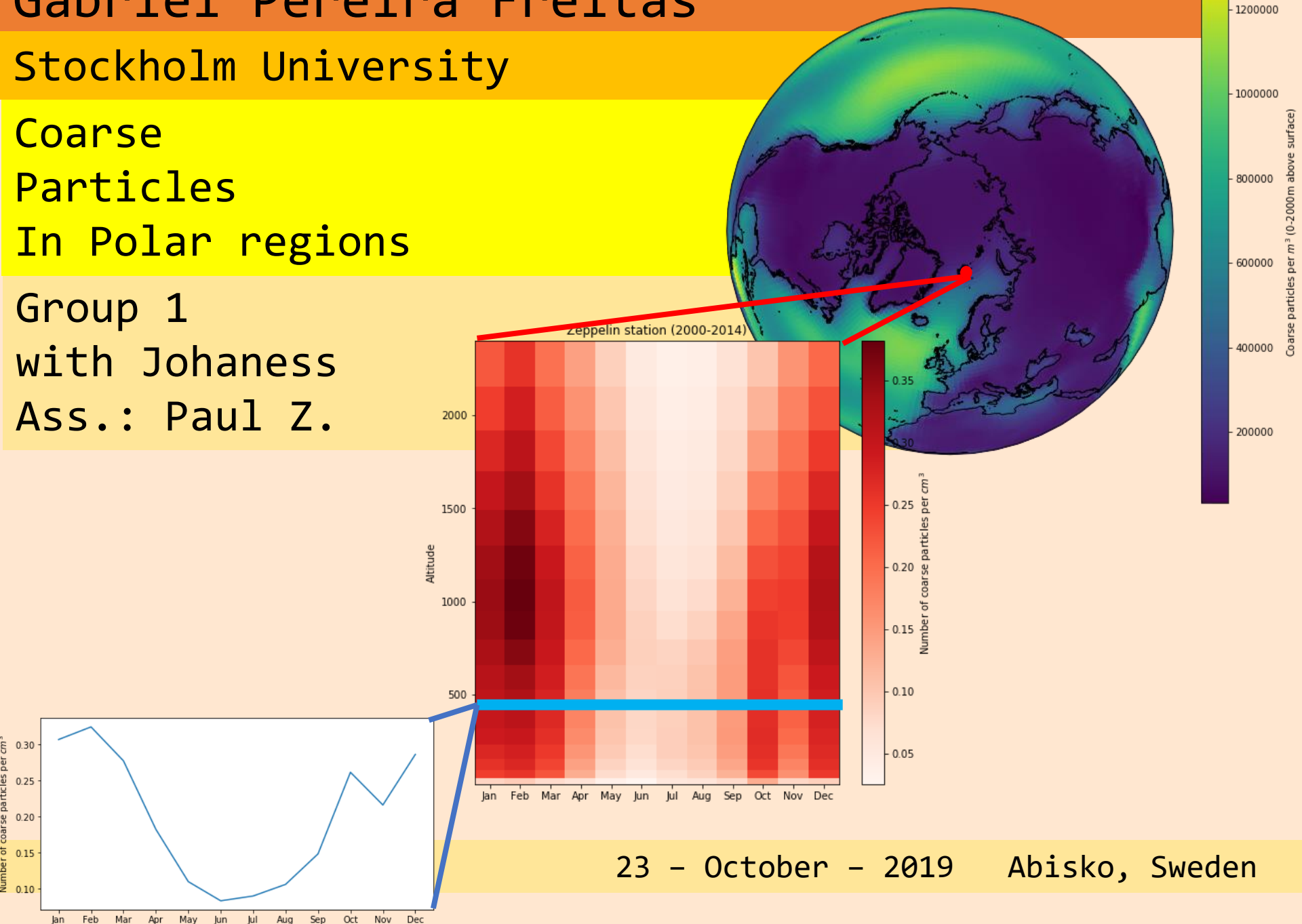


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Coarse Particles In Polar regions

Group 1
with Johanness
Ass.: Paul Z.



Introduction

Motivation

Coarse particles are the ones bigger than 1 μm

1. Coarse particles are important for radiative effects and cloud formation (i.e. giant cloud condensation nuclei)
 2. My own current measurement at Zeppelin with a MBS to study coarse particles (e.g. biological particles) and their importance for cloud formation
- Coarse mode in the Arctic in models:
 - Year trends?
 - Are they relevant for radiative forcing?
 - Representation in models:
 - Only few models generate their concentration as a variable
 - Mostly, only sea-salt and dust particles are considered

Introduction

Objectives

- Compare observations and historical model data
- Yearly trends of coarse particles in the Arctic (and Antarctica)
- Which model better represents the observations?
- What are the parameters that drive coarse mode concentration?
- Spatial and temporal variability
- What will be the evolution of coarse particles in the Arctic for different climate scenarios?

