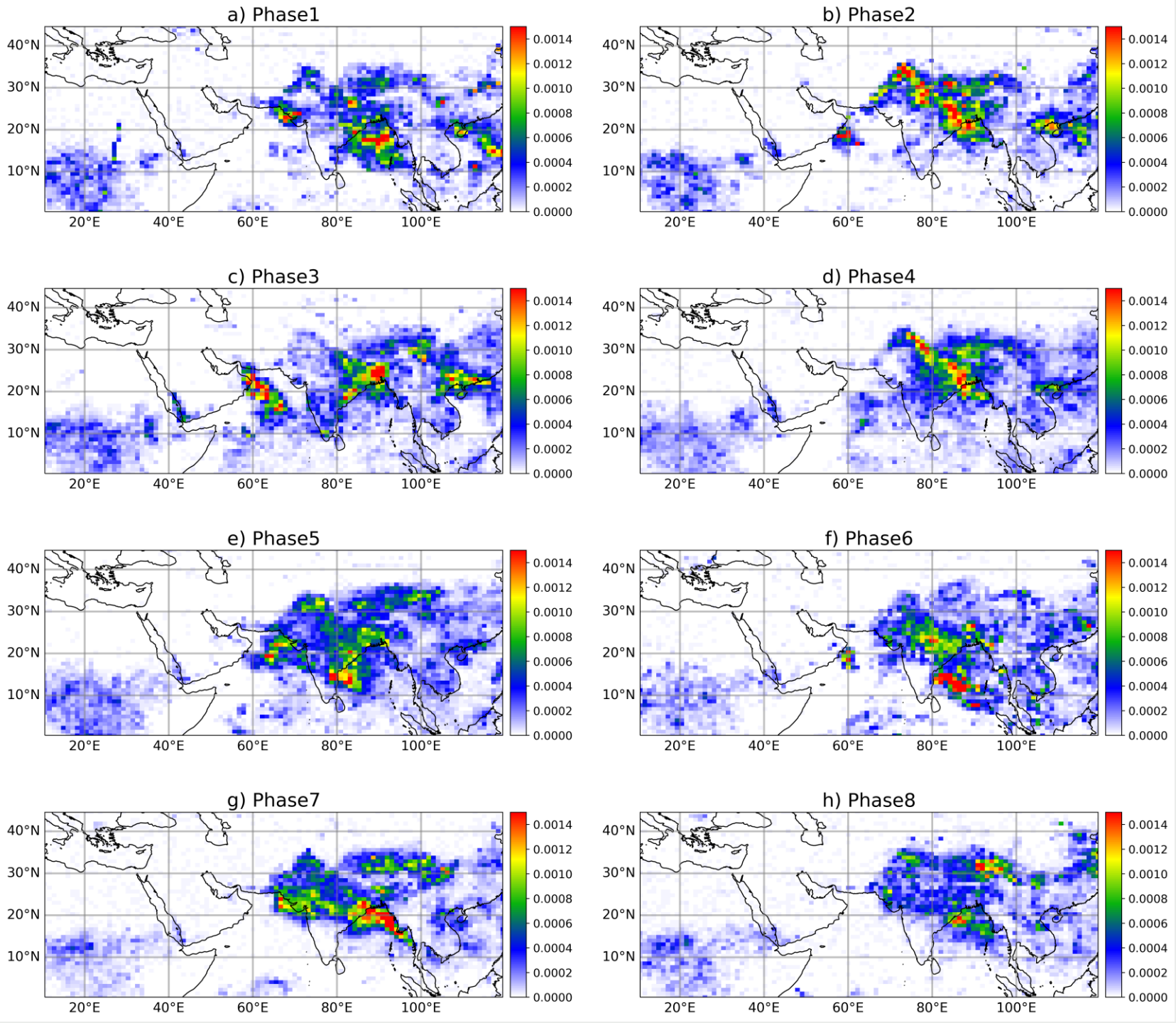
RESULTS



SVC source distribution for the monsoon season 2007-2010



