Aerosols, diurnal convection cycle and tropical waves

Peter Bechtold1, Alessio Bozzo1, Michael Herman2, Željka Fuchs2,3, Cathryn Birch4

(1) European Centre for Medium-Range Weather Forecasts (ECMWF); (2) New Mexico Institute of Mining and Technology; (3) University Split, (4) Leeds University and MetOffice

### 1a. New MACC Aerosol climatology

- Seasonal climatology of total aerosol OD at 550 nm in the operational model (OPER, based on Tegen et al. (1997) ) and the new MACC derived climatology (Morcrette et al. 2009).

### 1b. Impact on radiation biases and Asian Monsoon

**Summary 1** New aerosol climatology implemented in ECMWF-IFS. Main impact is to remove unrealistic aerosols over Horn of Africa and to add more realistic dust over the continents. The Asian monsoon circulation improves significantly, precipitation over West India is reduced and the middle latitudes troposphere over land is slightly cooled.

### 2a. Diurnal cycle of convection

**Phase (LST) of the diurnal cycle of precipitation during JJA as from (a) GPCP2.2 and an experiment without diurnal cycle convective closure and (b) with and without diurnal cycle convective closure. From 15-year seasonal integrations with and without the convective closure for the diurnal cycle. Statistical significant differences are denoted by the hatched areas.**

**Summary 2** An accurate representation of the diurnal cycle of convection is not only important for accurate (medium-range) forecasts of mesoscale convective systems and the convection synoptic flow feedback, but also for seasonal and climate predictions of monsoons, in particular the northward propagation of the African summer monsoon. Currently, the daily peak in precipitation is realistic but convective activity is on average too weak during early night-time. This implies an insufficient meridional moist static energy gradient. The afternoon near-surface humidity errors (dry bias) are significantly improved with a realistic diurnal cycle.

### 2b. Diurnal cycle, Monsoon and dry bias over land

**JJA difference in total precipitation (mm/day) between (a) GPCP2.2 and an experiment without diurnal cycle convective closure and (b) with and without diurnal cycle convective closure. From 15-year seasonal integrations with and without the convective closure for the diurnal cycle. Statistical significant differences are denoted by the hatched areas.**

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### 3. Tropical waves and convection feedback

- **Observed as well as (b) Rossby and (c) Kelvin filtered Outgoing Longwave Radiation (OLR) using 90-days ECMWF analysis and forecast for 9 March 2015.**

**Summary 3** Wavenumber-frequency band filtering of the OLR is used to extract the large-scale Rossby and Kelvin waves. Vertical structure and wave composites for different variables are then obtained by regression. Both the ERAI reanalyses and IFS seasonal forecasts reproduce the observed waves. The Kelvin wave controls convection by subsiding gravity motions ahead generating CIN, while the convective heating coincides with the upper-level warm anomaly generating potential energy and converting it into kinetic energy.