The Final Countdown: Status and Preparation of the WWRP RDP COPS

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- **COPS region and research goal**
- **Instrumentation**
- **Mission Planning**
- **Action items for this workshop**

COPS (Convective and Orographically-induced Precipitation Study)

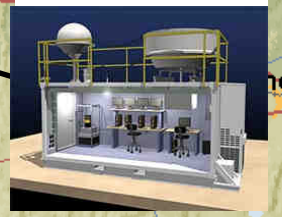
PQP
Praecipitationis
Quantitativae
Praedictio

Goal: Advance the quality of forecasts of orographically-induced convective precipitation by 4D observations and modeling of its life cycle

Region: Southwestern Germany, eastern France
Date: 1 June – 31 August 2007
Features: Severe thunderstorm activity but low QPF skill
Information: www.uni-hohenheim.de/cops/

COPS „Natural convection laboratory“
Area (270 x 150 km²)

ARM Mobile Facility



Supersite

Cases and phases

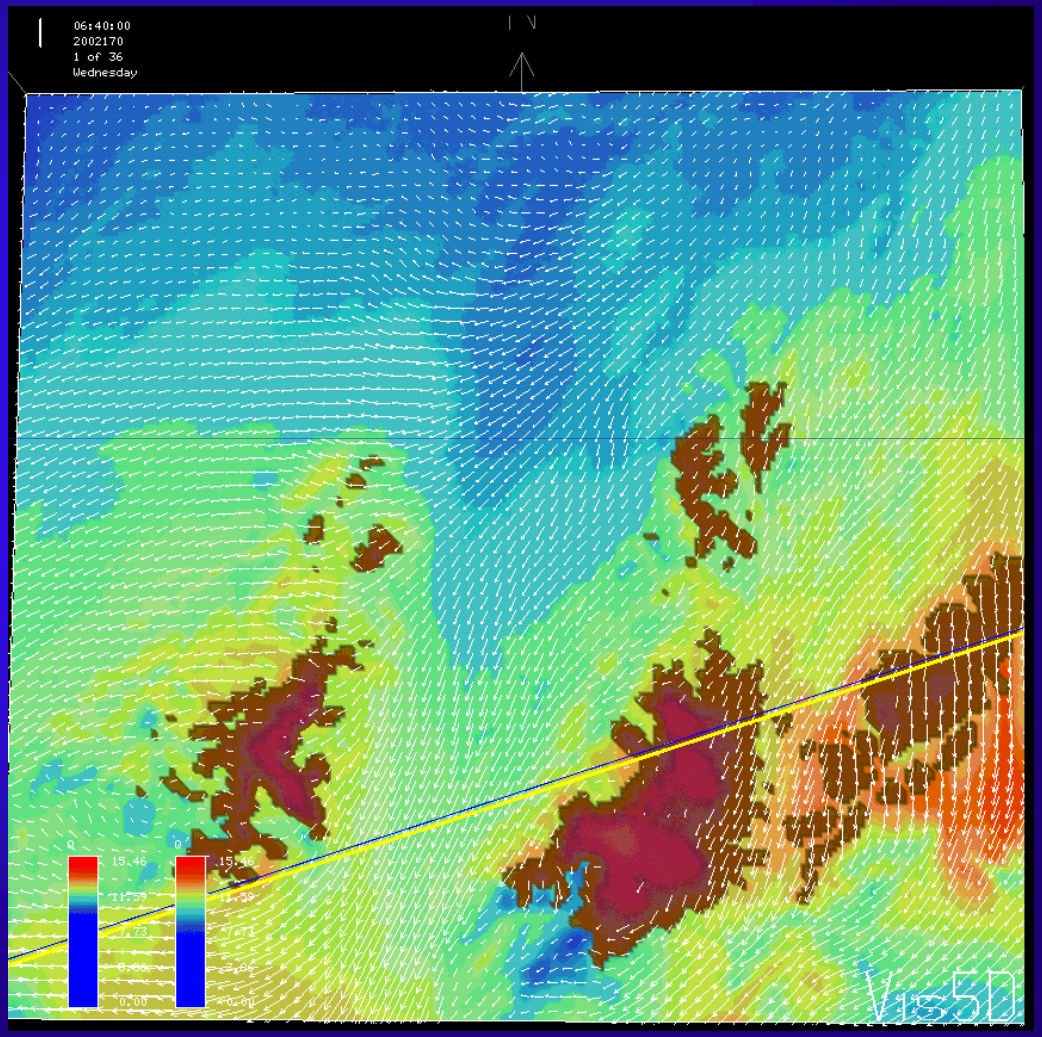
MM5 high-resolution modeling study of June 19, 2002 (6-18 UTC)

Events with large amounts of precipitation are mainly

- **forced/frontal: Convection imbedded in frontal line**
- **forced/non-frontal: synoptic-scale ascent, but no surface front**
- **non-forced/non-frontal: air mass convection**

Example: forced/non-frontal

Boundary layer water-vapor mixing ratio, wind, cloud, and precipitation fields.