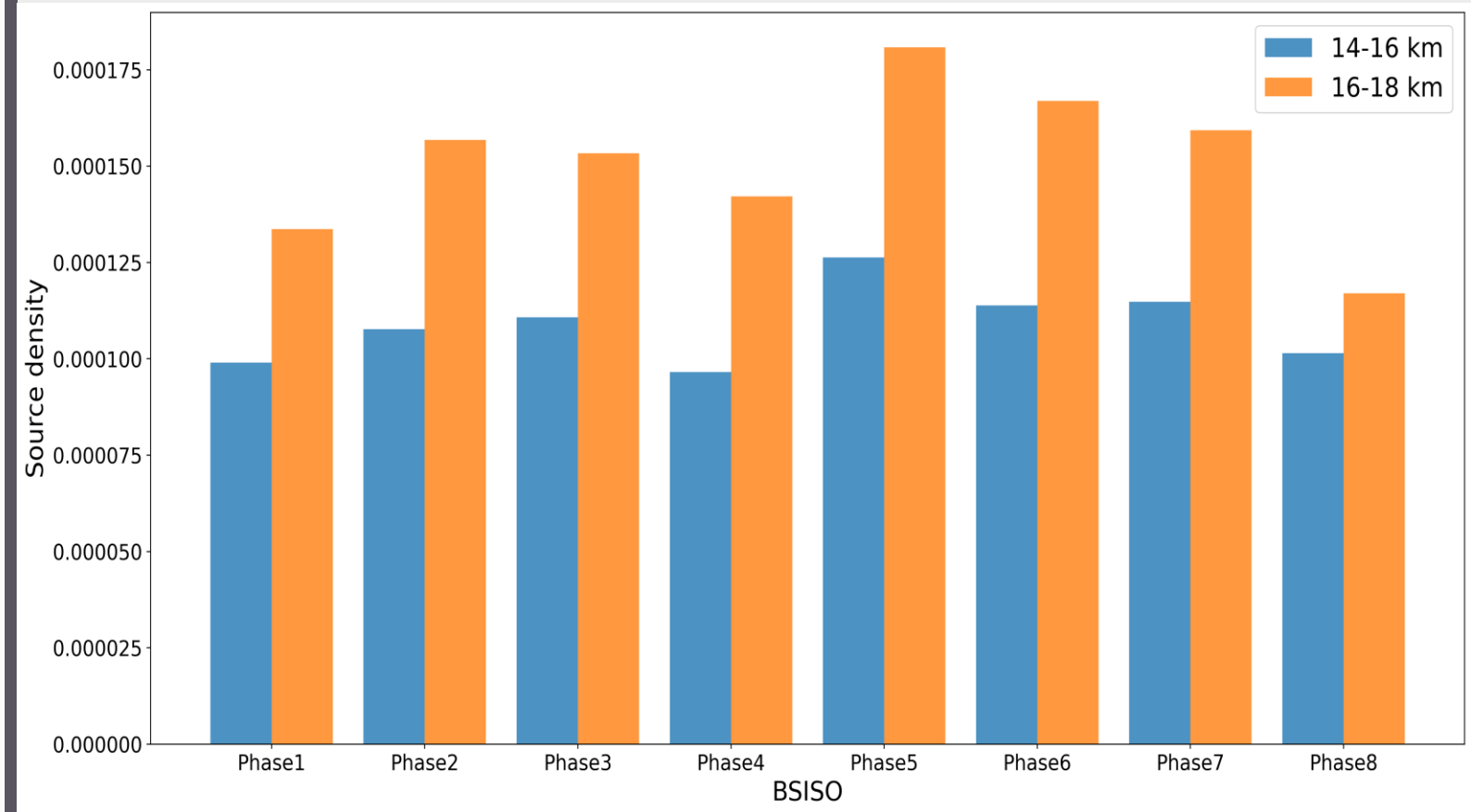
Convective Sources (14-16 km) for different phases of BSISO