Methods and Data

Observational data:

OPSS(FIDAS) at **Zeppelin Observatory** (2018-2019)

Arctic

APS at **Neumayer** (2011-2013)

Antarctica

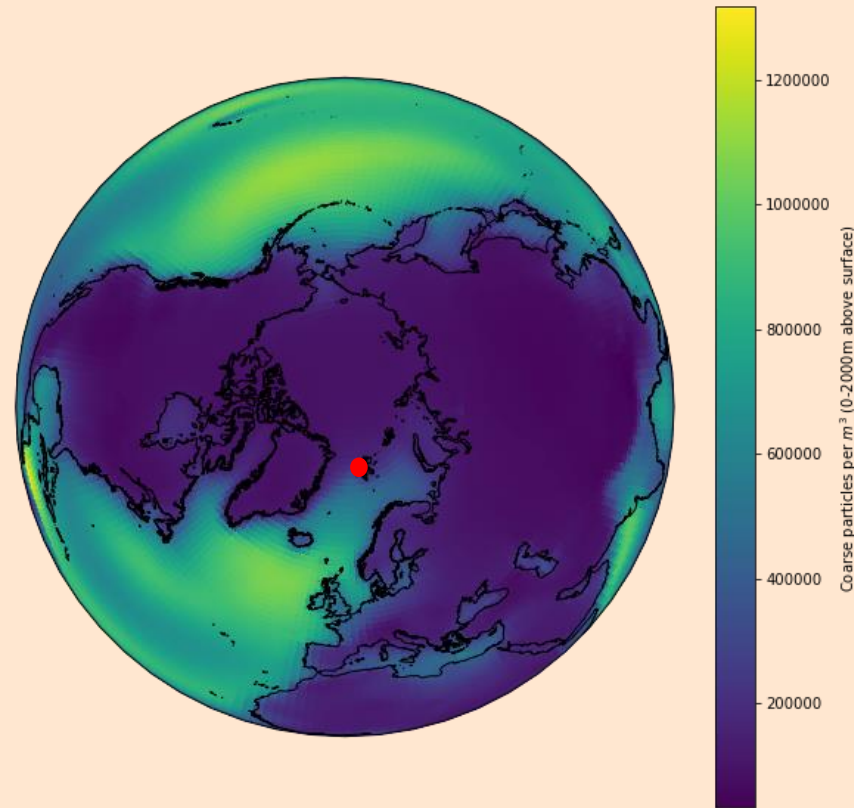
Model data:

UKESM:

esm-hist, ssp126, ssp585

CESM2 and CESM-WACCAM:

