Robust identification of interannual Arctic sea ice variability modes

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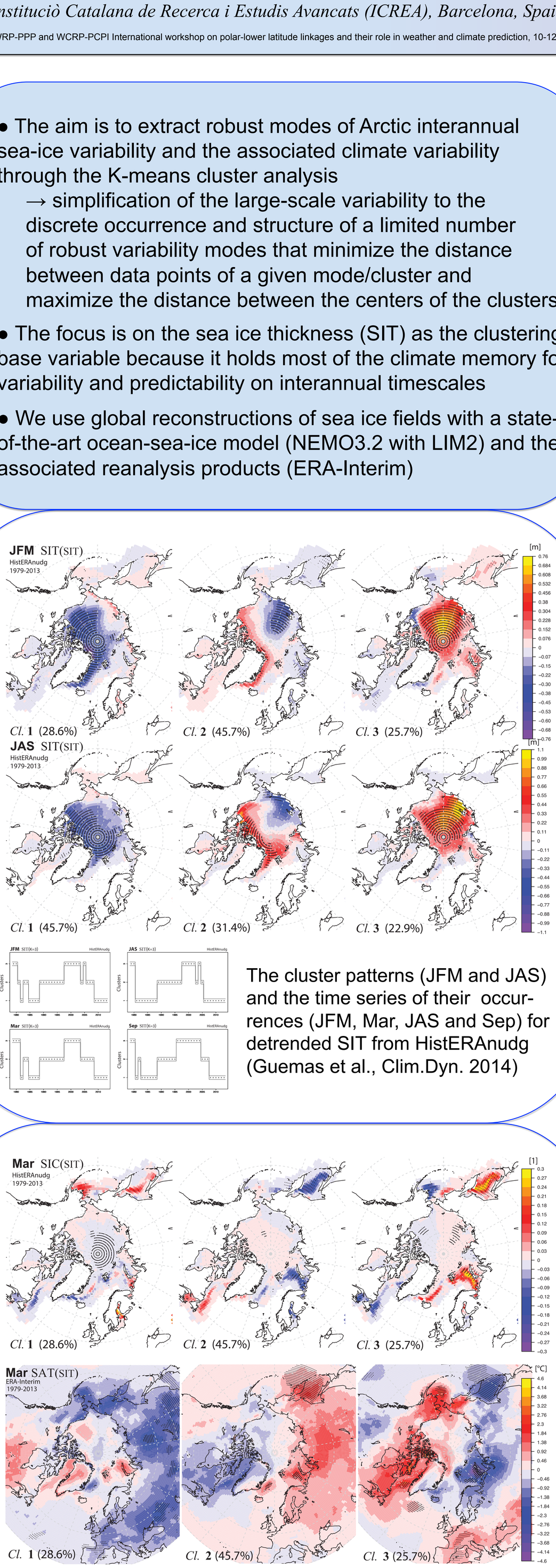
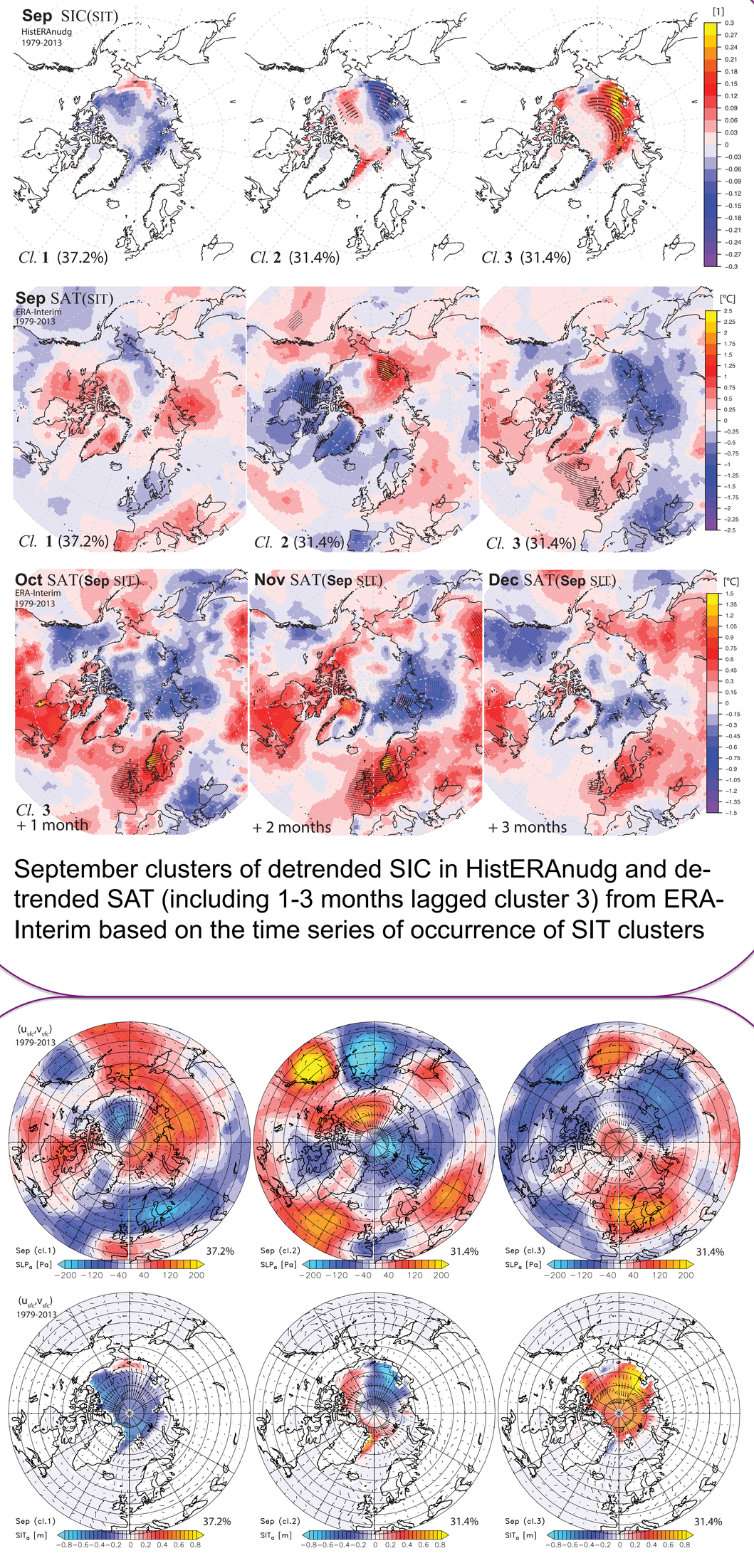
- The aim is to extract robust modes of Arctic interannual sea-ice variability and the associated climate variability through the K-means cluster analysis
  → simplification of the large-scale variability to the discrete occurrence and structure of a limited number of robust variability modes that minimize the distance between data points of a given mode/cluster and maximize the distance between the centers of the clusters
- The focus is on the sea ice thickness (SIT) as the clustering base variable because it holds most of the climate memory for variability and predictability on interannual timescales
- We use global reconstructions of sea ice fields with a state-of-the-art ocean-sea-ice model (NEMO3.2 with LIM2) and the associated reanalysis products (ERA-Interim)



The cluster patterns (JFM and JAS) and the time series of their occurrences (JFM, Mar, JAS and Sep) for detrended SIT from HistERAnudg (Guemas et al., Clim.Dyn. 2014)

March clusters of detrended sea ice concentration (SIC) in HistERAnudg and detrended surface air temperature (SAT) from ERA-Interim based on the time series of occurrence of SIT clusters



September clusters of detrended SIC in HistERAnudg and detrended SAT (including 1-3 months lagged cluster 3) from ERA-Interim based on the time series of occurrence of SIT clusters

September clusters of detrended mean sea level pressure (SLP) from ERA-Interim and detrended SIT from HistERAnudg both overlaid by clusters of detrended surface winds from ERA-Interim

- The optimal number of SIT clusters is K=3 (NbClust)
- SIT cluster patterns and their time series of occurrence are very similar between different seasons and months
- The associated SIC cluster patterns vary more between seasons and months but they are framed by SIT patterns
- SAT clusters are more closely associated with SIC clusters in winter than in summer, but summer SAT anomalies can persist until winter for a specific SIT/SIT mode
- SIT clusters are mixed dynamic and thermodynamic modes