Convective Sources (16-18 km) for different phases of BSISO

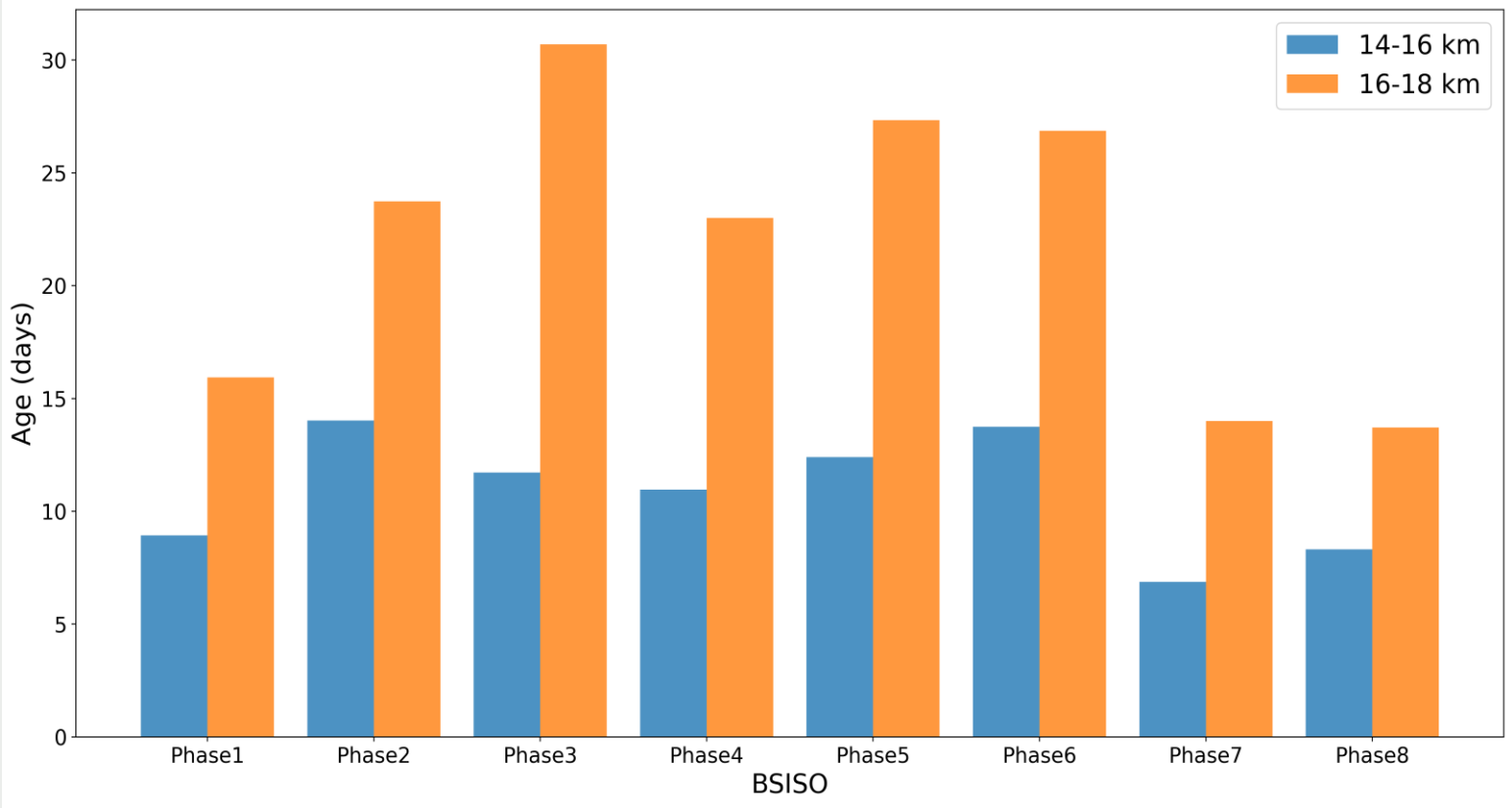
Quantification of source density

Average source density over ASM for different phases of monsoon intraseasonal oscillation.