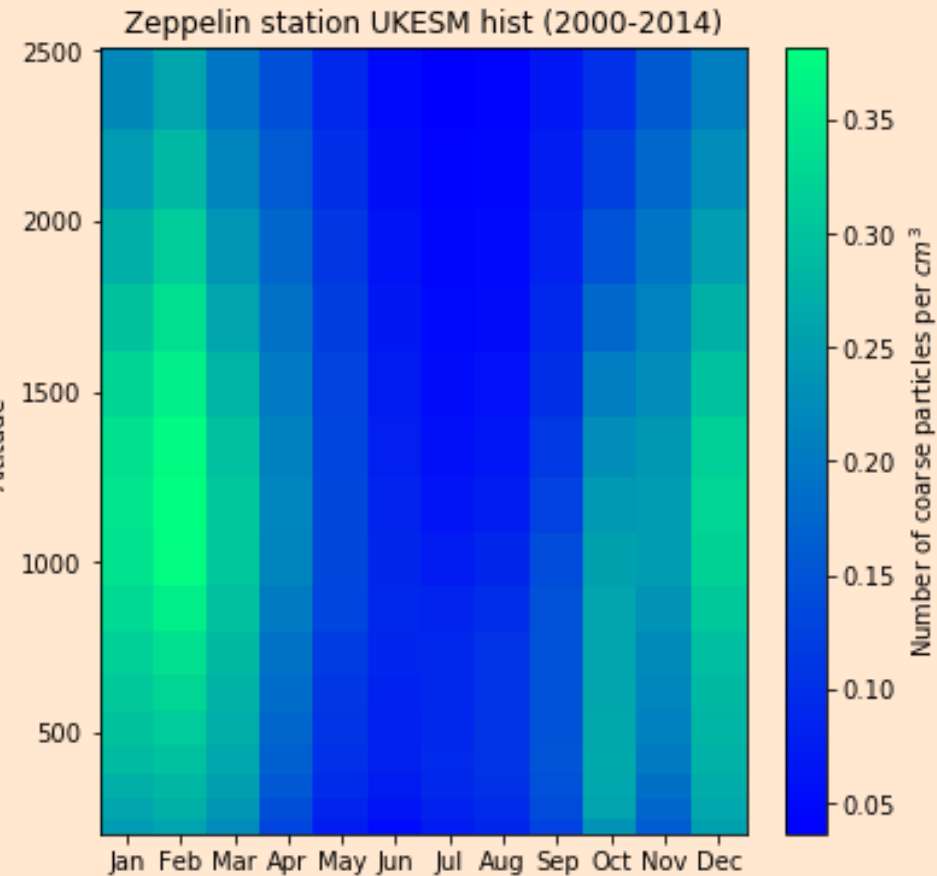
historical, ssp126, ssp686



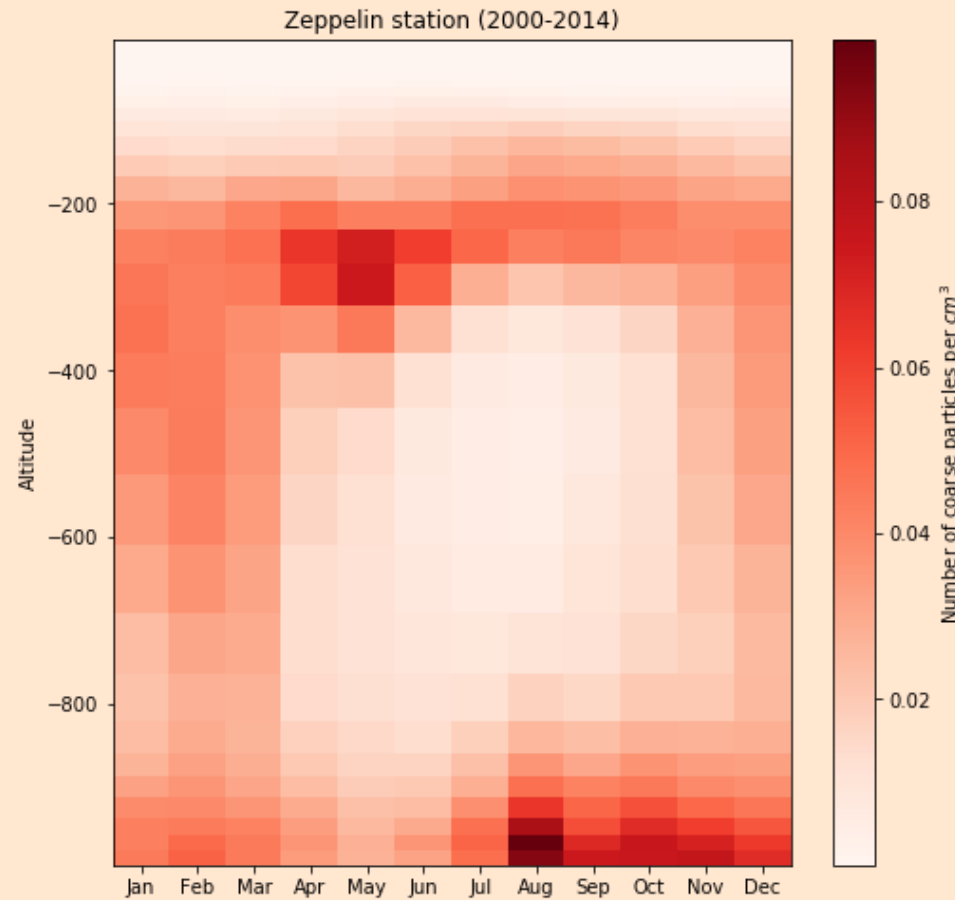
Results

Yearly and vertical variations

Zeppelin 2000-2014



UKESM



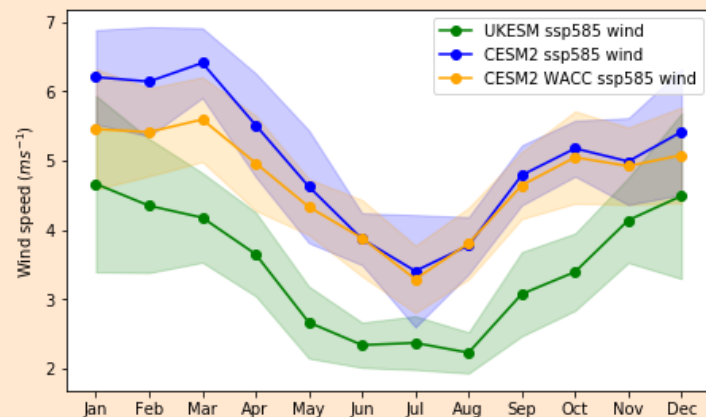
