

The Impact of Taiwan's Rugged Orography on Air Pollutant Transport and the Numerical Modeling of 20 March 2018 Case

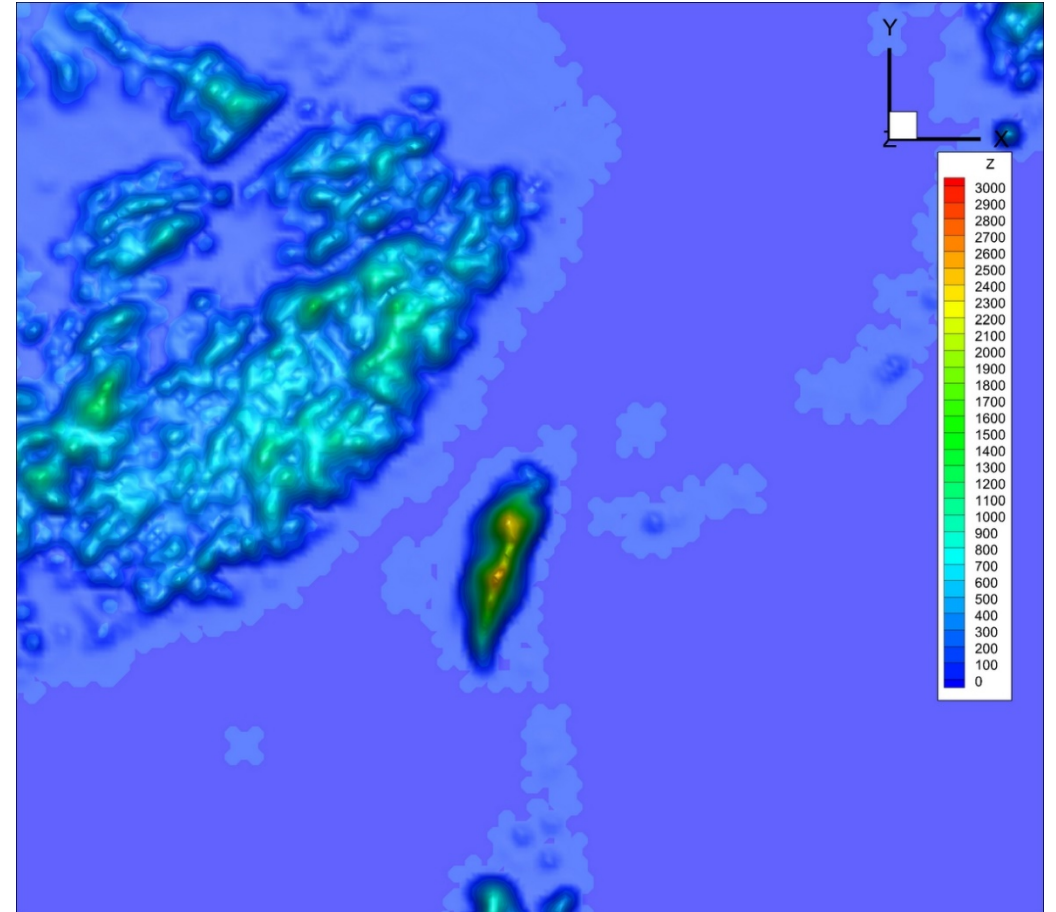
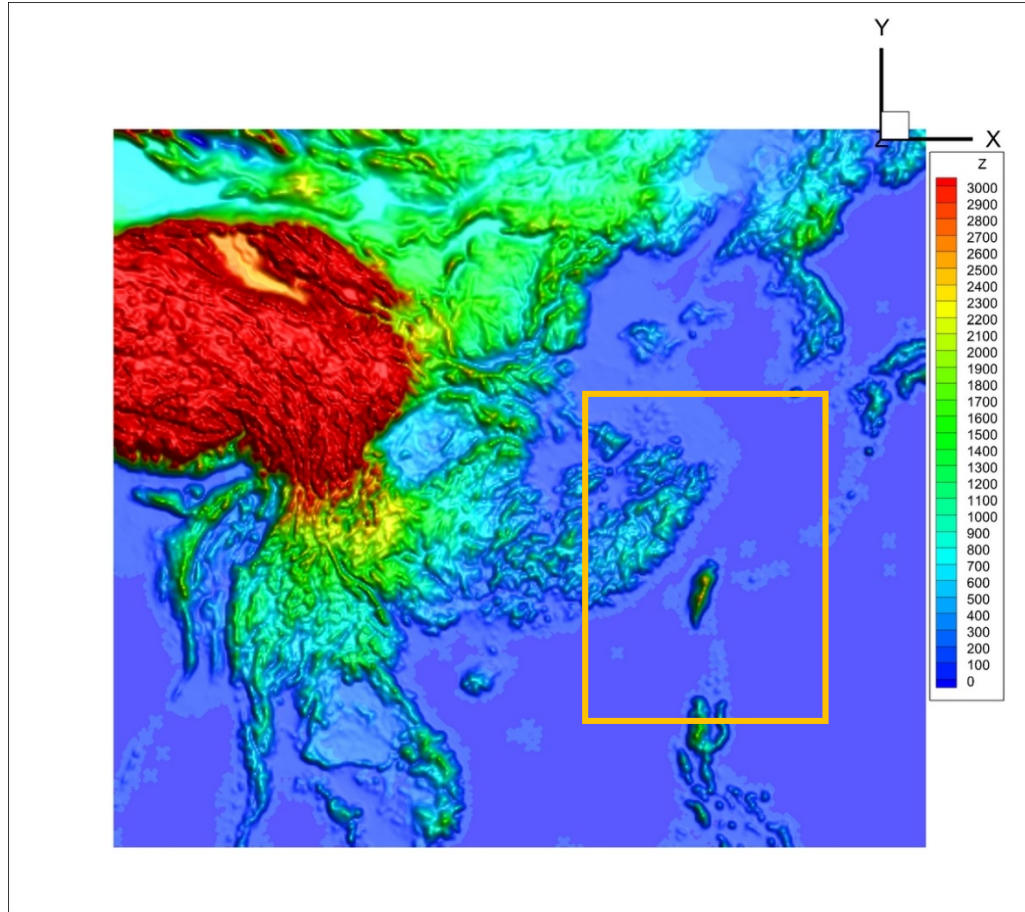
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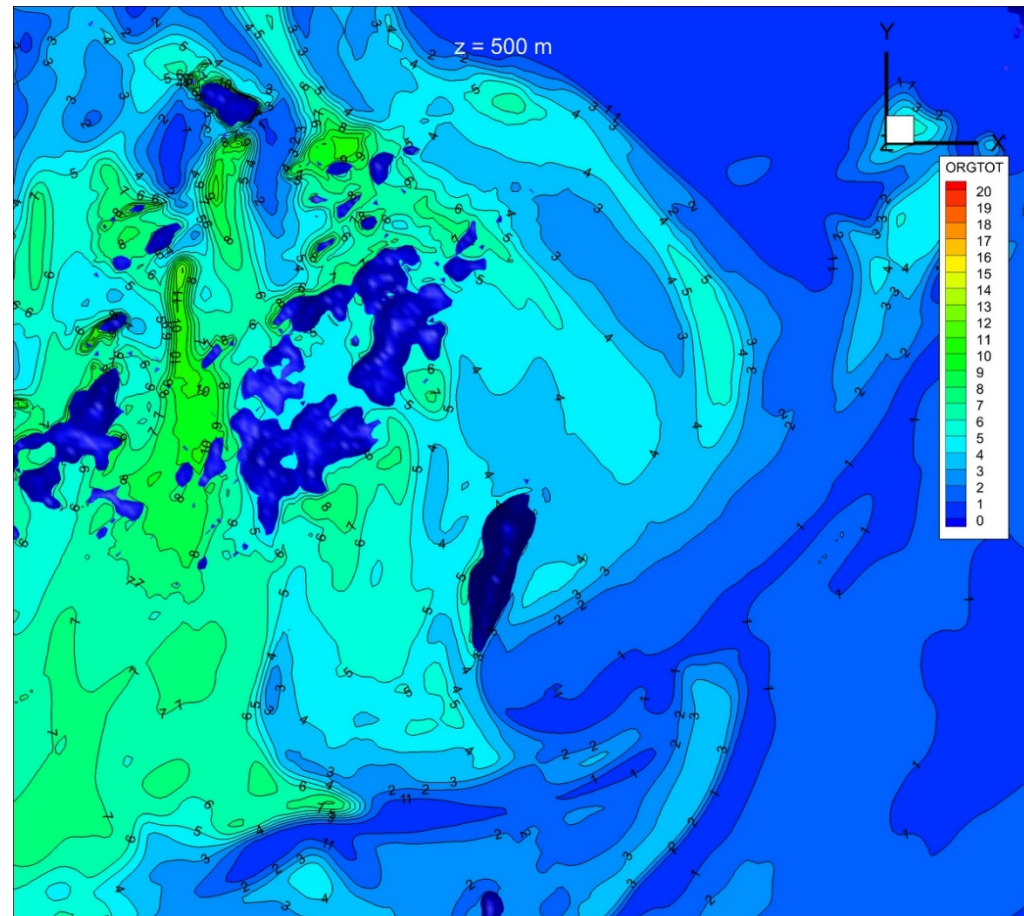
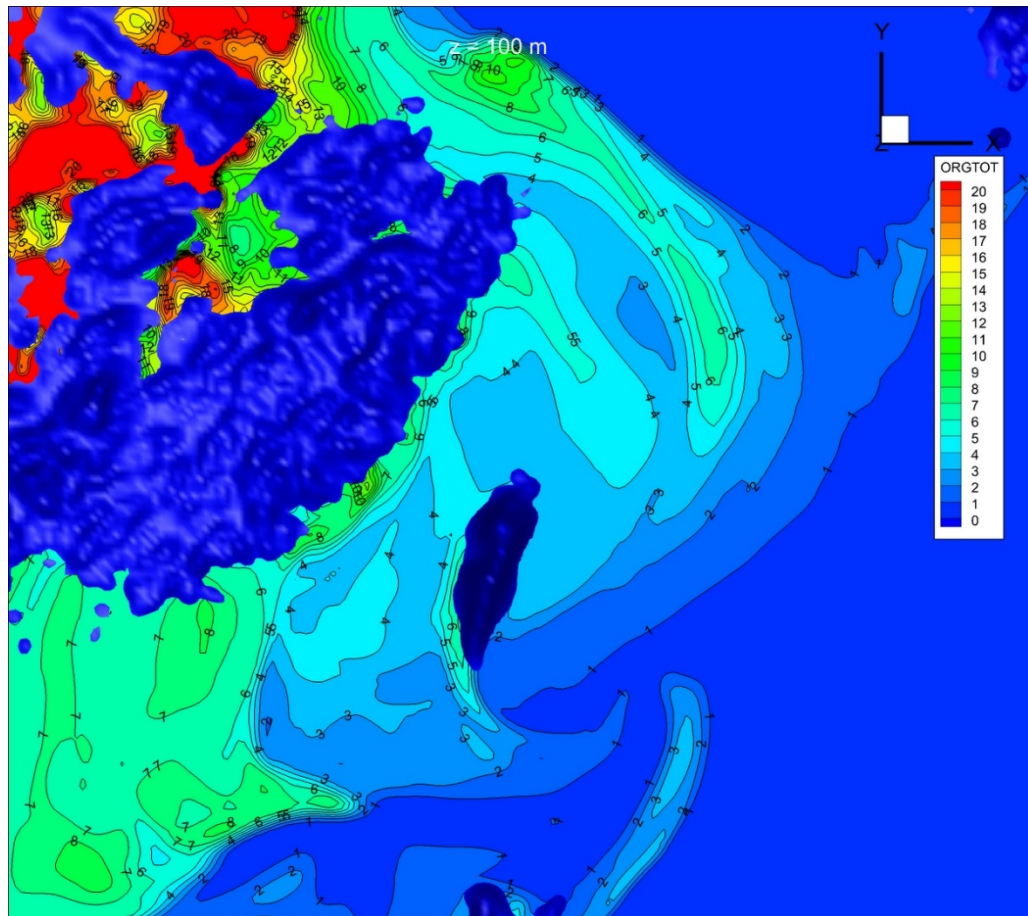
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- Taiwan has many tall mountains with 268 peaks taller than 3000 m and the highest peak is nearly 4000 m. Such rugged topography has strong impact on the air flow around Taiwan and hence the transport pattern of air pollutants. In March-April of 2018, EMeRGe-Asia used Tainan in southern Taiwan as the base to conduct airborne measurements of pollutant plumes in East Asia. This paper intends to show the impact of topography on the transport pattern. The case of 20 March 2018 is chosen and WRF-Chem simulation is performed. In this preliminary discussion, we showed a few horizontal and vertical cross-sections of the distribution of VOC. It is obvious that the patterns are quite complex and hence care must be taken to interpret observational results.