Cases and phases

MM5 high-resolution modeling study of June 19, 2002 (6-18 UTC)

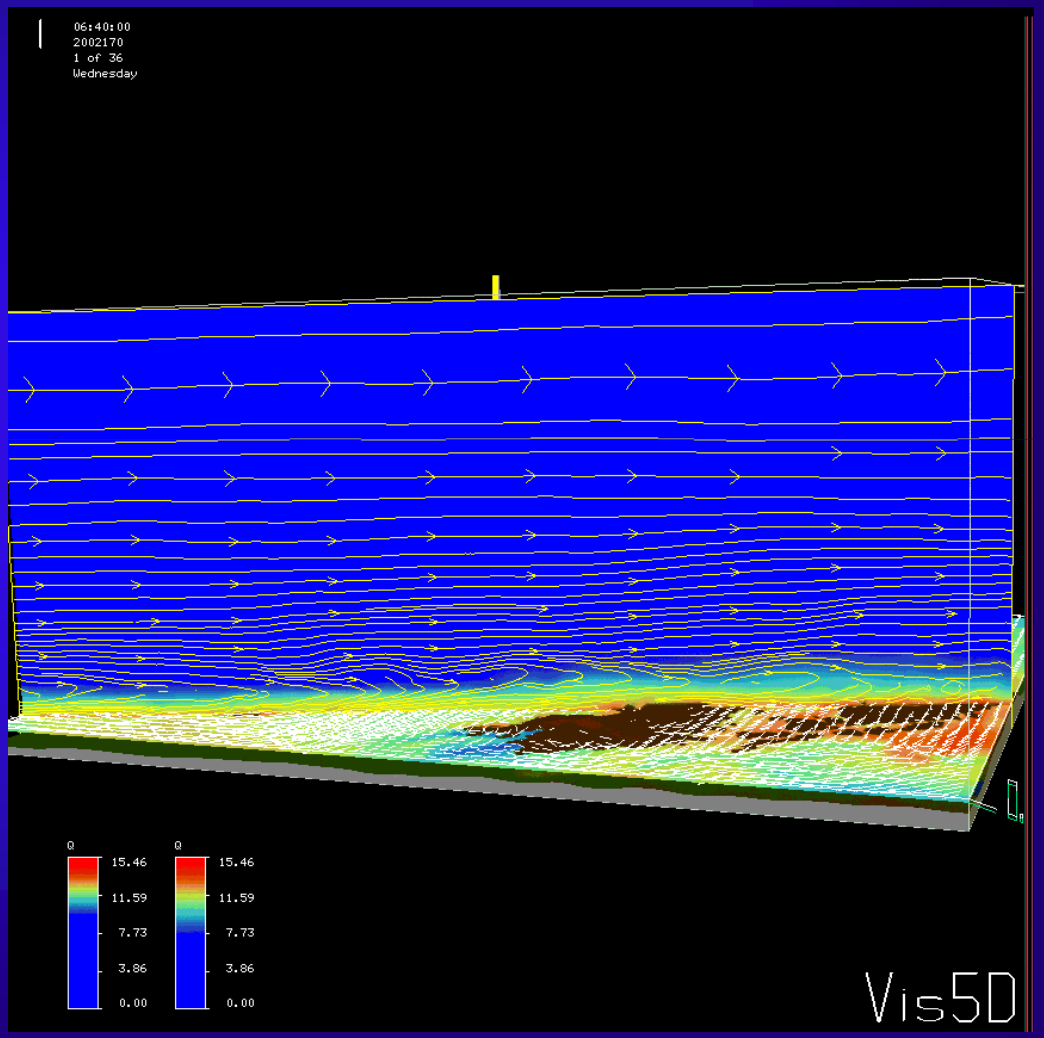
Phase 1: Pre-convection

Phase 2: Convection initation, cloud formation considering aerosol-cloud interaction

