Support figures

Figure S1 Particle size distribution in marine atmosphere. (a:16 October to 5 November 2011, b:2 to 11 November 2012).

Figure S2 Comparison of median diameter of particle mode ($D_{pg,i}$) and number concentrations of nucleation mode particles (N_{30nm}) between two sites on 4 November 2012.

Figure S3 New particle formation on 18 October 2011 deducted of the ship plumes.

Figure S4 Variations of median diameter of preexisting particle mode ($D_{pg,2}$) and number concentrations of median diameter particles (N_i) of particle growth event over China Seas on 26 October, 2011.

Figure S5 MODIS derived chlorophyll-a oceanic concentrations on 26 October 2011 over China Seas (pentacle represents the location of new particle burst event).

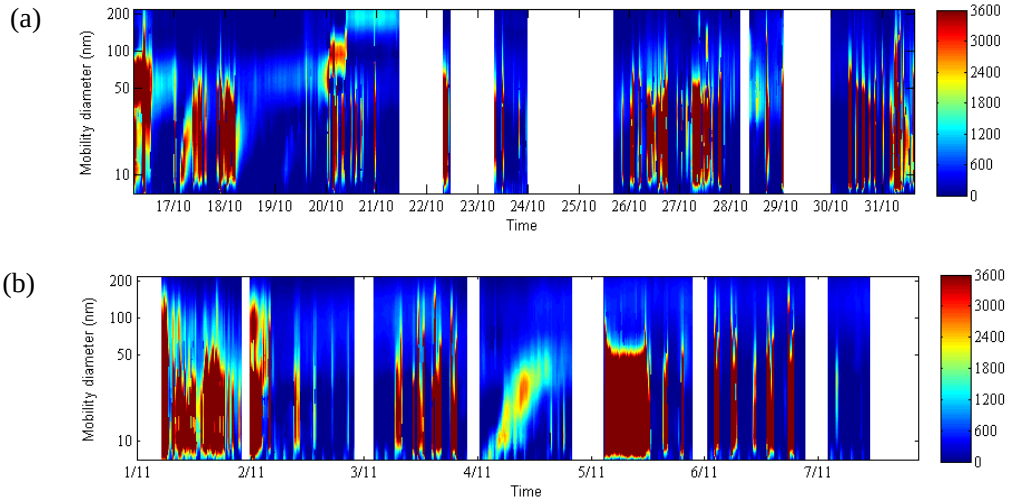

Figure S1 Particle size distribution in marine atmosphere. (a:16 October to 5 November 2011, b:2 to 11 November 2012).

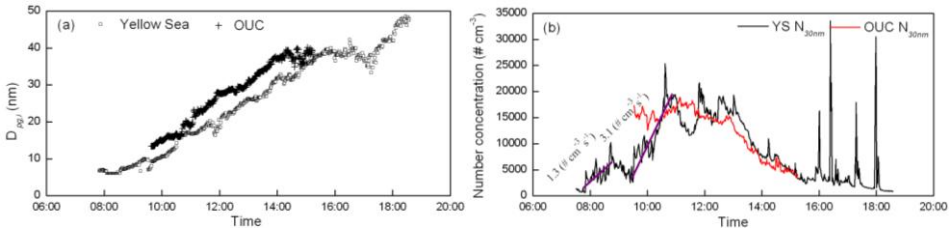

Figure S2 Comparison of median diameter of particle mode ($D_{pg,i}$) and number concentrations of nucleation mode particles (N_{30nm}) between two sites on 4 November 2012.

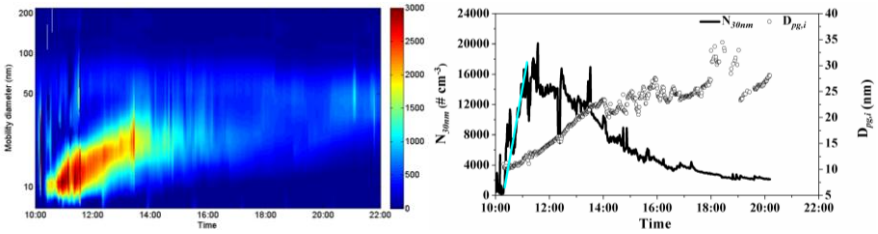

Figure S3 New particle formation on 18 October 2011 deducted of the ship plumes.

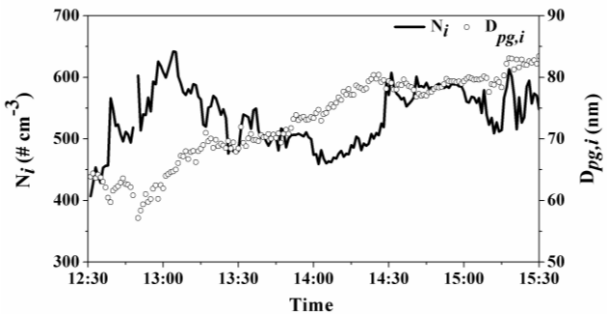

Figure S4 Variations of median diameter of preexisting particle mode ($D_{pg,2}$) and number concentrations of median diameter particles (N_i) of particle growth event over China Seas on 26 October 2011.