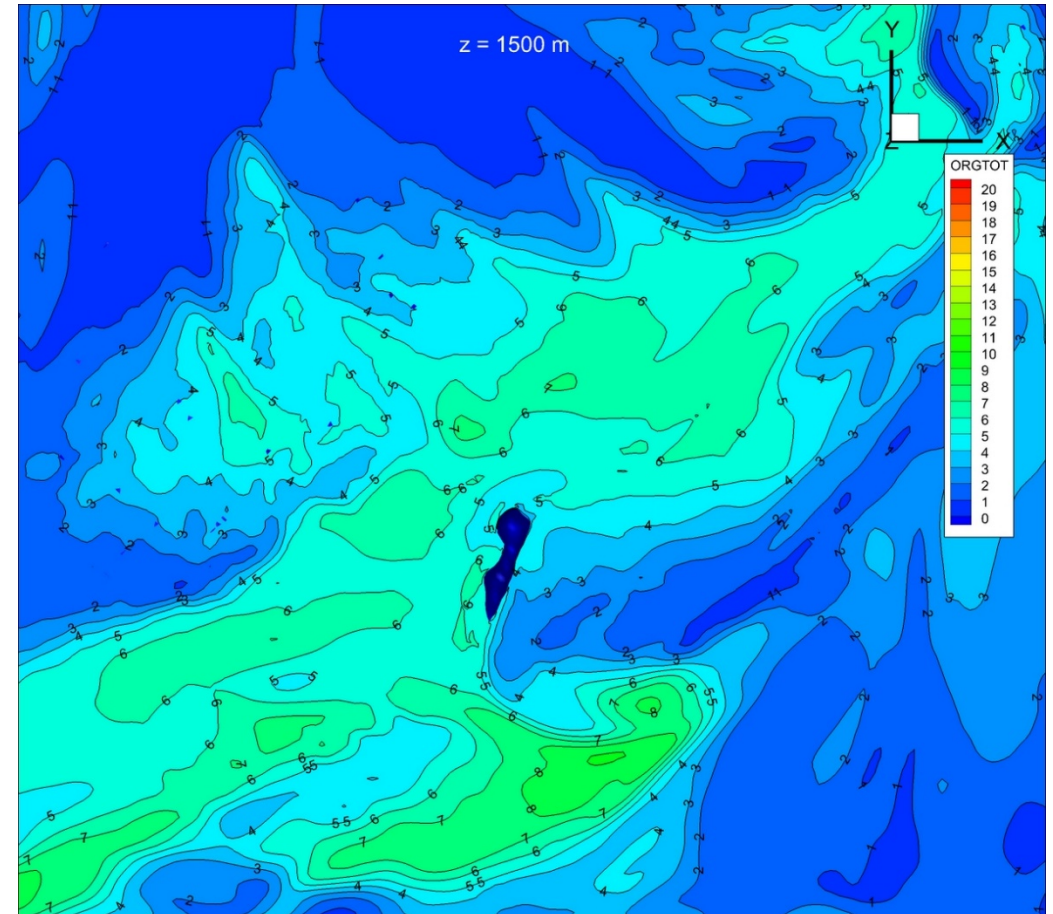
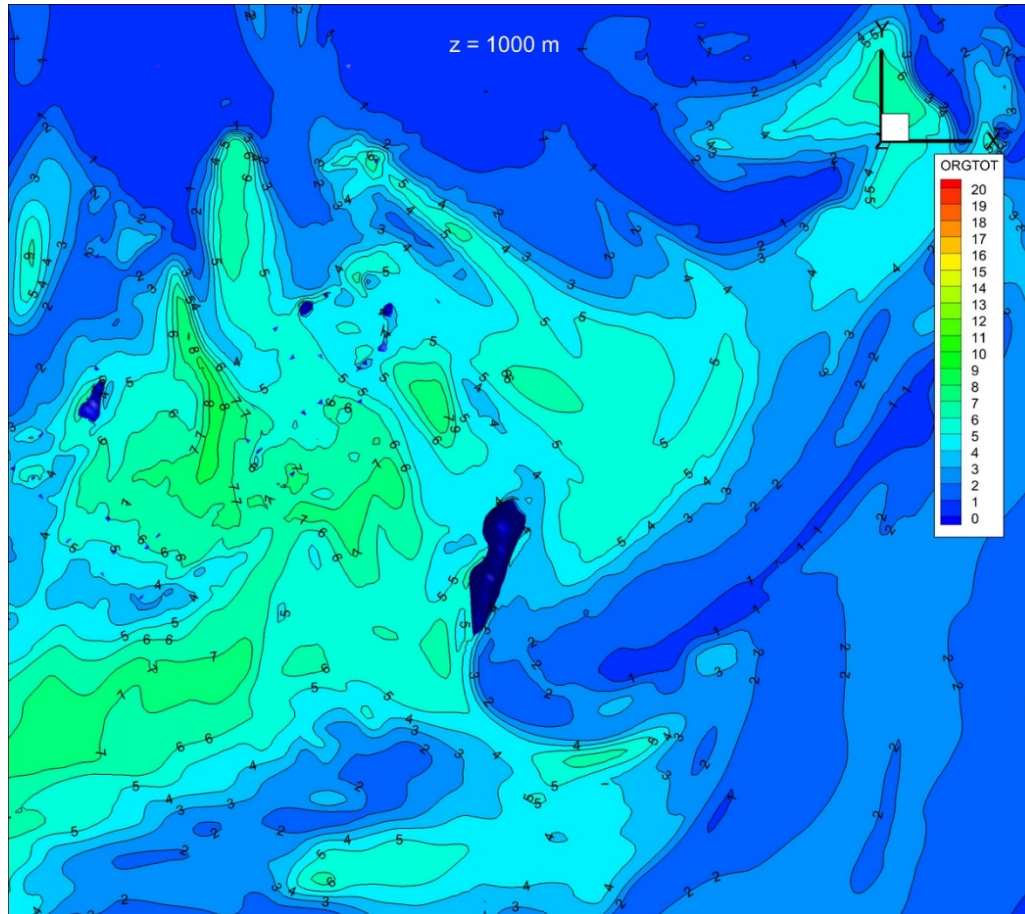
Topography represented by the model: (left) East Asia; (b) Region around Taiwan



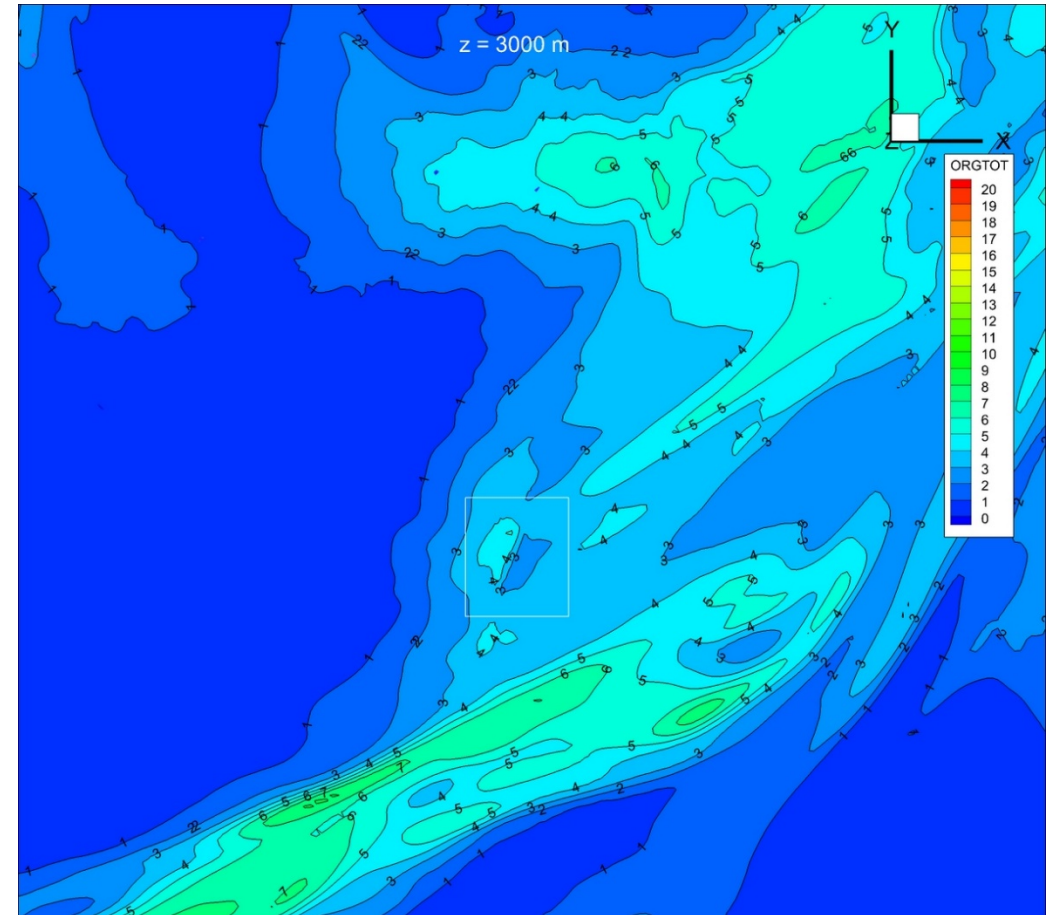
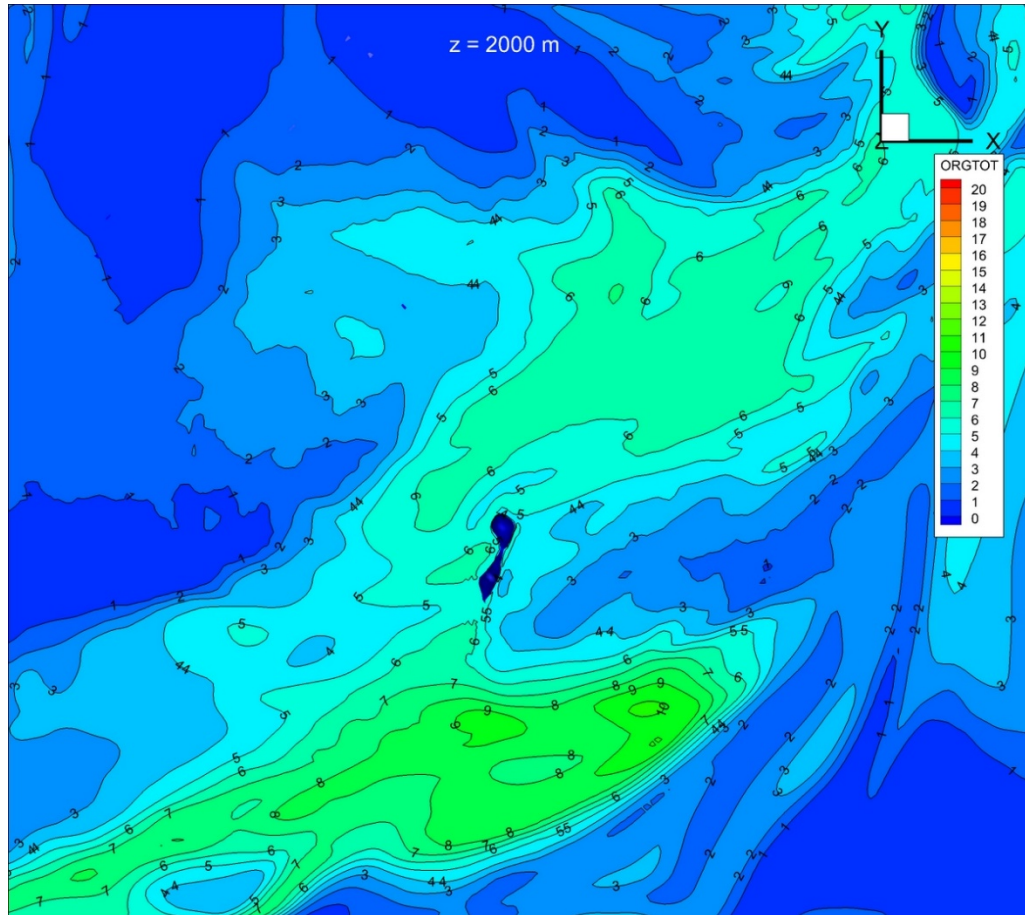