Phase 3: Development of convection, onset of precipitation

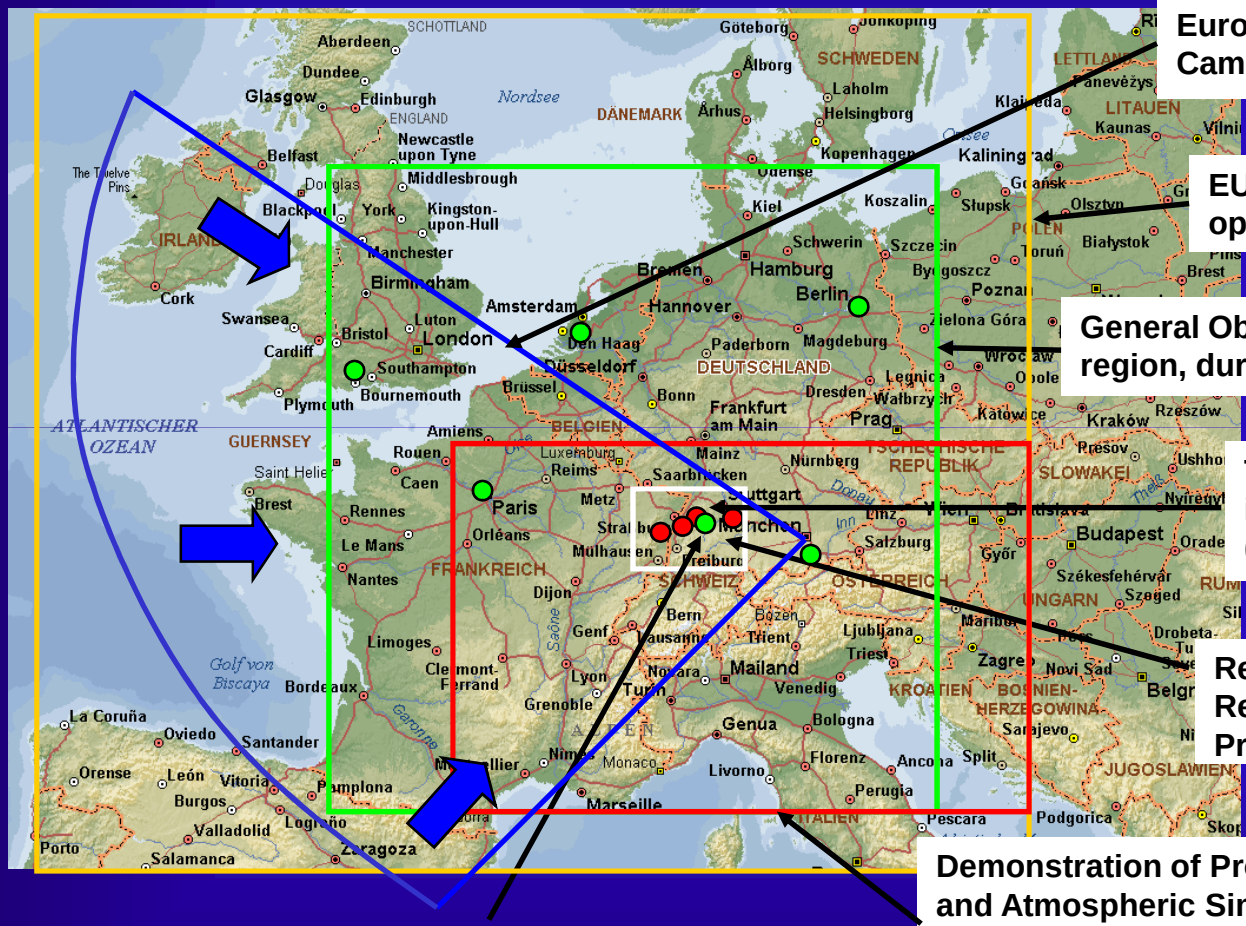
Phase 4: Maintenance and decay of precipitating system

Simultaneous large-scale and small-scale synergetic 4D observations of key variables.



Boundary layer water-vapor mixing ratio, wind, cloud, and precipitation fields.

International collaboration: European summer experiments 2007



European THORPEX Regional Campaign 2007 (ETReC07)

EUMETSAT special satellite operation modes and data

General Observations Period (GOP) region, duration: 1 year in 2007

Transport and Chemistry in Convective Systems (TRACKS) region

Region of COPS, WWRP Research and Development Project (RDP)

Demonstration of Probabilistic Hydrological and Atmospheric Simulation of flood Events in the Alpine region (D-PHASE), WWRP Forecast and Demonstration Project (FDP)

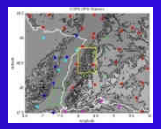
Atmospheric Radiation Measurement (ARM) Program Mobile Facility (AMF)