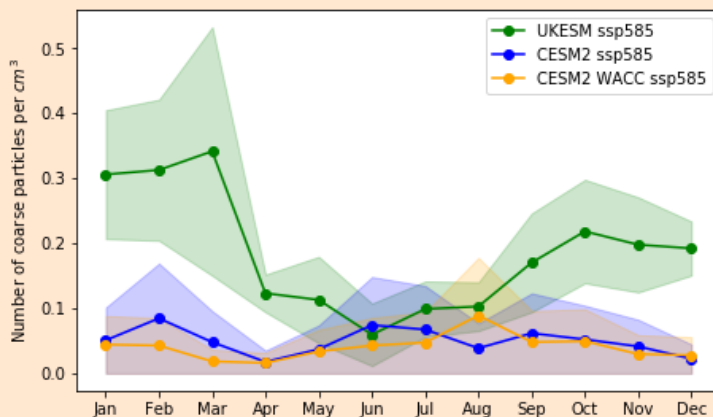
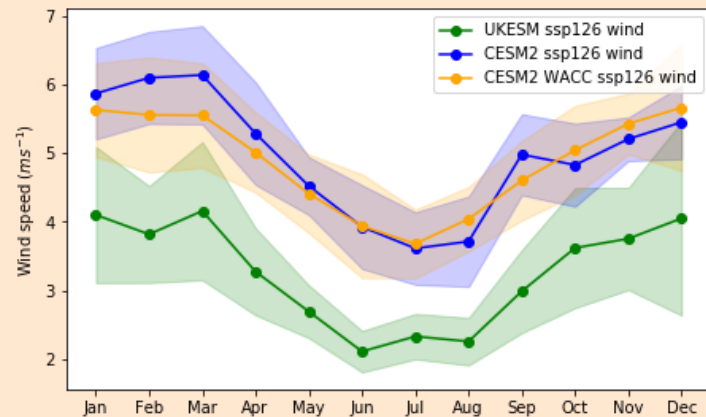
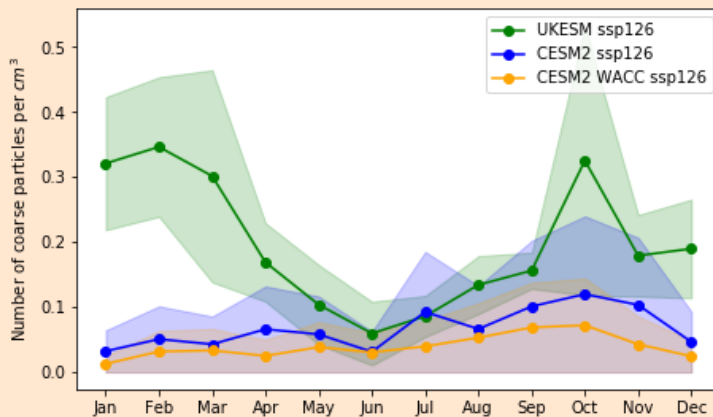
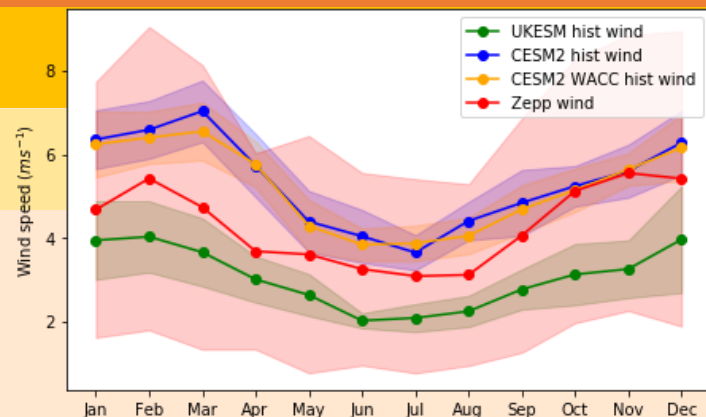
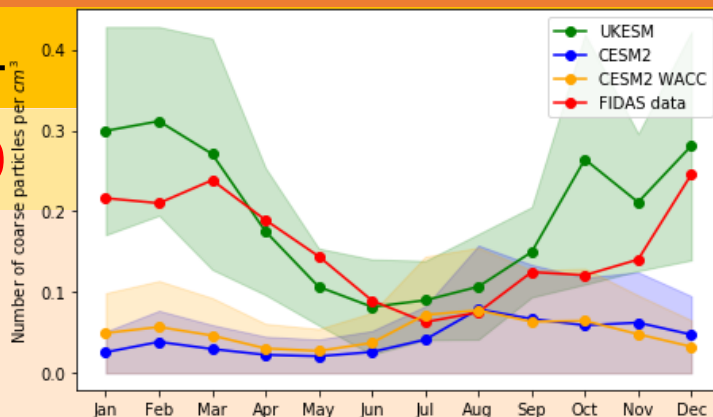
CESM2

