International Workshop on "fine-scale rainfall estimation"

Leuven, 16 April 2012

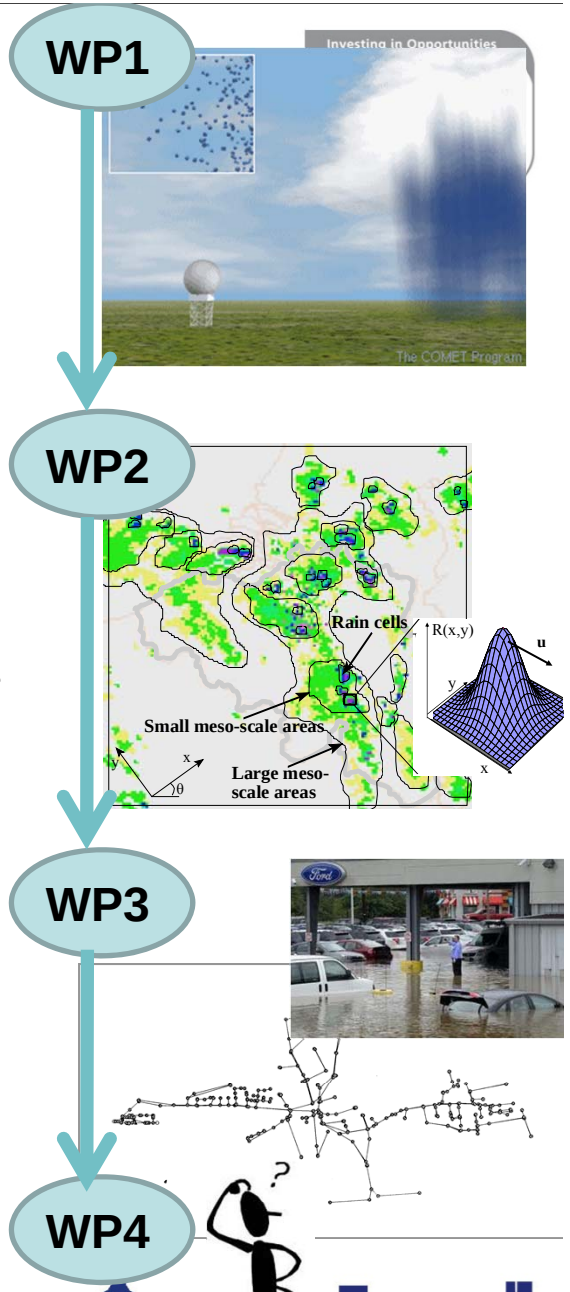
WP2: Fine-scale rainfall data acquisition and prediction:

Objective: develop and implement a system for estimation and forecasting of fine-scale (100m, minutes) rainfall

- Rainfall estimation: combining data from radars (X & C-band) and rain gauges
- Rainfall forecasting: combining with numerical weather prediction

✓implement and test for pilot sites (Leuven, Paris, Rotterdam, London)

✓applicable for urban areas of North-West Europe: guidelines, demonstrations, training, …



WP2: Fine-scale rainfall data acquisition and prediction:

Actions:

WP2 A5 & A6: Rainfall estimation

- A5: Workshop on radar technology, calibration and rainfall estimation (Leuven, 16 April 2012)
  - ✓ Outcome: recommended methods for fine-scale rainfall estimation (combining/integrating rain gauges, X-band, C-band + uncertainty)

- A6: rainfall estimation in pilot sites
  - ✓ Outcomes: fine-scale rainfall estimates for recent storms in pilot sites + comparison with traditional rainfall estimates (without radar)

WP2: Fine-scale rainfall data acquisition and prediction:

Timing:

- ✓ WP2 A5: rainfall estimation workshop: Leuven, 16-17 April 2012
- ✓ WP2 A6: autumn 2012 – spring 2014: all pilot sites
- ✓ WP2 A7: rainfall forecasting workshop: spring 2014
- ✓ WP2 A8: spring 2014 – spring 2015: all pilot sites
- ✓ WP2 A9: once a year: National Observer Meetings

Workshop topics
16 april

- Topic 1: X-band and C-band radar calibration : methods and experiences
- Topic 2: X-band versus C-band performance : experiences
- Topic 3: Integration of X-band, C-band and rain gauge measurements : methods and experiences
- Topic 4: Fine-scale rainfall estimation : recommendations and guidelines

Workshop focus 16 april

- On interfacing between radar meteorology / technology and application in urban hydrology
- On high resolution radar (X-band, super-resolution C-band) and interfacing with larger scale C-band
- On fine-scale rainfall estimation (later workshop: nowcasting/forecasting and integration with NWP)
- On interfacing between research and practise

Guidelines fine-scale rainfall estimation

- “Guidelines” (overview report) with methods and experiences (transferring knowledge from radar meteorologists to urban hydrologists)
  - To be prepared by Laurens Cas Decloedt (KU Leuven)
  - Distributed among experts for comments
- Recommendations depending on radar type
- Applications in pilot sites / allow intercomparisons

Guidelines fine-scale rainfall estimation

- Electronic radar calibration: make registered power equal to real receiving power of signal (electronic stability)
- Corrections required:
  - Noise cutoff
  - Clutter removal
  - Attenuation correction
  - Volume / vertical profile correction (e.g. over/undershooting)

Guidelines fine-scale rainfall estimation

- Scanning strategy:
  - beam width/resolution
  - speed/frequency:
    - slower: more accurate
    - quicker: fast moving, changing convective storms better captured
  - pulse length

Guidelines fine-scale rainfall estimation

- Rainfall estimation:
  - Based on:
    - Reflectivity (Z)
    - Differential reflectivity (Z_{DR}): better relationship with DSD
    - Differential phase (K_{DP}): to estimate attenuation, strong K_{DP} – R relationship when R is high
  - Errors due to highly non-linear physics of radar detection of precipitation:
    - Electronic stability radar
    - Detection range, ground clutter, blockage
    - Anomaly echoes
  - Dependence on atmospheric conditions (rain regimes, wind, humidity, temperature, …)
  - Influence of radome
  - Use of disdrometer

Guidelines fine-scale rainfall estimation

- Differences in types of radar technology:
  - Dual pol versus simple-pol
  - Fine versus coarser resolution
    - X-band
    - C-band: high resolution possible (increase scan speed, sharpen beam)
    - But: what is preferred: increase resolution or increase accuracy same resolution?? (urban hydrology application driven)

Guidelines fine-scale rainfall estimation

- Ground truthing / adjustment:
  - First correction for different types of radar “errors” before adjustment based on rain gauges
  - Take rain gauge uncertainty into account (5-20% depending on type of precipitation)
  - Grid-scale versus point scale: comparison at point scale or grid scale / urban area scale? (e.g. kriging)
  - Downscaling / upscaling (spatial interpolation) needed
  - Static versus dynamic adjustment methods
  - Use of sewer observations?

Guidelines fine-scale rainfall estimation

- Fine-scale rainfall estimation:
  - Integration of all sources: C-band radar, X-band radar, rain gauges, even microwave links
  - Integration rainfall products requires quality of data to be considered (is time, space variable)
  - Several integration methods exist: mean field bias / Brandes correction / kriging (with external drift) / Kalman filter
  - Scale dependent variability needs to be considered
  - Stochastic downscaling methods (scaling laws, fractal theory)