Observing strategy

Extension of radar coverage

Transect with supersites, observations along valleys

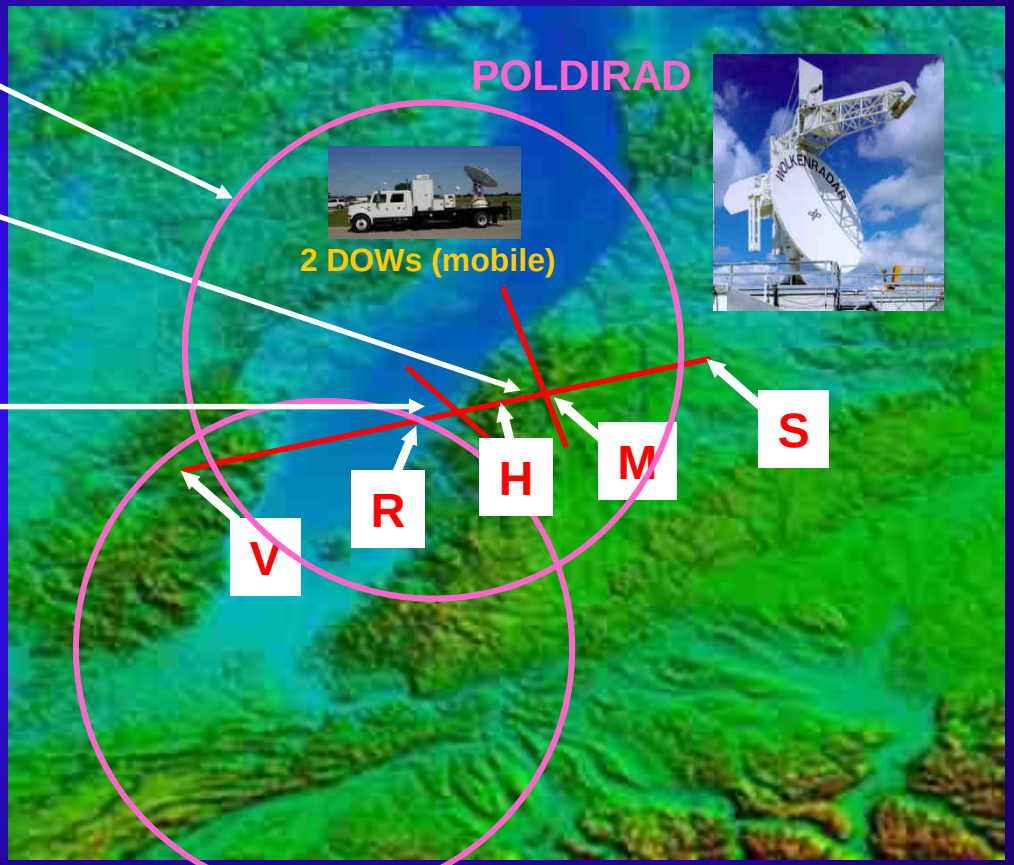
Densification of networks



Mobile teams

Regional observations between supersites performed by various airborne platforms

Large-scale and mesoscale observations provided by dedicated aircrafts



Locations of the five COPS Supersites

Supersite S, Gliders Airport Deckenpfronn („S“ for „Stuttgart“)
Site management: **Siegfried Vogt, Manfred Dorninger**
8.813 °E, 48.635 °N
ca. 600 m ASL

Supersite M, AMF Murgtal, Heselbach
Site management: **Kim Nitschke**
8.405 °E, 48.545 °N
ca. 500 m ASL

Supersite H, Hornisgrinde
Site Management: **Ulrich Corsmeier, Andreas Wieser**
8.204 °E, 48.604 °N
ca. 1150 m ASL

Supersite R, Rhine Valley, Achern
Site Management: **Paolo Di Girolamo**
8.066 °E, 48.638 °N
ca. 140 m ASL

Supersite V, Vosges Mountains
Site Management: **Joel van Baelen, Cyrille Flamant**
Valley: (most instruments)
Meistratzheim, 7.545 °E, 48.443 °N
Mountain: (X-band and GPS)
a) Mont Ste Odile Monastery, 7.405 °E 48.438 °N
b) Bishenberg, 7.473 °E 48.483 °N

Location POLDIRAD
Waltenheim sur Zorn
7.610 °E, 48.739 °N
ca. 250 m ASL, i.e., 120 m above the Rhine Valley

Supersite equipment

Lidars
Cloud radars
Precip. radars
Radiometers
Radiosondes
Sodars

POLDIRAD

V R H M S

- CNRS WV Raman lidar
- CNRS TRESS = Aerosol Raman Lidar IR radiometer, sun ph.
- LaMP X-band (scanning)
- LaMP K-band (vertical)
- MF radiosondes
- MF surf. flux stations (3)
- MF soil moisture (1-3)
- MF UHF prof., sodar
- GPS receiver

- FZK WTR
- UV MRR
- UV radiosondes
- UV tethersonde
- UV AWS network
- CNR MW radiometer
- GFZ GPS receiver
- FZK soil moisture

- UHOH WV DIAL (scanning)
- UHOH RR lidar (scanning)
- FZK WindTracer (scanning)
- FZK cloud radar (45°scan)
- UHOH X-Band (vertical)
- UHH MRR
- TARA?
- UK radiosondes
- ADMIRARI (scanning)?
- UK aerosol in-situ analysis
- GFZ GPS receiver

- AMF: RS, MWR, AERI, RWP, WACR, aerosol in-situ analysis
- HATPRO
- 90/150 GHz
- IfT MWL
- IfT WILI
- UHH MRR
- GFZ GPS receiver
- FZK soil moisture