Results

H: 2000-2014

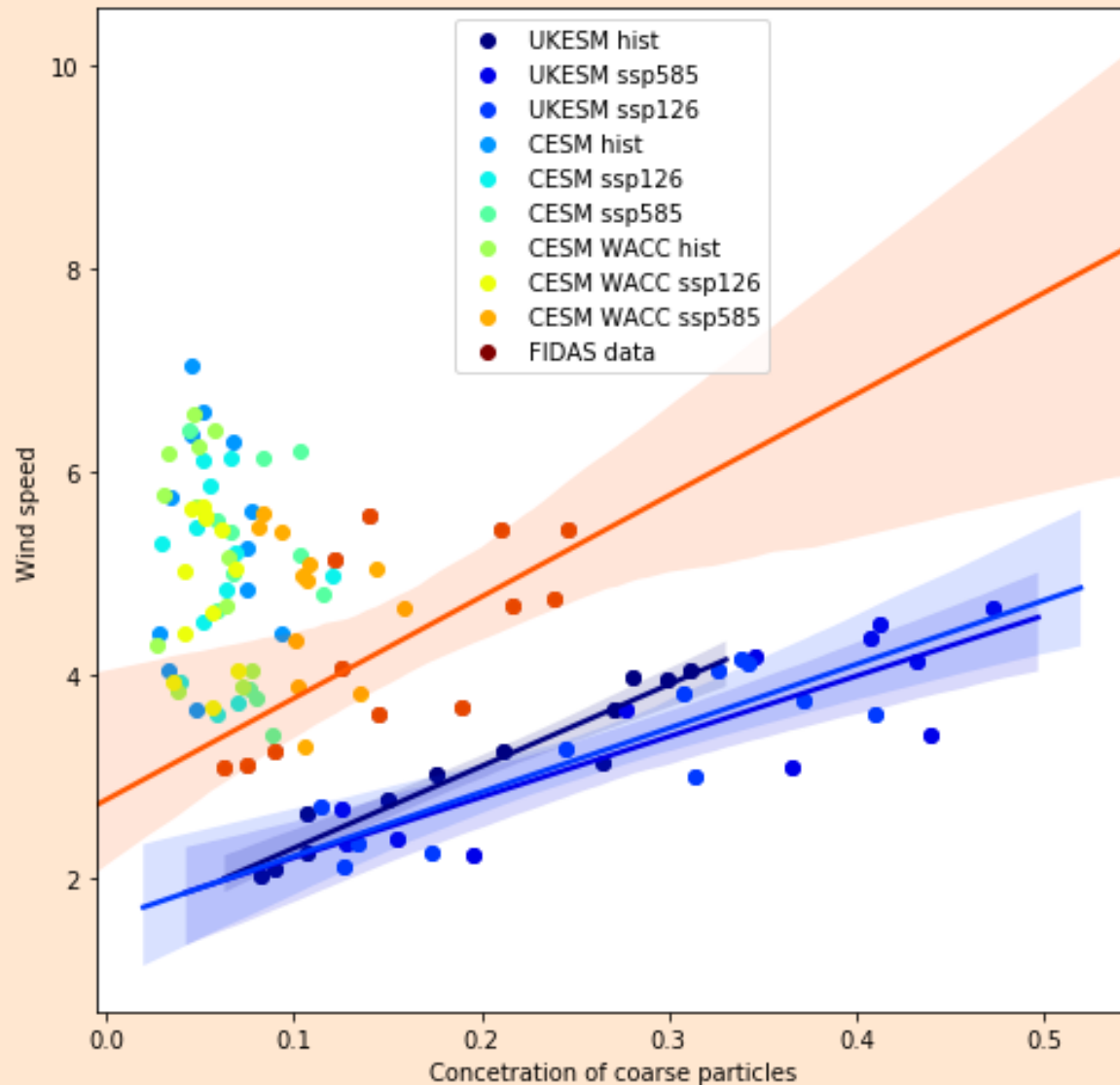
S: 2015-2020

OPSS 2018-2019



Results

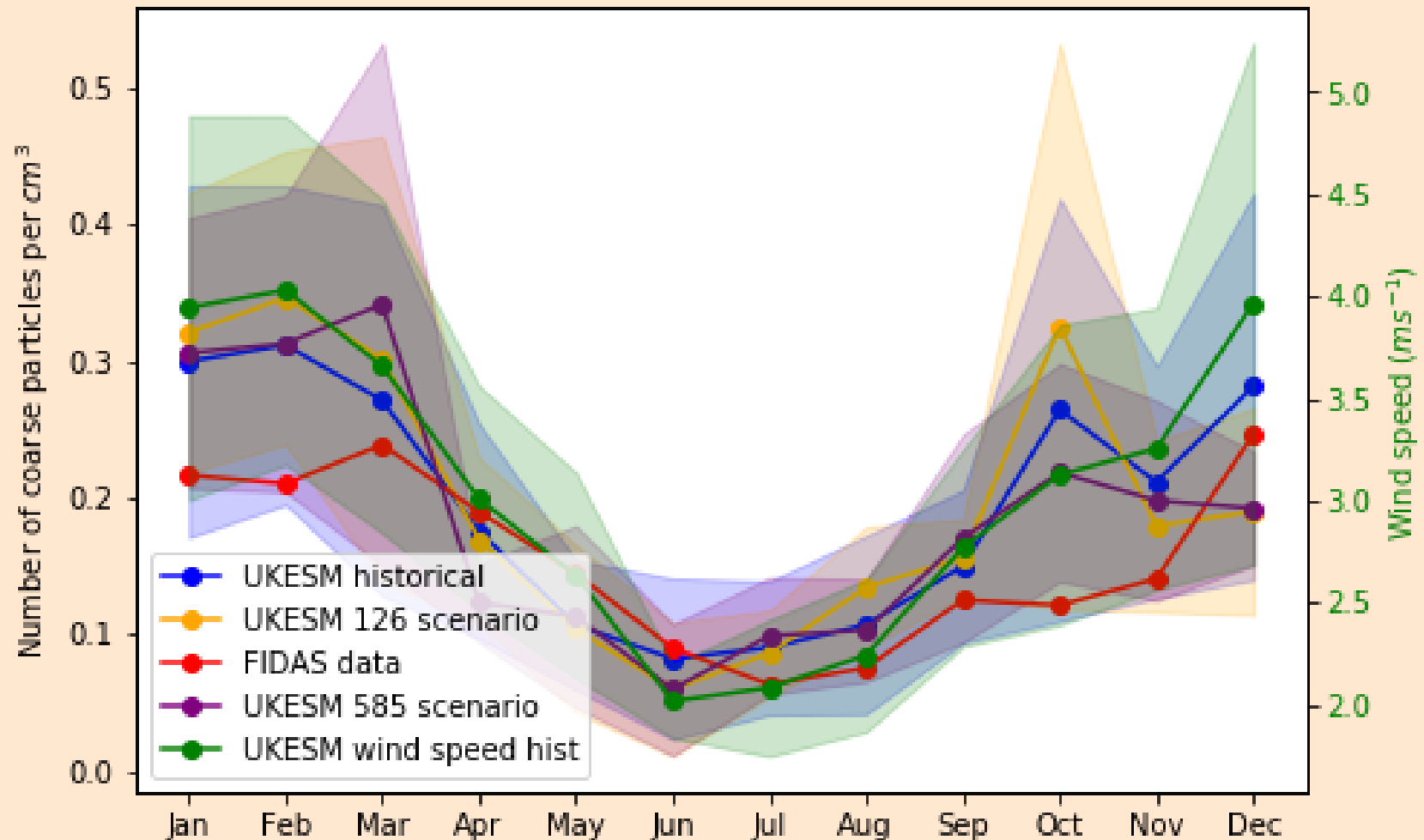
Coarse mode vs Wind speed



Results

Close-up for UKESM model

Comparison between UKESM model (scenario/hist) with FIDAS coarse mode data at Zeppelin

