SUMO profile flights from BLLAST

– Flux estimates under various conditions

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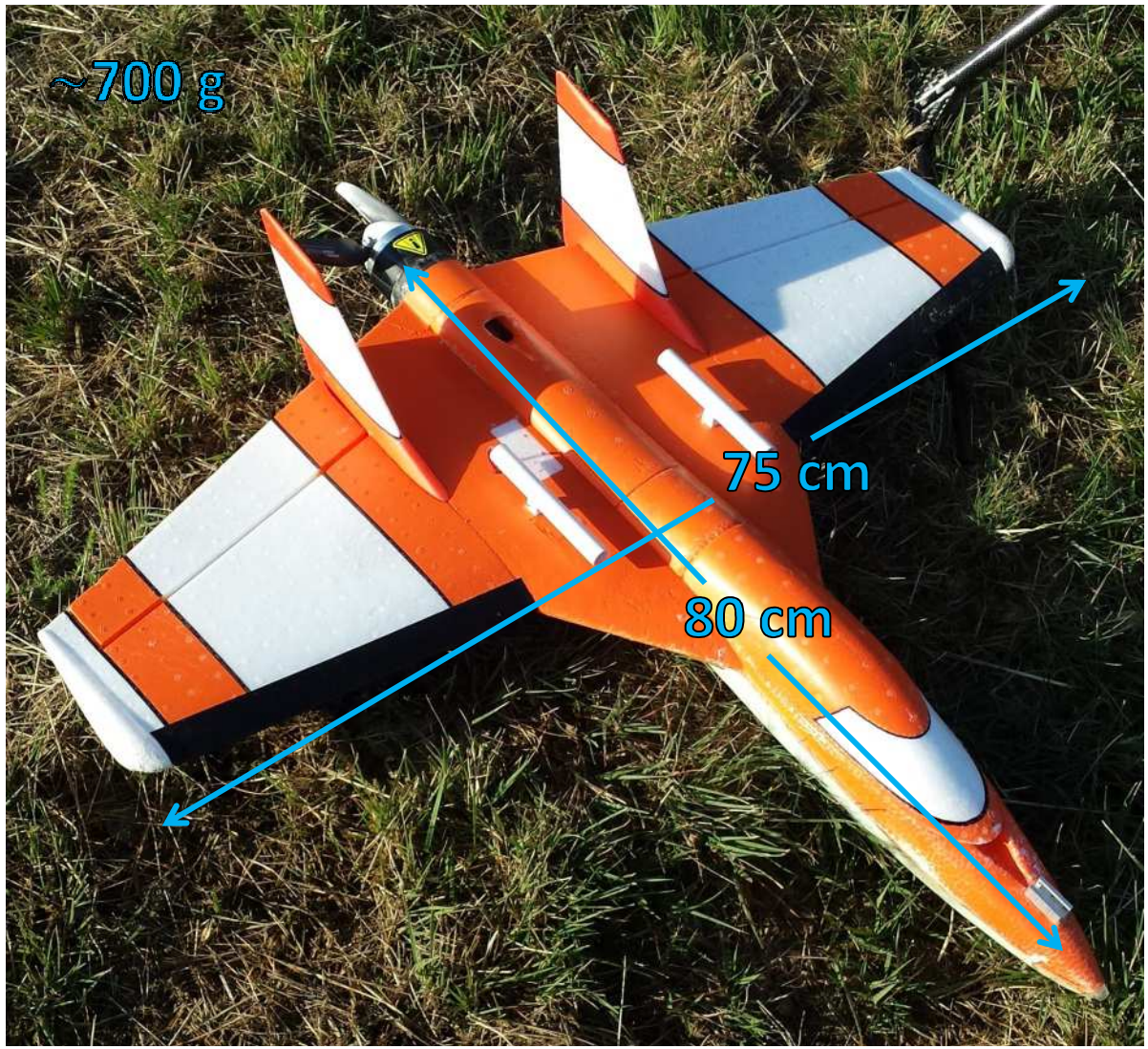
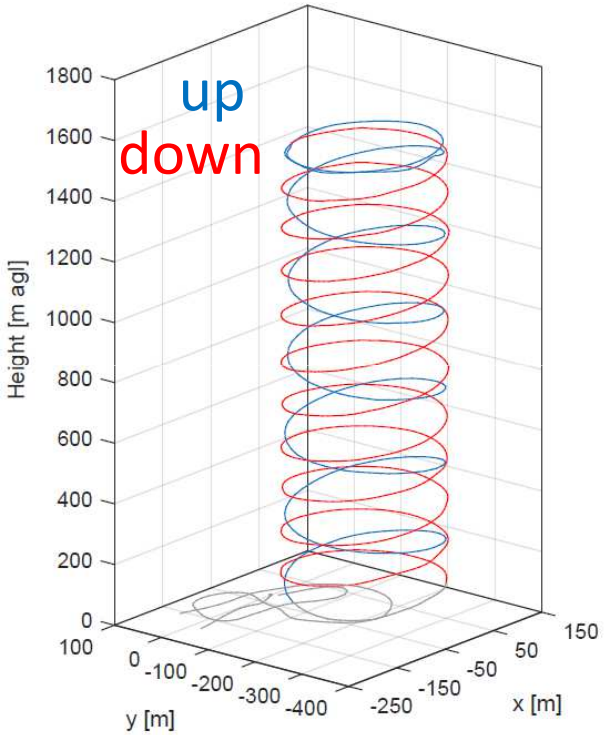
SUMO - Small Unmanned Meteorological Observer





Reuder er et al. (2016)