- UNIBAS Raman lidar
- UK Doppler lidar
- UK wind profiler
- UK MWR
- UHH cloud radar
- UK radiosondes
- UHH MRR
- GFZ GPS receiver
- FZK soil moisture

Black Forest valley entrances

- FZK and UBT sodars (entrance of Murg and Kinzig V.)
- UF sodar (entrance of Rench V.)
- 3 UK sodars (Murg Valley)

FZK

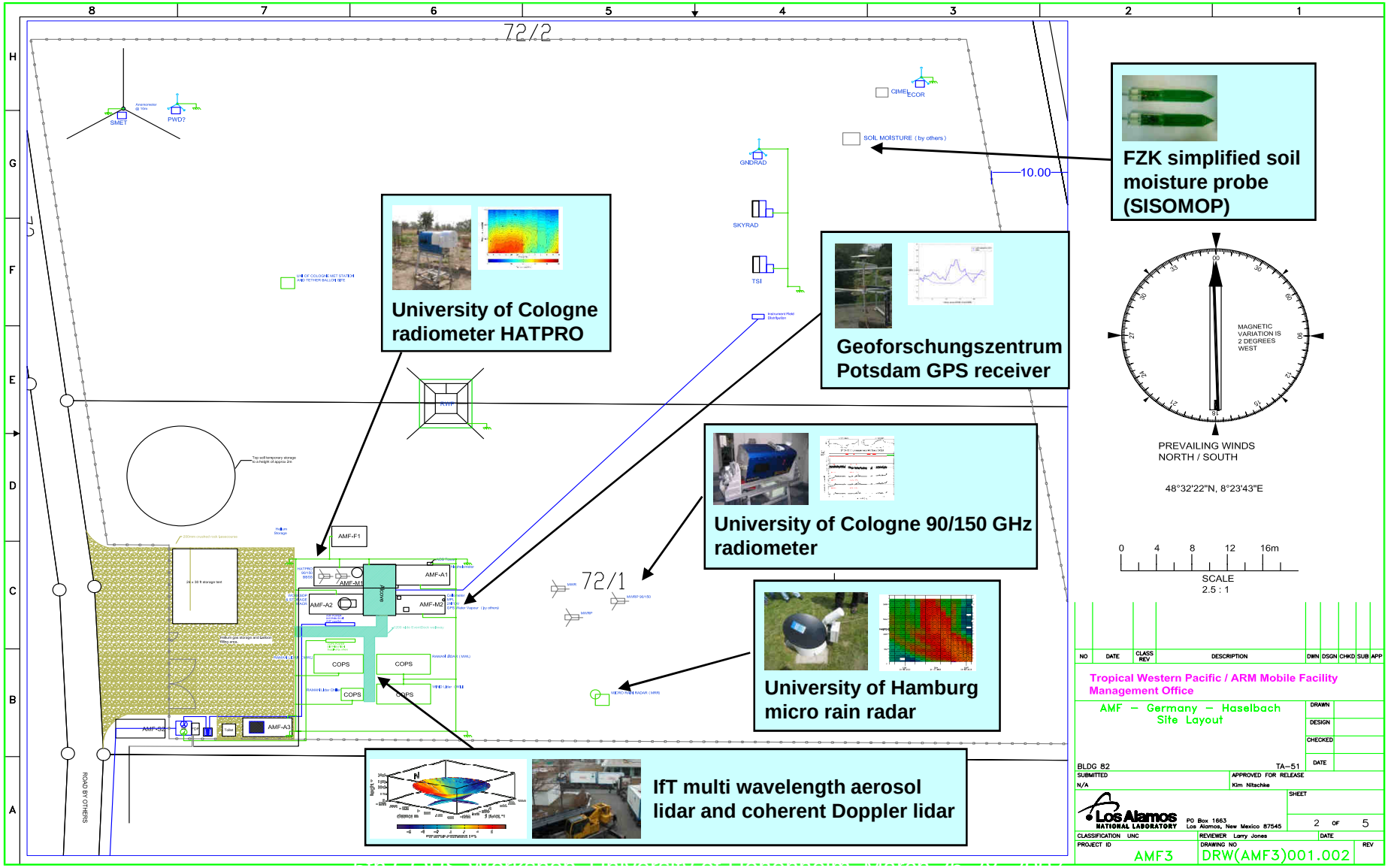
- FZK RS station (mobile)

„Burgundische Pforte“

- FZK RS station (mobile)

Action item: Finalization of set up and logistics

AMF Supersite in the Murg Valley



Additional networks during COPS

Met. stations: Manfred Dorninger (Uni Vienna), Norbert Kalthoff (FZK)

Rain gauge network: Martin Hagen (DLR), Armin Mathes (Uni Bonn)