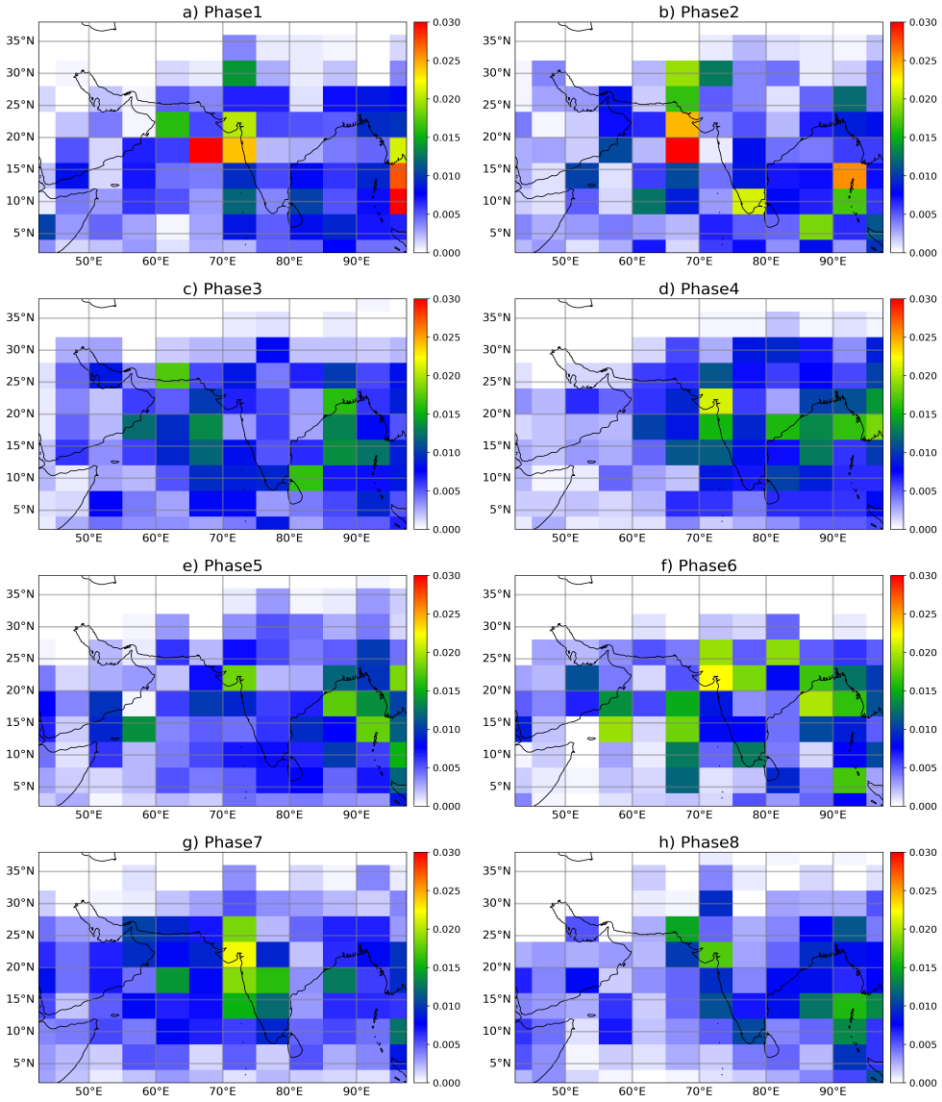


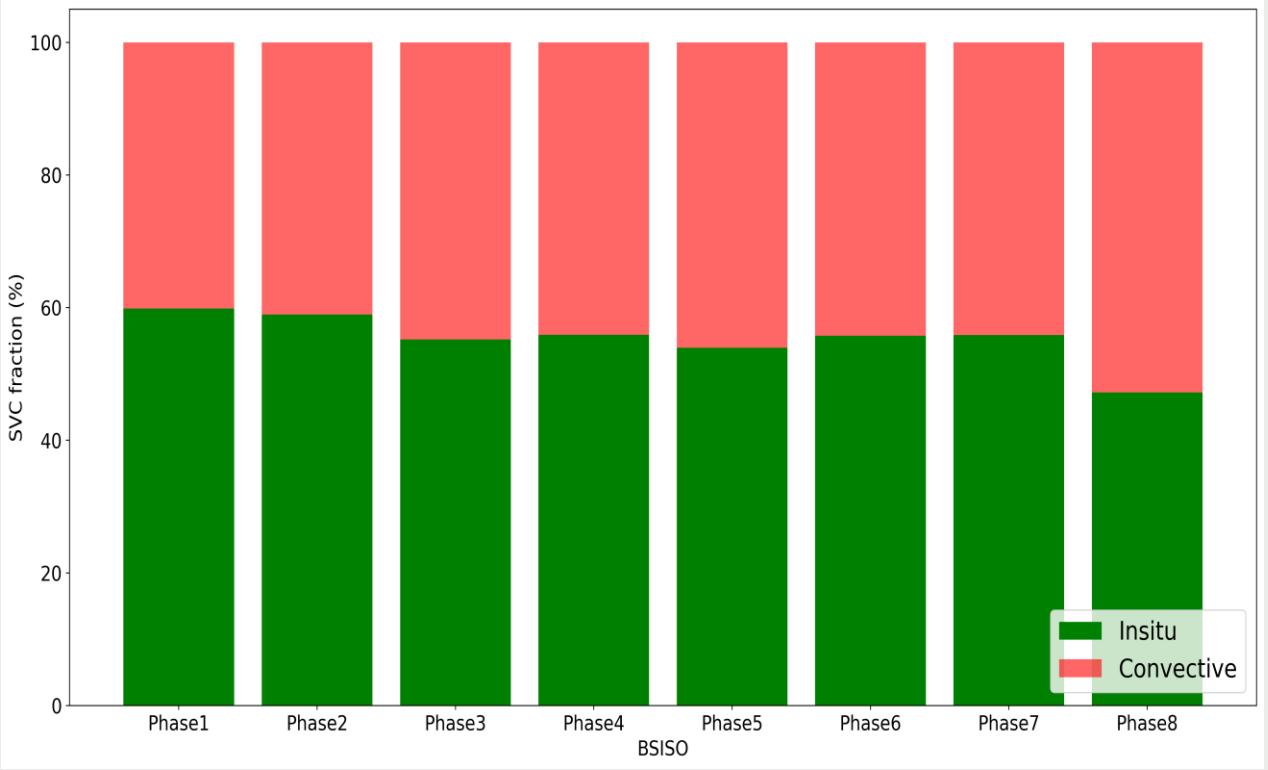
Quantification of Age over ASM

Transit time is highly variable and is evident between 16-18 km. Less