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Flux estimation from RPAS

Vertically-integrated horizontally averaged thermodynamic equation

$$\overline{w'\theta'}(z) = \int_z^{h_{F0}} \left(\frac{\partial \theta}{\partial t} + w \frac{\partial \theta}{\partial z} \right) \mathrm{dz}$$

$$SH = c_p \rho \overline{w'\theta'}(z) = \sum_{z/\Delta h}^{h_{F0}/\Delta h} c_p \rho \frac{\Delta \theta}{\Delta t} \Delta h \quad [\mathrm{Wm^{-2}}]$$

$$LH = L \rho \overline{w'q'}(z) = \sum_{z/\Delta h}^{h_{F0}/\Delta h} L \rho \frac{\Delta q}{\Delta t} \Delta h \quad [\mathrm{Wm^{-2}}]$$

$\Delta h = 1$ m (vertical grid spacing)
$c_p = 1004$ $\mathrm{JK^{-1}kg^{-1}}$ (spesific heat)
$L = 2.5 \times 10^6$ $\mathrm{Jkg^{-1}}$ (latent heat of vaporization)
$\rho =$ density calculated from T and p

Bonin et al. (2013), Deardorff et al. (1980)

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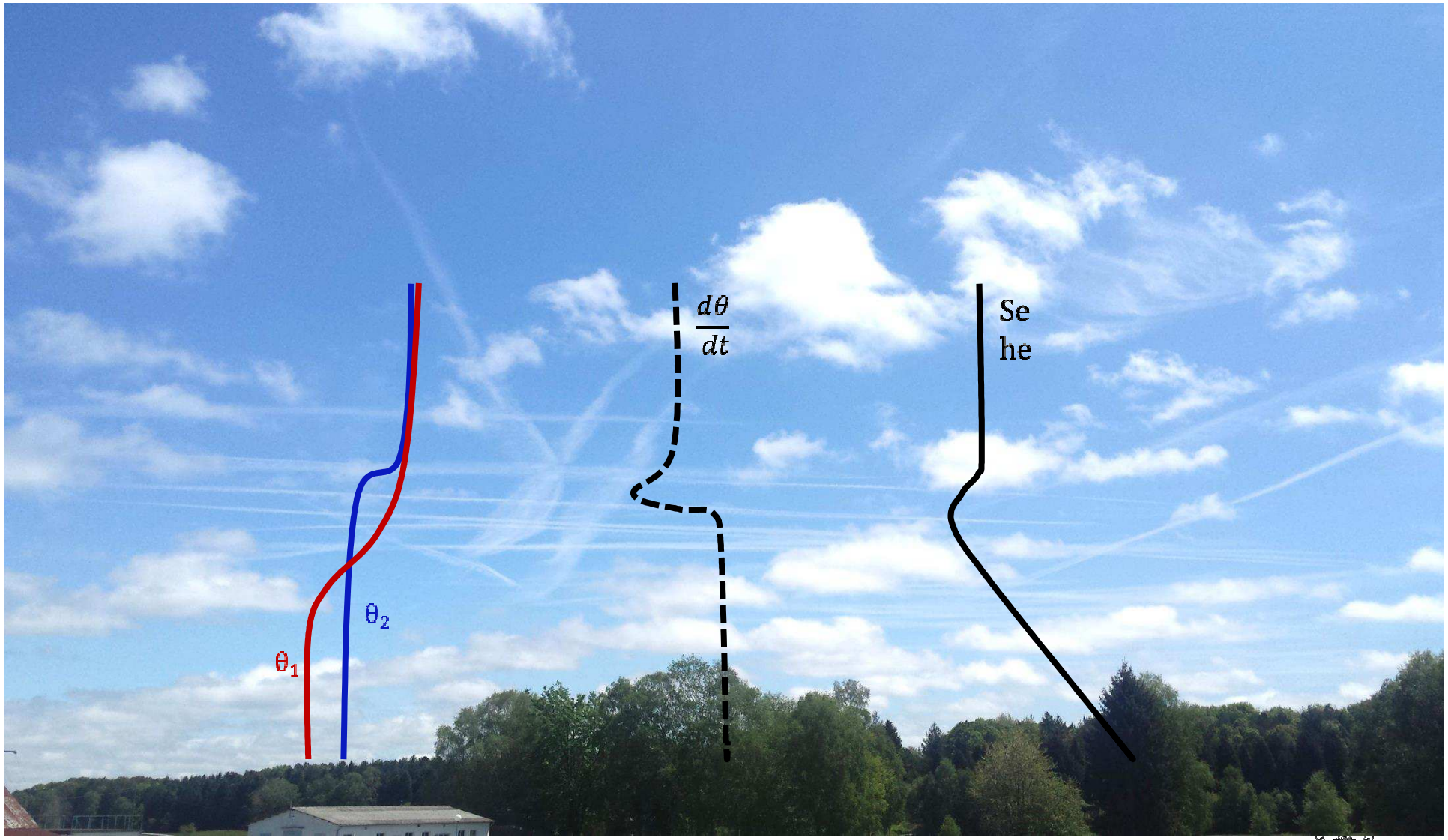
Flux estimation from RPAS