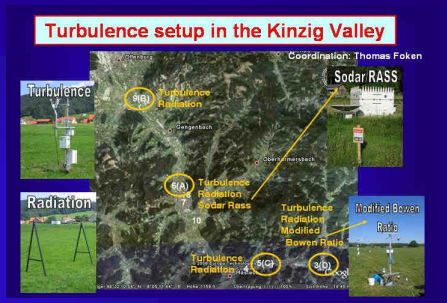
Soil moisture network: Christian Hauck (FZK)

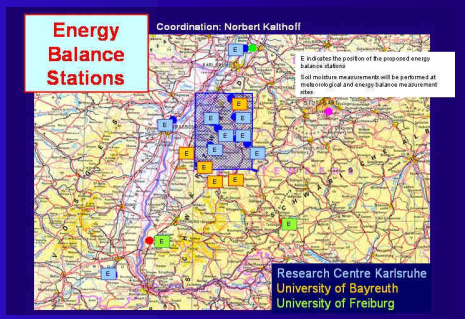
Energy balance stations: Norbert Kalthoff (FZK)

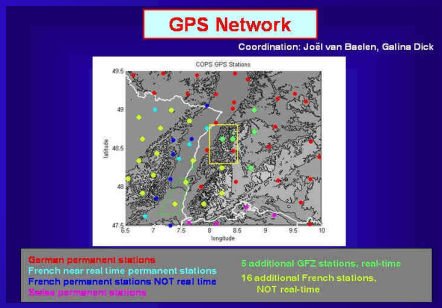
Turbulence network: Thomas Foken (Uni Bayreuth)

MRR network: Gerhard Peters (Uni Hamburg)

GPS network: Cédric Champollion (Service d'Aéronomie), Galina Dick (GFZ)







Action item: Finalize the coordination and distribution of networks (transects along supersites and valley, densification). Deploy instrumentation until May 2007.

June 2007 | July 2007 | August 2007

DLR Falcon with water vapor DIAL, Doppler lidar, dropsondes
30 allocation days, 45 flight hours

SAFIRE F20 with water vapor DIAL and 120 dropsondes
24 allocation days in July 2007 (tbd)
35 flight hours

FAAM BAe 146 with aerosol and cloud microphysics sensors
Confirmed for 3 weeks
84 science hours

Coordinator:
Heinz Finkenzeller, DLR

DO128
38 allocation days
125 flight hours

Successful EUFAR proposals:
- TU Delft, Partenavia
- Uni Cologne, Dimona
- UNIBAS, SAFIRE F20

FZK Ultra Light
16 days, 40 flight hours

MPIfC Learjet
13 days within TRACKS, stationed in Hohn
3-4 flights

FZJ Zeppelin
16 days within TRACKS, stationed in Friedrichshafen, 80 flight hours

Met Air / FZJ Dimona
16 days within TRACKS, Baden airpark, 4 flights

Mission Scenario "Forced Convection"

Coordination: Ulrich Corsmeier, Christoph Kiemle

***: VFR**

Blue Sky --- > Shallow Convection -- > Deep Convection-- > Dis. Convection

forced, non frontal/frontal

07—08--09---10---11---12---13---14---15---16---17---18---19---20---21---22 local

Learjet ----------ANVIL-BOX , tropopause ---------ANVIL-BOX, outflow anvil----------
----------FL 330/400, low appr. EDSB ---- FL 330/400, low appr. EDSB ----------

G-Falcon ----------MAP pattern (2 MAPs) -------→Box pattern CuCong, Cb ----------
----------FL 250/400, Drops ----------→FL 250/400, Drops ----------

F-Falcon ----------MAP pattern (1 MAP) ---------→BOX pattern CuCong, Cb----------
----------FL 150, Drops----------→FL150, Drops ----------

(*)BAE 146----------LONG-LEGS-----→BOX pattern----------
----------VFR < FL 100----→FL 100/270 ----------