Total VOC concentration at 20 March 2018 1600 LST at $z = 100$ m (left); $z = 500$ m (right)



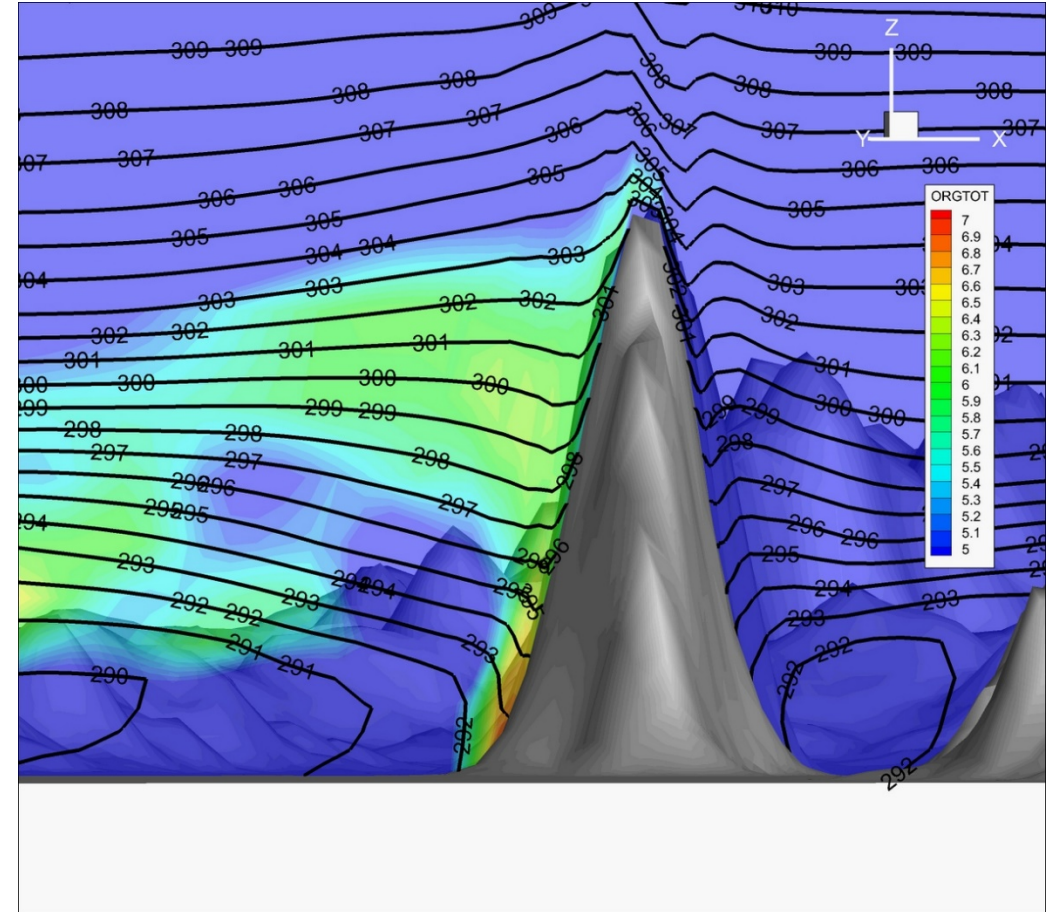
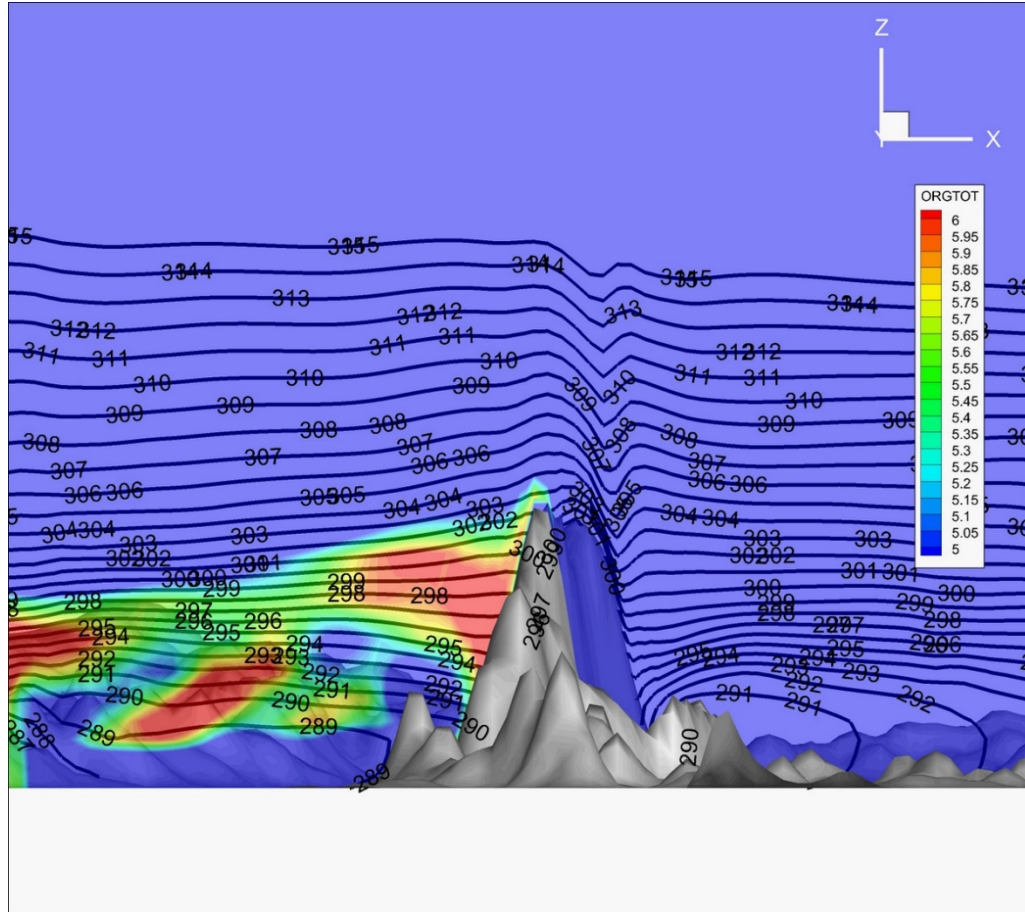
Total VOC concentration at 20 March 2018 1600 LST
at $z = 1000$ m (left); $z = 1500$ m (right)



Total VOC concentration at 20 March 2018 1600 LST at $z = 2000$ m (left); $z = 3000$ m (right)



Total VOC concentration at 20 March 2018 1600 LST vertical cross-section at (left) northern Taiwan; (right) southern Taiwan
note: scales are different. Contours are θ_e isotherms.



Summary

- In general, HALO intercepted a plume near Taiwan showing a high VOC concentration at ~ 3000 m and much lower concentration near the surface. The model results are quite consistent with the measured result (figure not shown).
- Model results appear to show that there are two plumes – one from China and the other from Indochina Peninsula region. More details need to be examined.
- The vertical cross-section shows that the vertical distribution can be rather complicated on the windward side, and not all transport are adiabatic. We need to take this into account when we examine the measurement results (ongoing work).