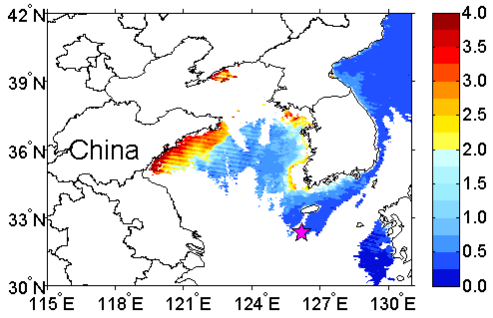

Figure S5 MODIS derived chlorophyll-a oceanic concentrations on 26 October 2011 over China Seas (pentacle represents the location of new particle burst event).

Supporting information

1. SOA simulation in CMAQ

The U.S. EPA Community Multi-scale Air Quality Model (CMAQ v4.7.1; Byun and Ching, 1999) with the AE5 SOA module was used to simulate the processes of secondary organic aerosol formation during new particle burst events.

Related SOA formation reactions and SOA composition in CMAQ4.7.1 are shown in Figure S 6(Carlton et al., 2010). Table S1 provides the acronym and definition of each SOA species. The concentration of SOA in this study represents the sum of 19 species listed in Table S1.

Table S 1 Acronym and definition of each SOA species in CMAQ 4.7.1.

Acronym	Definition
AALKJ	SOA from alkanes
ABNZ1J	Low-volatility SOA from benzene
ABNZ2J	High-volatility SOA from benzene
ABNZ3J	Non-volatile SOA from benzene (low-NOx)
ATOL1J	Low-volatility SOA from mono-substituted aromatics
ATOL2J	High-volatility SOA from mono-substituted aromatics
ATOL3J	Non-volatile SOA from mono-substituted aromatics
AXYL1J	Low-volatility SOA from poly-substituted aromatics
AXYL2J	High-volatility SOA from poly-substituted aromatics
AXYL3J	Non-volatile SOA from poly-substituted aromatics (low-NOx)
AOLGAJ	Oligomers from semi-volatile anthropogenic SOA species
AISO1J	High-volatility SOA from isoprene
AISO2J	Low-volatility SOA from isoprene
AISO3J	Acid-enhanced SOA from isoprene
ATRP1J	Low-volatility SOA from monoterpenes
ATRP2J	High-volatility SOA from monoterpenes
ASQTJ	SOA from sesquiterpenes
AOLGBJ	Oligomers from semi-volatile biogenic SOA species
AORGCJ	SOA from in-cloud oxidation of dialdehydes

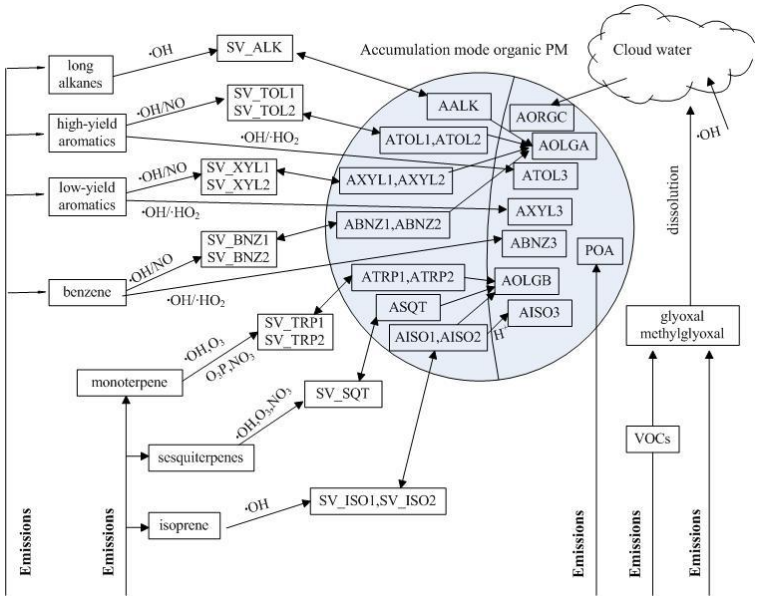

Figure S 6 Schematic of CMAQv4.7 SOA module (Carlton et al., 2010)

2. An approach used to deduct the contribution of ship-emitted primary particles

The ship-emitted primary particles exhibited a uni-modal size distribution of their number concentrations in our two cruise campaign. The mode was distributed at 25-29 nm. However, there was a small difference between these number concentration size distribution spectra, depending on the concentration. Thus, the measurements in low background number concentration days were used to establish a library of number concentration size distribution spectra of ship-emitted particles in various concentration levels.

In the cruise campaign, the observed concentration some times reflects a combination of the contributions from new particle formation, ship-emitted particles and background particles. To deduct the contribution from ship emissions, the number concentration size distribution spectrum of ship-emitted particles with the concentration at 25-29 nm same as the observed particles at the size were selected. The observed number concentrations minus the values in the selected size distribution spectrum generated the concentrations of particles from new particle formation and background particles.

References:

Carlton, A.G., Bhave, P.V., Napelenok, S.L., Edney, E.O., Sarwar, G., Pinder, R.W., Pouliot, G.A. and Houyoux, M.: Model representation of secondary organic aerosol in CMAQ v4.7, Environ. Sci. Technol., 2010, 24, 8553-8560.

Byun, D., Ching, J.:Science Algorithms of the EPA Models-3 Community Multiscale Air Quality (CMAQ) Modeling System, EPA Report 600/R-99/030, Washington DC, 1999, http://www.epa.gov/asmdnerl/models3/doc/science/science.html.