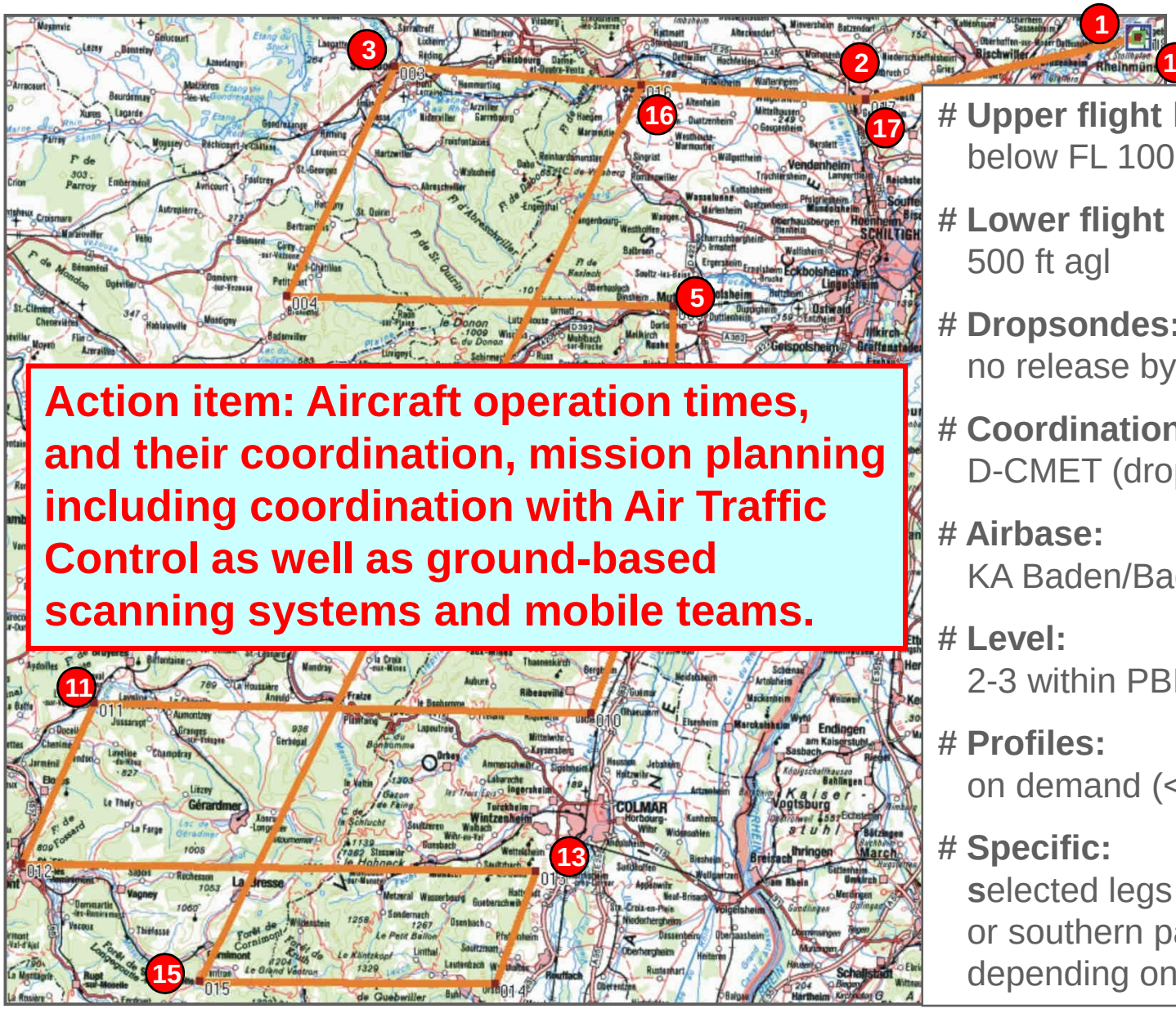
(*)DO 128--------PreCon pattern----SupDe pattern (3x)--------BOX pattern (DeDe)----------
--------low PBL (VFR)------low, mid PBL, BL-Inv ---up to FL 245 (IFR) ----------

***Zeppelin**--Valley pattern (Rhine-Kinzig-Murg-Nagold)----------Valley pattern (R-K-M-N)--→CuCong----
---lowest level, VFR----------lowest level, VFR----------→on request-

***Dimona**----------MAP (2 MAPs) or Valley----------MAP (2 MAPs) or Valley----------
----------lowest level PBL (VFR)----------lowest level PBL (VFR)----------

***Enduro**----------Triangle or Cross-Sec., profiles ------Triangle or Cross-Sec., profiles ----------
----------low PBL, FL100 (VFR)----------low PBL, FL100 (VFR)----------