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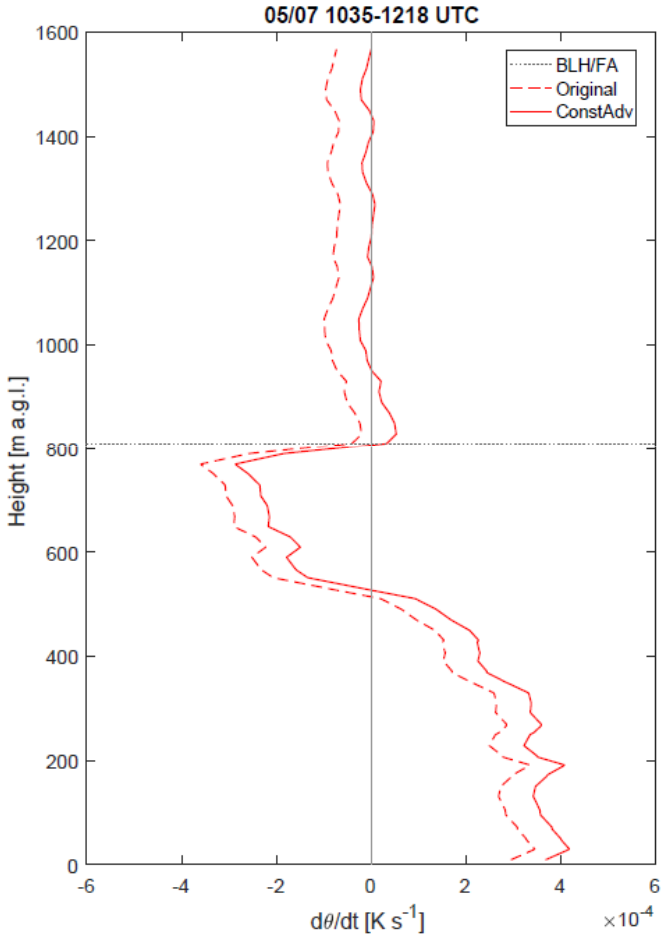
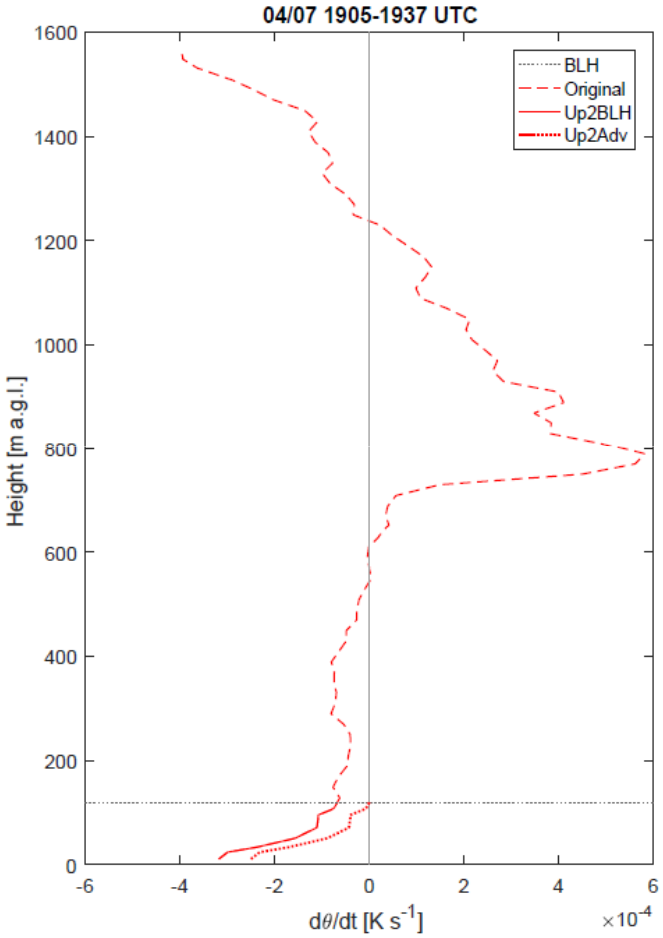
Advection correction