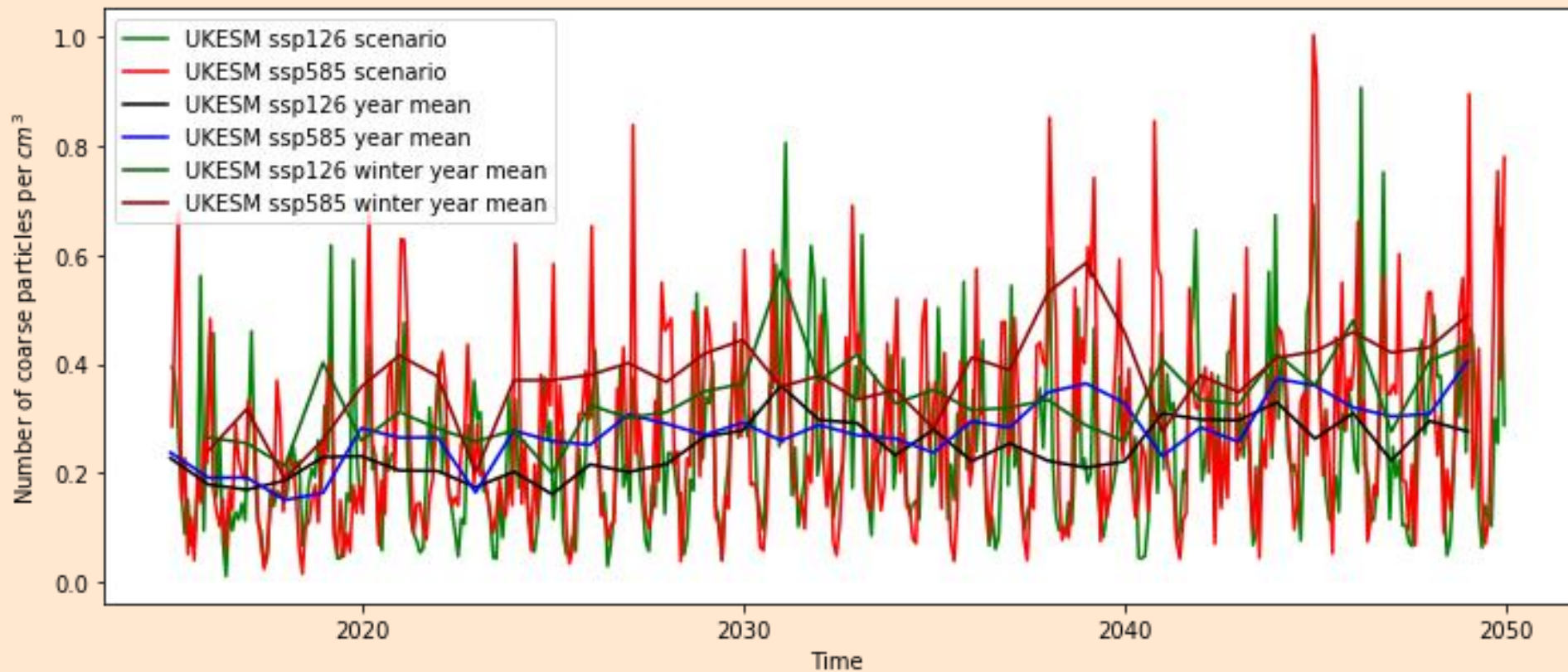


Results

Future trends for UKESM

2014-2050

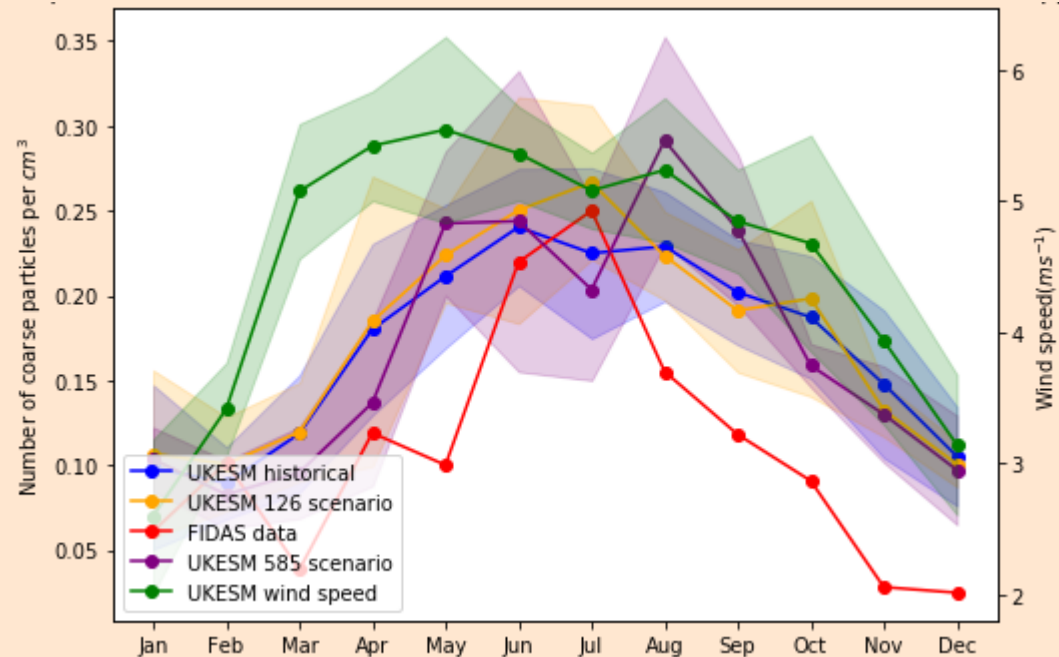
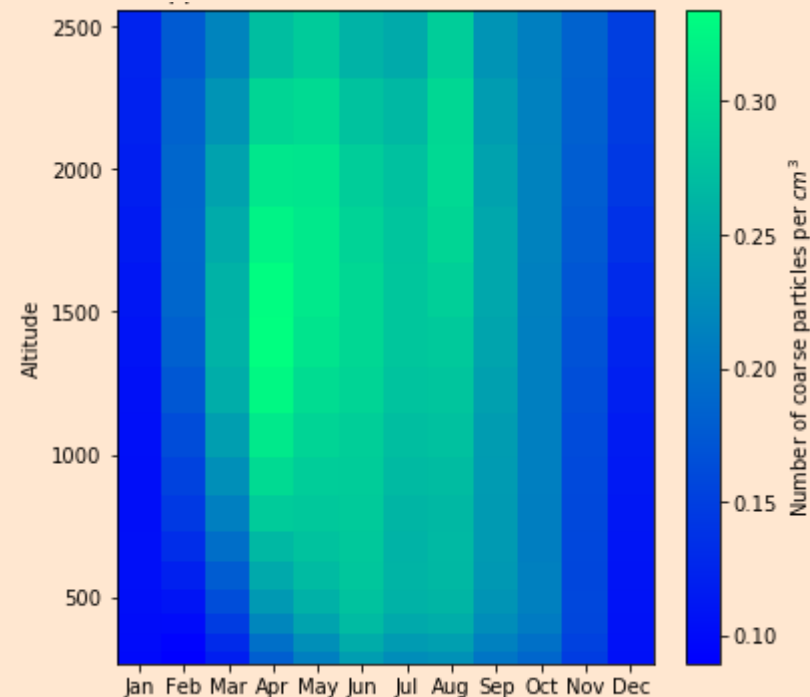
50 - 100% increase in Coarse mode concentration in 30 years



Results

A look to the other pole: Antarctica

Normalized (No instruction on the data files)



Conclusions

- Coarse particles are prevalent in the winter
- UKESM better represents observations
- Although wind speeds do not clearly match
- Dependence on wind is not straightforward
- Both 126 and 585 scenarios represents almost the same increase in coarse mode concentration
- CESM2 and CESM2-WACC don't have good parameterization for coarse particles

Outlook

Report

Future

- Retrieve coarse mode data from other sites (Barrow, Alert...) and compare to models
- Learn how coarse mode particles are parametrized in the models. What are the main variables that drive these concentrations?
- What is the UKESM model taking into account that CESM2 and WACC doesn't?
- Correct data from Neumayer for better comparability between modelling in north and south pole
- Effect on radiative forcing
- Continue monitoring our OPSS at Zeppelin
- How can we enhance coarse mode representation in models