

# The value of data assimilation for research satellites

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## Operational vs Research satellites

### Operational:

Used by NWP centres - objective is to improve weather forecast -> measure dynamical quantities (temperature & humidity)

Continuity/heritage (NOAA-17...)

Near-real-time (NRT): typically within 3 hours

### Research:

Used for research - objective is to study key issues (ozone hole; climate change...) -> measure a range of quantities, both dynamical & chemical (ozone, ...)

Often one-off: continuity for Envisat/Aura -> Metop, GMES Sentinels?

Often not NRT (useless for NWP); BUT recent use of research satellite data (GOME, Envisat) - HIRDLS?

# Importance of satellite observations at ECMWF

ECMWF satellite data  
Courtesy J.-N. Thépaut

## ● A few figures:

- ~ 99% of the observations confronted to the ECMWF quality control/screening are satellite data
- ~ 90 % of the observations actively assimilated in the ECMWF system are satellite data

## ◆ However,...

- A large number of currently available observations are not used (96% rejection rate)
  - ◆ Quality control
  - ◆ Representativeness error (thinning)
  - ◆ poor representation of surface emission (land and s/ice)  
poor representation of clouds/aerosols/rain
  - ◆ etc...

## Future plans

- Core operational missions will remain priority number one:
  - ◆ consolidation of the exploitation of high spectral resolution IR sounders:
    - preparation for METOP/IASI and NPOESS/CrIS
  - ◆ exploitation of microwave sounders and imagers
    - ATMS, SSMIS, CMIS,...
  - ◆ More aggressive use of radiances over land
- New research missions offer new opportunities
  - ◆ ADM (Doppler Wind Lidar)
  - ◆ SMOS (soil moisture and ocean salinity)
  - ◆ AQUA train (clouds, radiation, aerosols, etc...)
- NEW projects: GEMS (*see Hollingsworth paper*), Rainclouds,...

## Benefits from research satellites

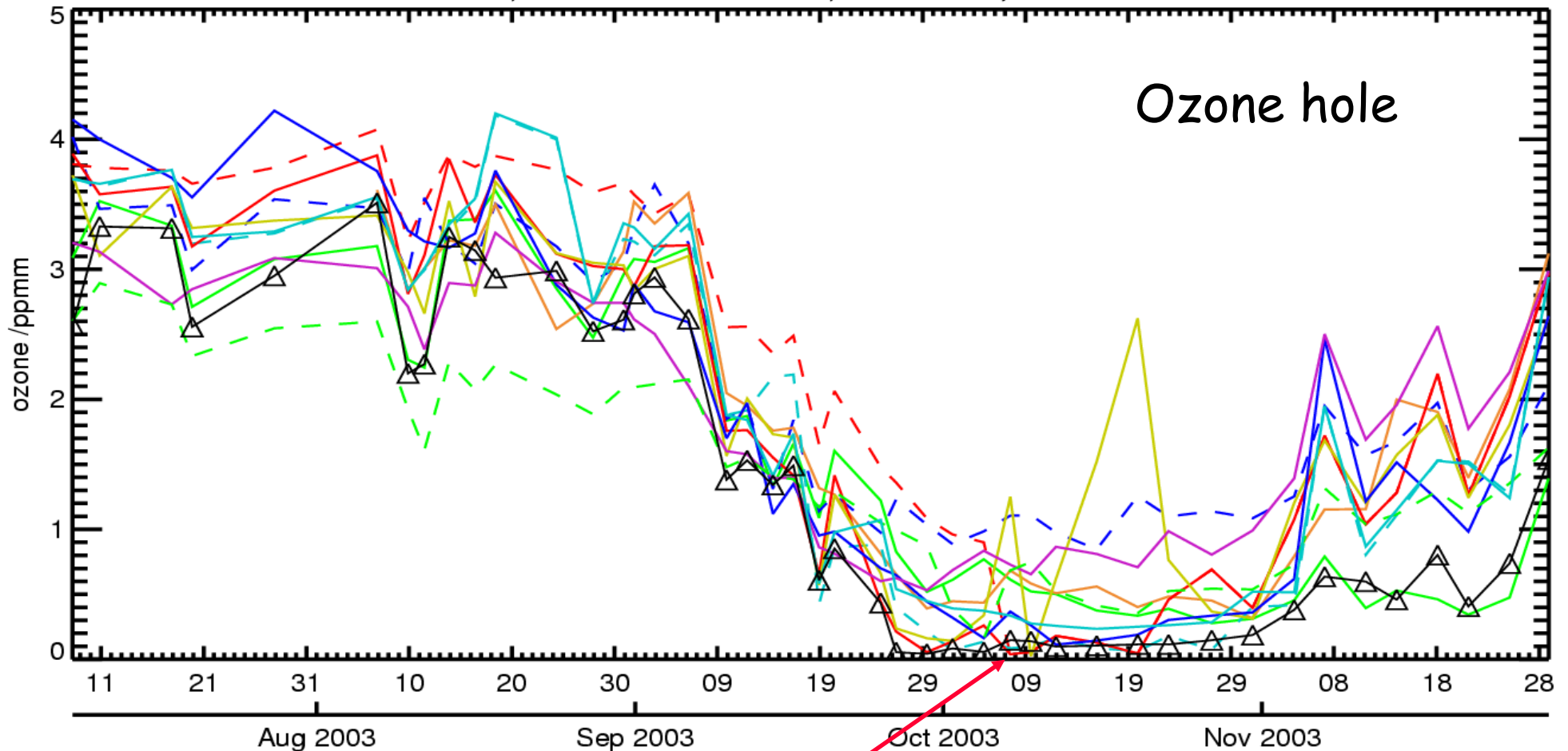
- Novel data types: ozone (for NWP) -> radiative transfer (nadir radiances); wind information; UV forecasts
- Synergy: e.g. limb/nadir -> information on tropospheric ozone; relatively high vertical resolution of limb sounders
- Information to help make chemical forecasts: tropospheric ozone -> air quality (GMES)
- Research satellite of today -> operational satellite of tomorrow

Interest in research satellites by the NWP agencies make them more attractive to the EO community

Differences between research and operational satellites becoming blurred: e.g. use of Envisat data

## Benefits from data assimilation

- Evaluate mission: pre-launch -> post-launch (quantify benefits)
- Confront models with observations (operational/research satellites) -> quantify errors, improve use of observations, evaluate model errors
- Add value: better observations (monitoring), better models (forecasting, climate), better estimates of state of atmosphere (monitoring, science)



Ozone hole

ECMWF assimilate MIPAS ozone

Example from: Geer et al., ACPD, 2006

- ECMWF operational
- ECMWF MIPAS
- DARC/Met Office UM
- KNMI SCIA profiles
- KNMI TEMIS
- BASCOE v3d24
- BASCOE v3q33
- MOCAGE-PALM Cariolle v2.1
- MOCAGE-PALM Reprubus
- Juckes
- MIMOSA
- Logan/Fortuin/Kelder climatology