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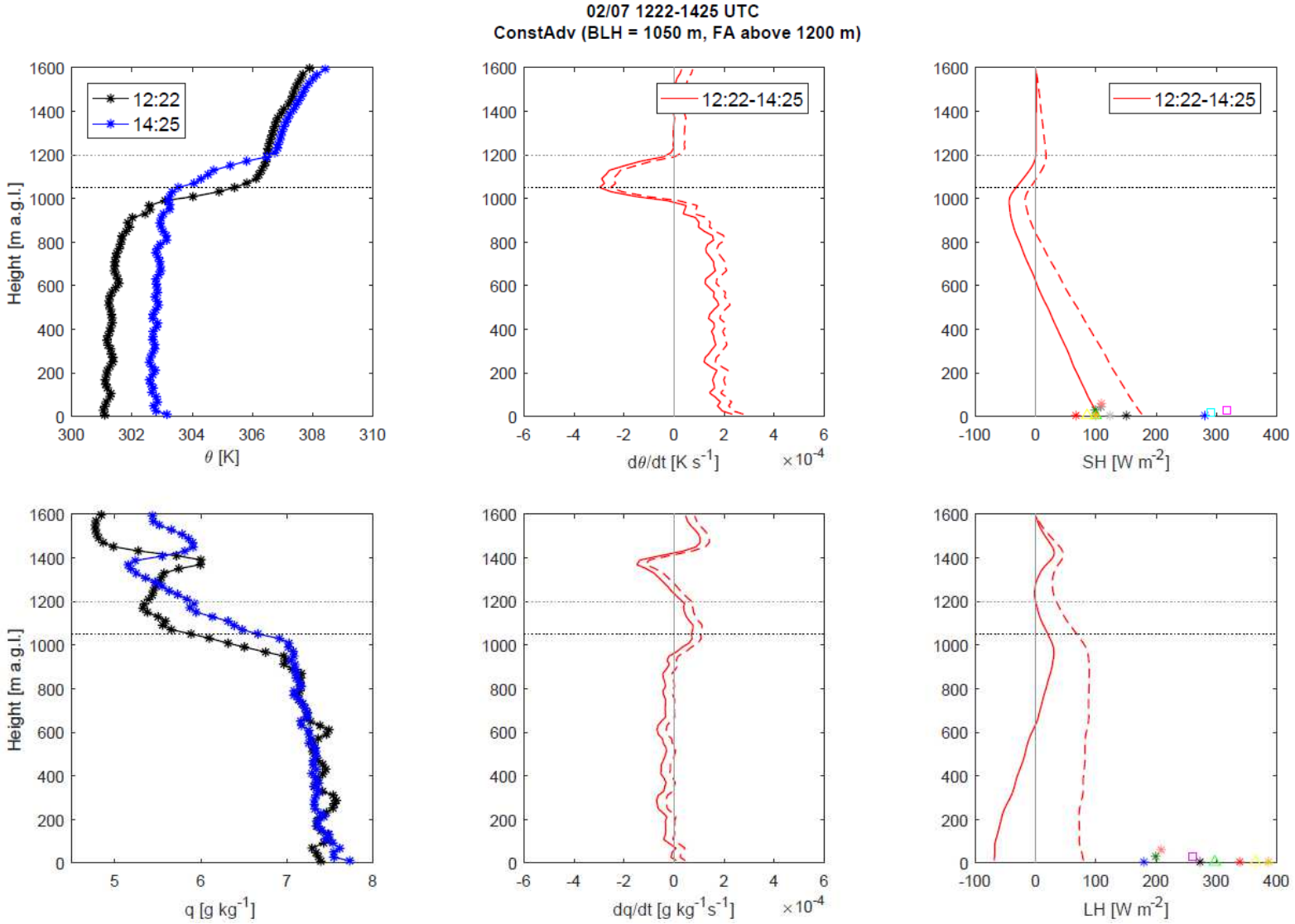
Constant advection



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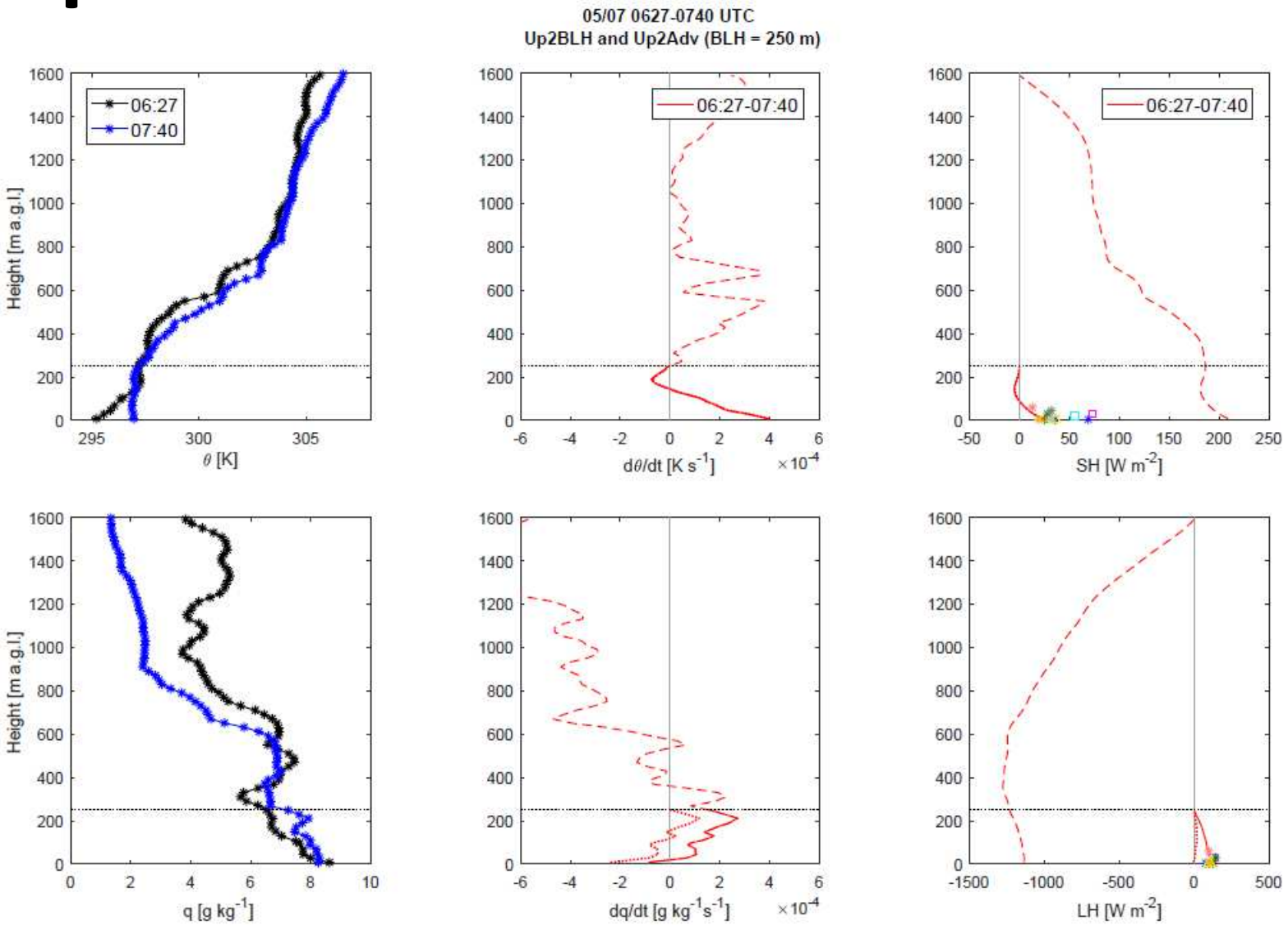
Up2BLH