transit time in phases 7 and 8 may be due to presence of strong sources over Tibetan and China (previous figure)



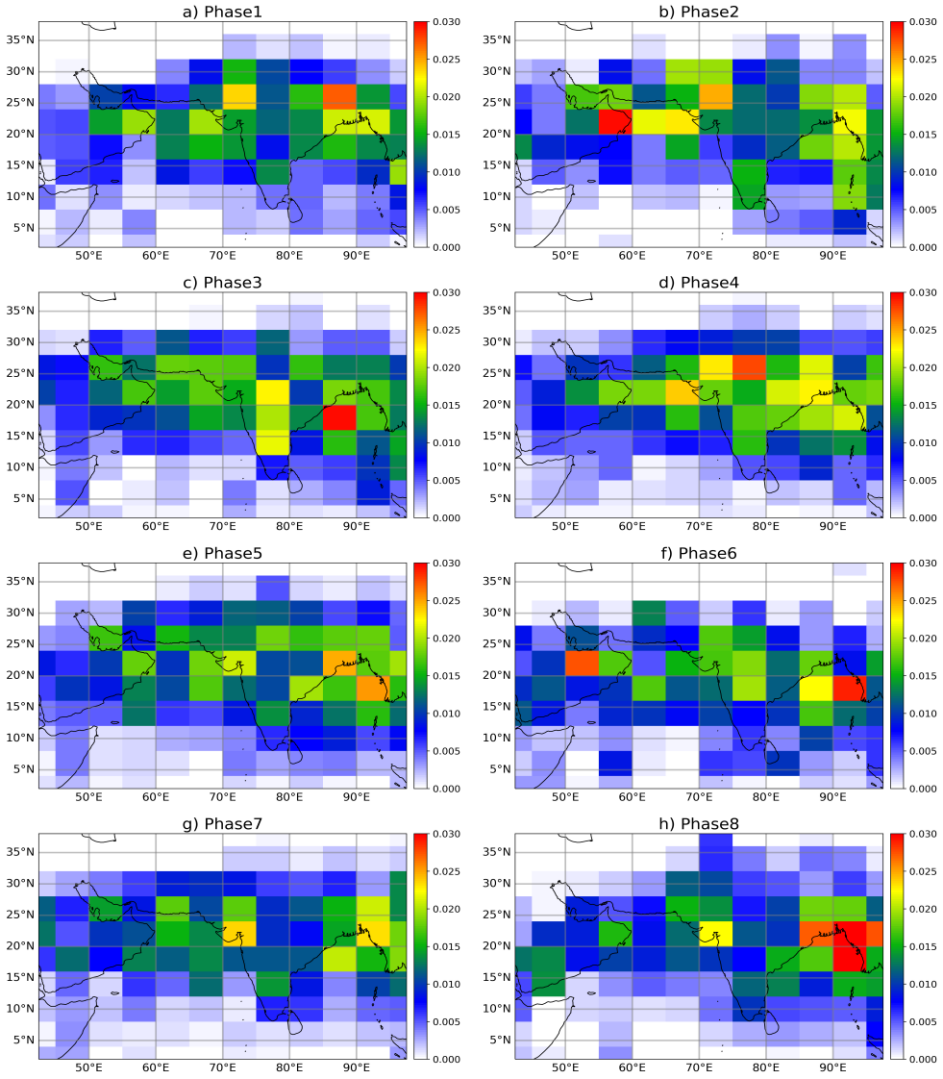
Occurrence of SVC (14-16 km)