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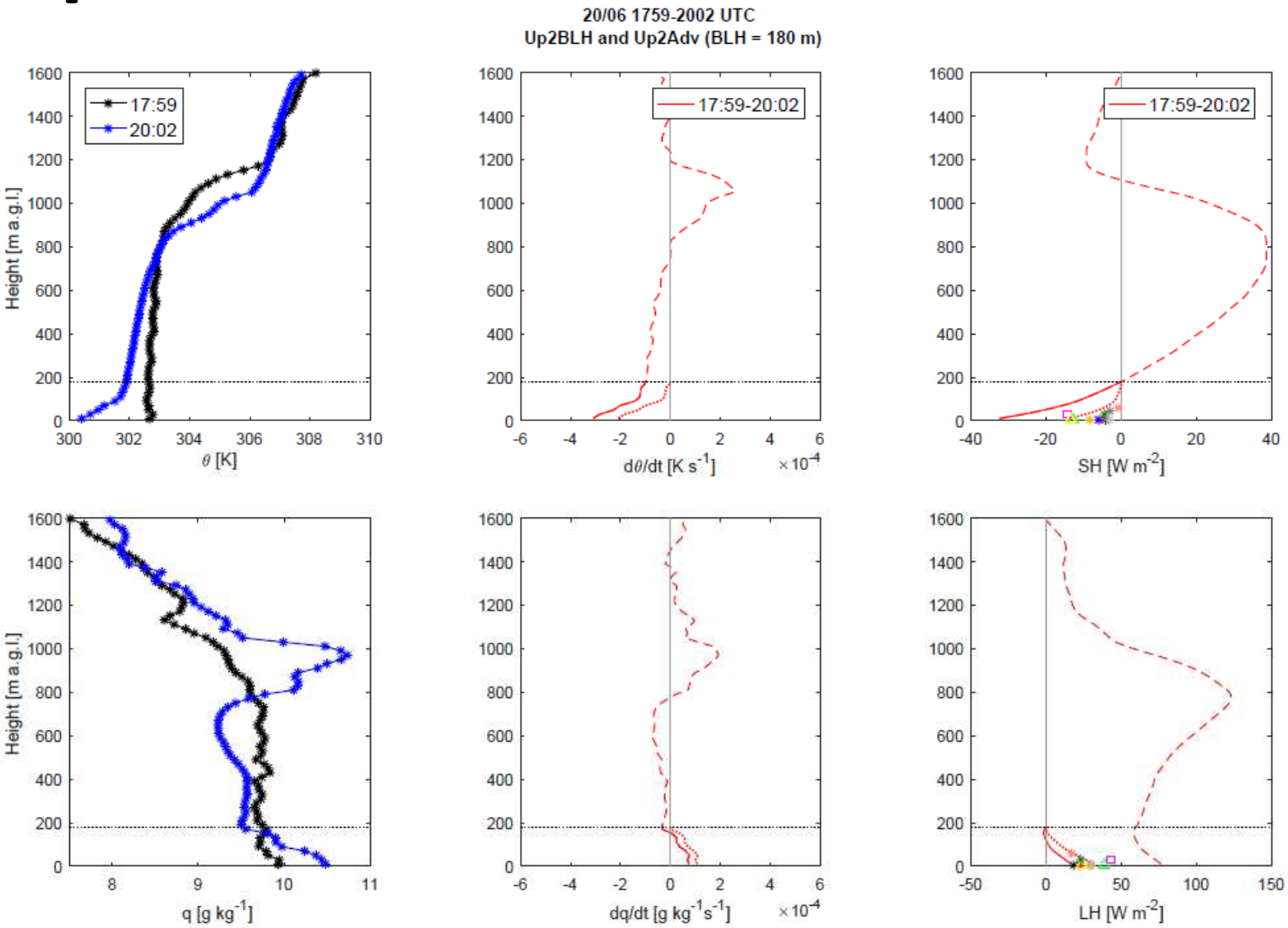
Up2Adv



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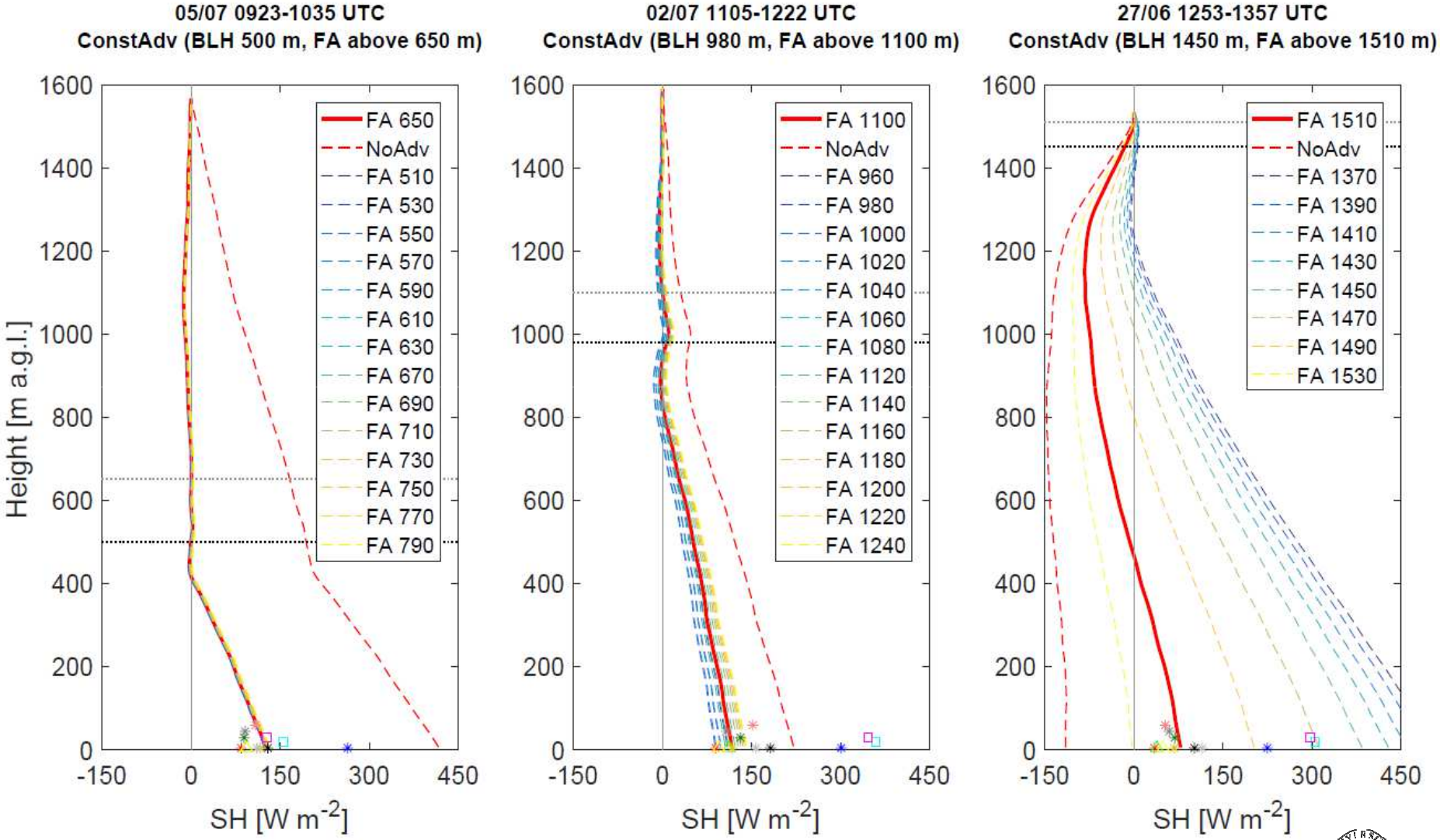
BLH and FA sensitivity



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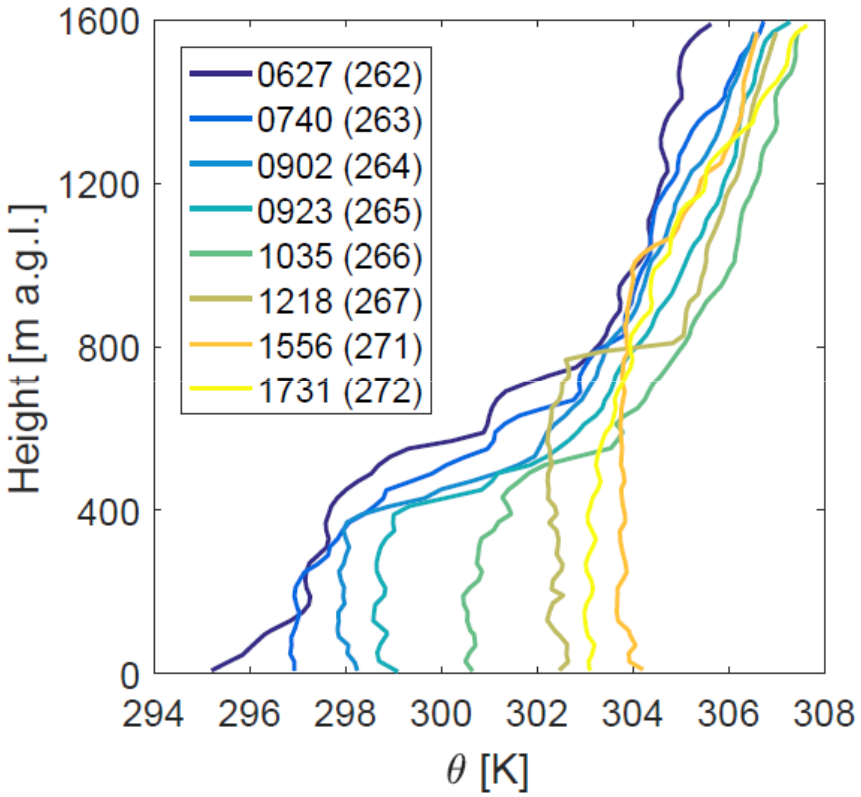
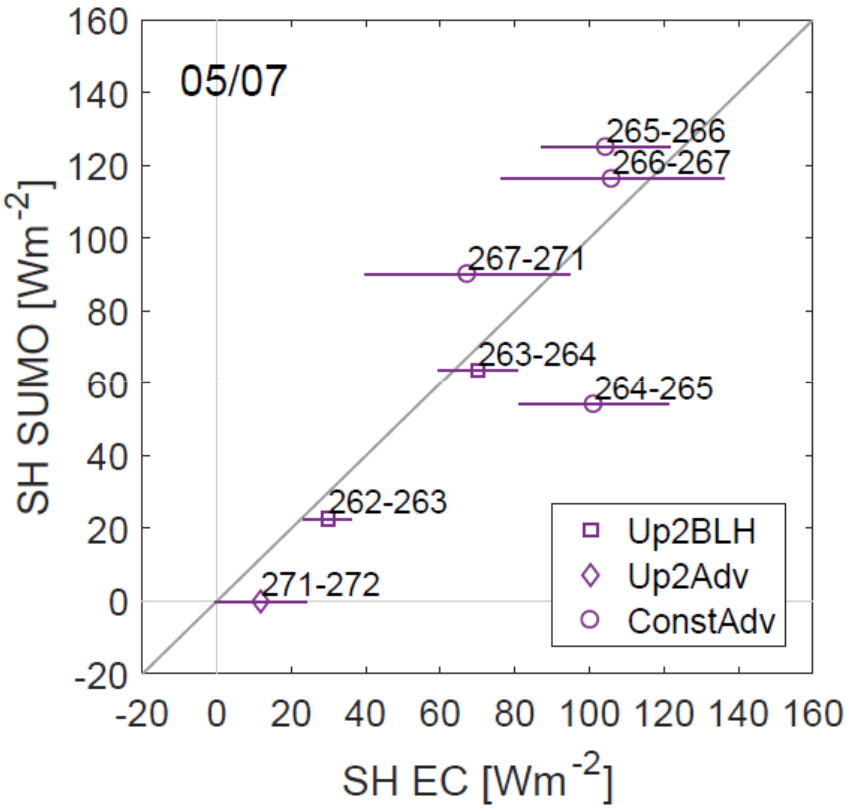
Daily evolution 05/07 (IOP11)