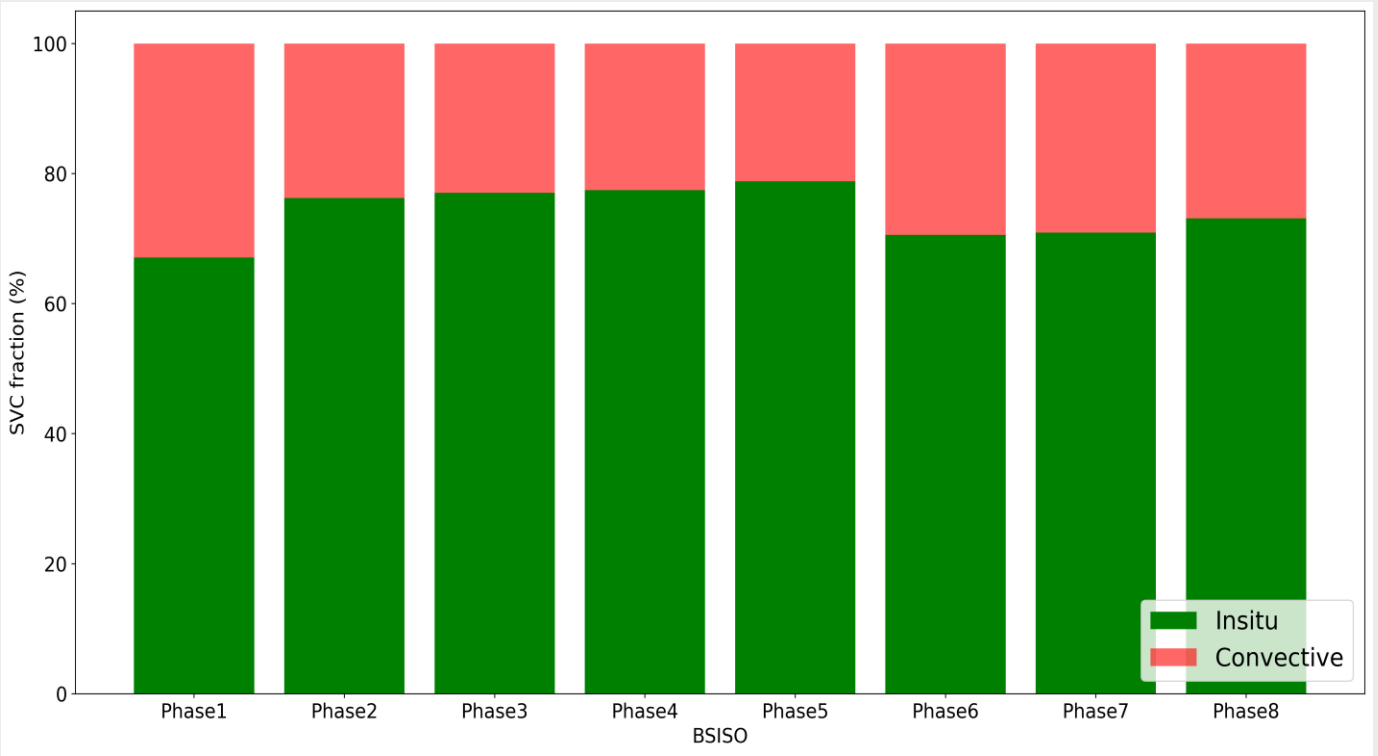




Regional distribution insitu SVC fraction by during different phases of BSISO for 14-16 km

Occurrence of SVC (16-18 km)





Regional distribution insitu SVC fraction by during different phases of BSISO for 16-18 km

Conclusions

- SVC source density is more over northern Bay of Bengal and the adjoining Indian landmass.
- The BSISO phases influence the north-south distribution of SVC source density.
- SVC source density as well as transport time varies with the phases of BSISO.
- The regional distribution of *in situ* SVC fraction is modulated by BSISO.
- *In situ* SVC formation is predominant for the two altitude ranges in the study with more percentage in the 16-18 km.

Thank You!