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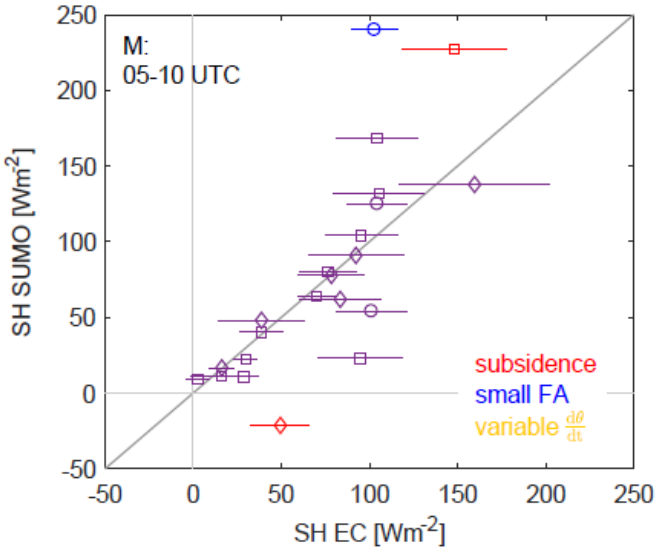
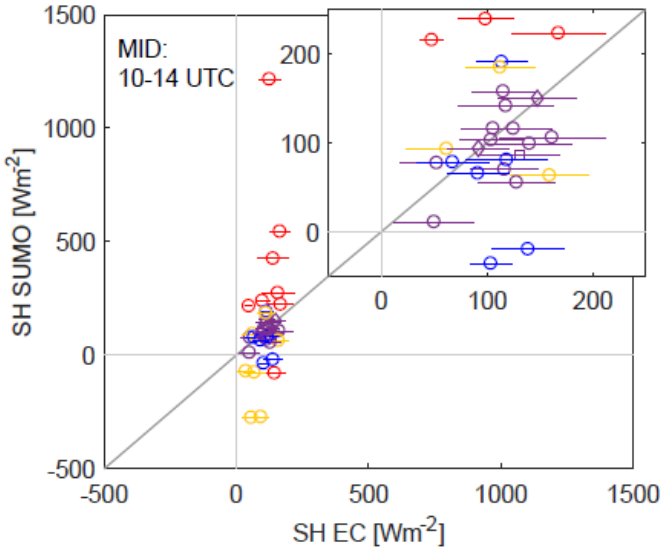
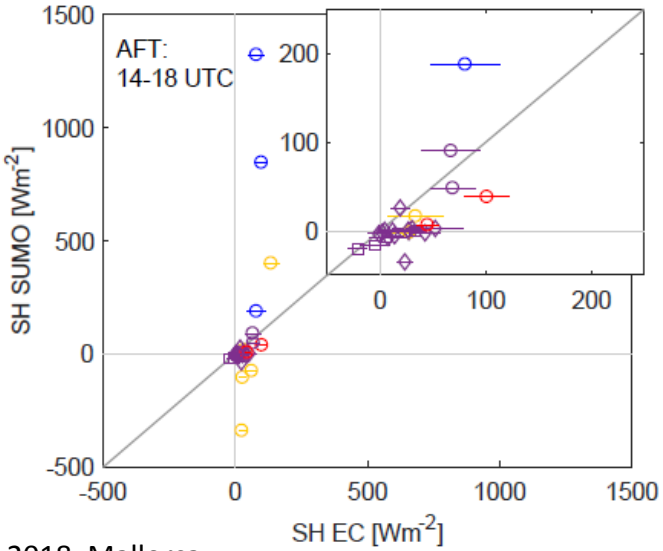
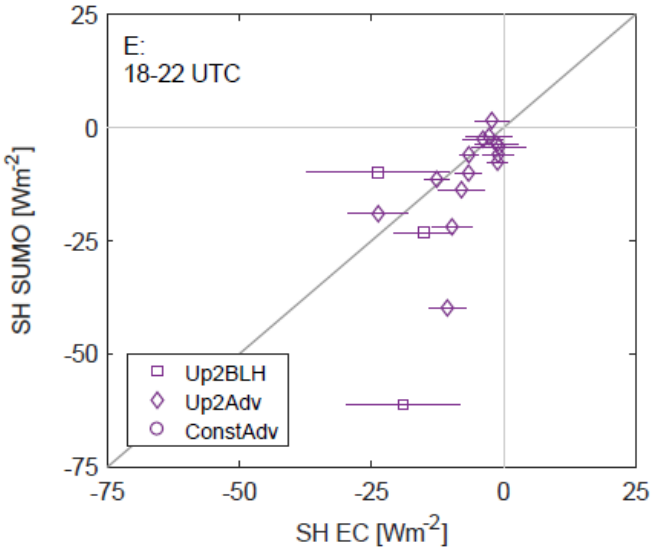
SH statistics – all 105 flux estimates









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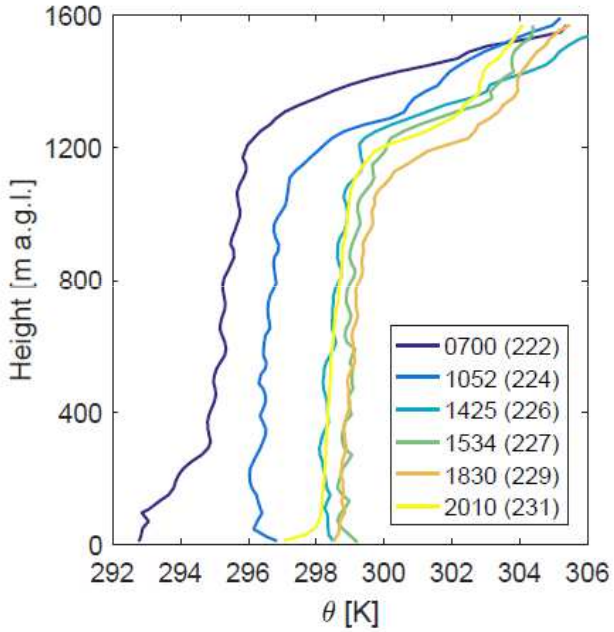
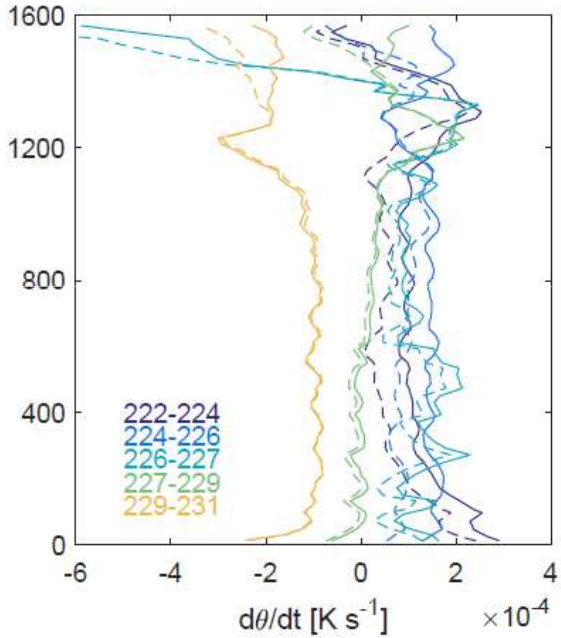
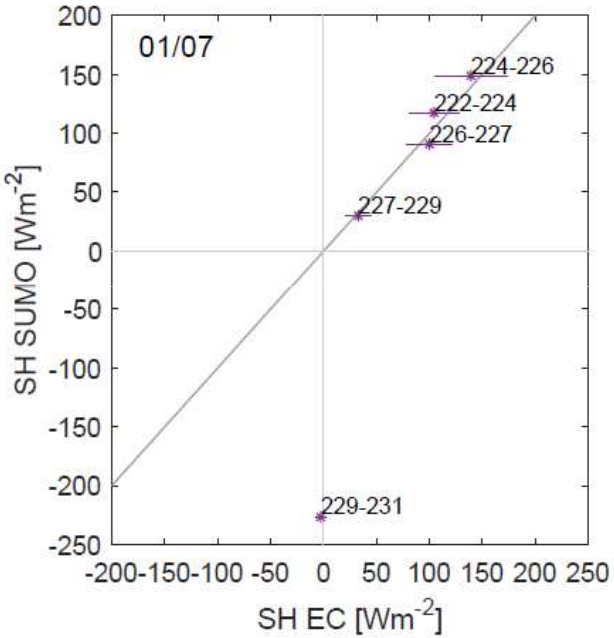
MesoNH horizontal advection







Model output provided by **M. A. Jiménez**

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Conclusions

- SH works better than LH
- ConstAdv for fully developed CBL
- Up2BLH and Up2Adv for developing CBL or SBL (with RL above)
- Can be sensitive to BLH and FA levels

- SUMO flux profiles match EC (tower and surface stations)

- Daily evolution: great fit to EC e.g. IOP3, IOP10 and IOP11*
- All flux estimates: subsidence, variable change and small FA give unrealistic results
- MesoNH model advection: good results for IOP 9*

- Limitations: footprint differences, sensor time constants

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