Scenario: Forced Convection
Platform 5: DO 128, D-IBUF
Mission: SupDe-RV



Supersites

 # Upper flight level
below FL 100

 # Lower flight level
500 ft agl

 # Dropsondes:
no release by IBUF

 # Coordination:
D-CMET (drops), F-Falcon (drops)

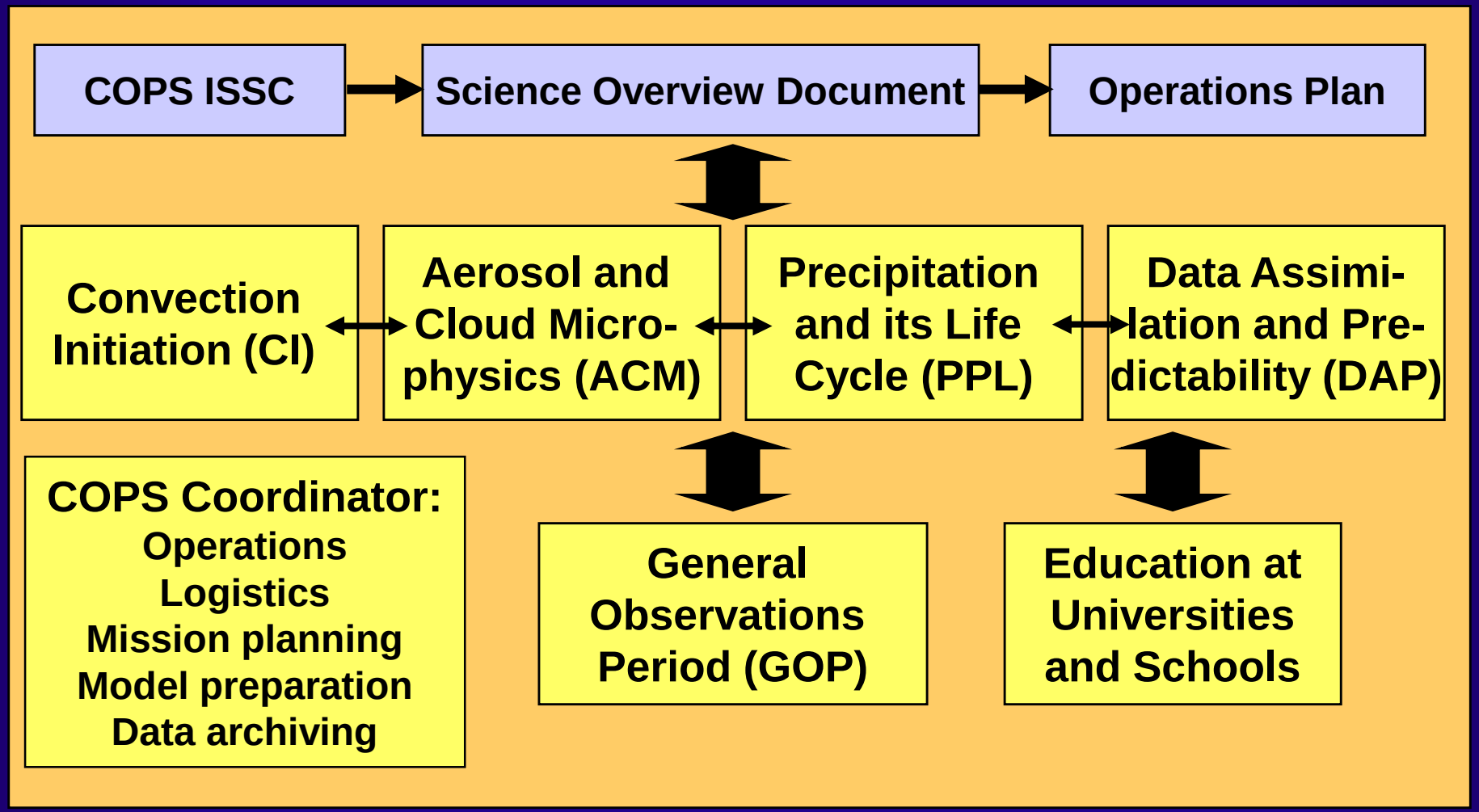
 # Airbase:
KA Baden/Baden

 # Level:
2-3 within PBL, 1 above PBL

 # Profiles:
on demand (< FL 100)

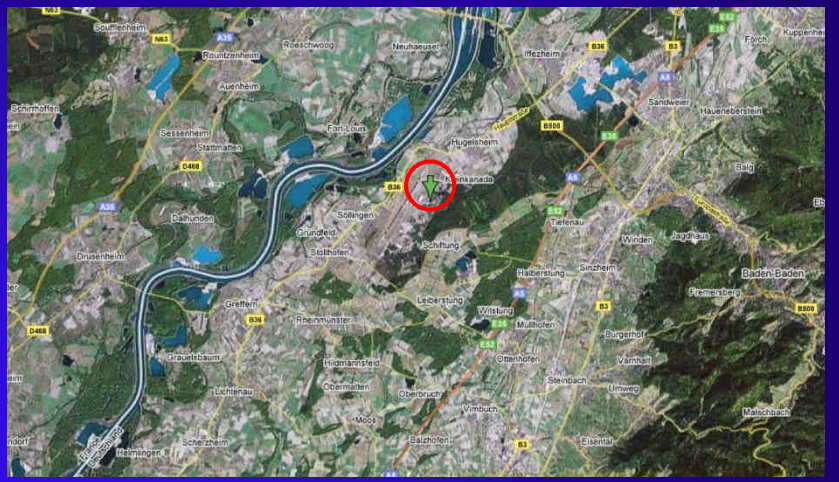
 # Specific:
selected legs of northern or southern pattern are flown, depending on weather.

COPS organizational structure



One day in the COPS Operations Center

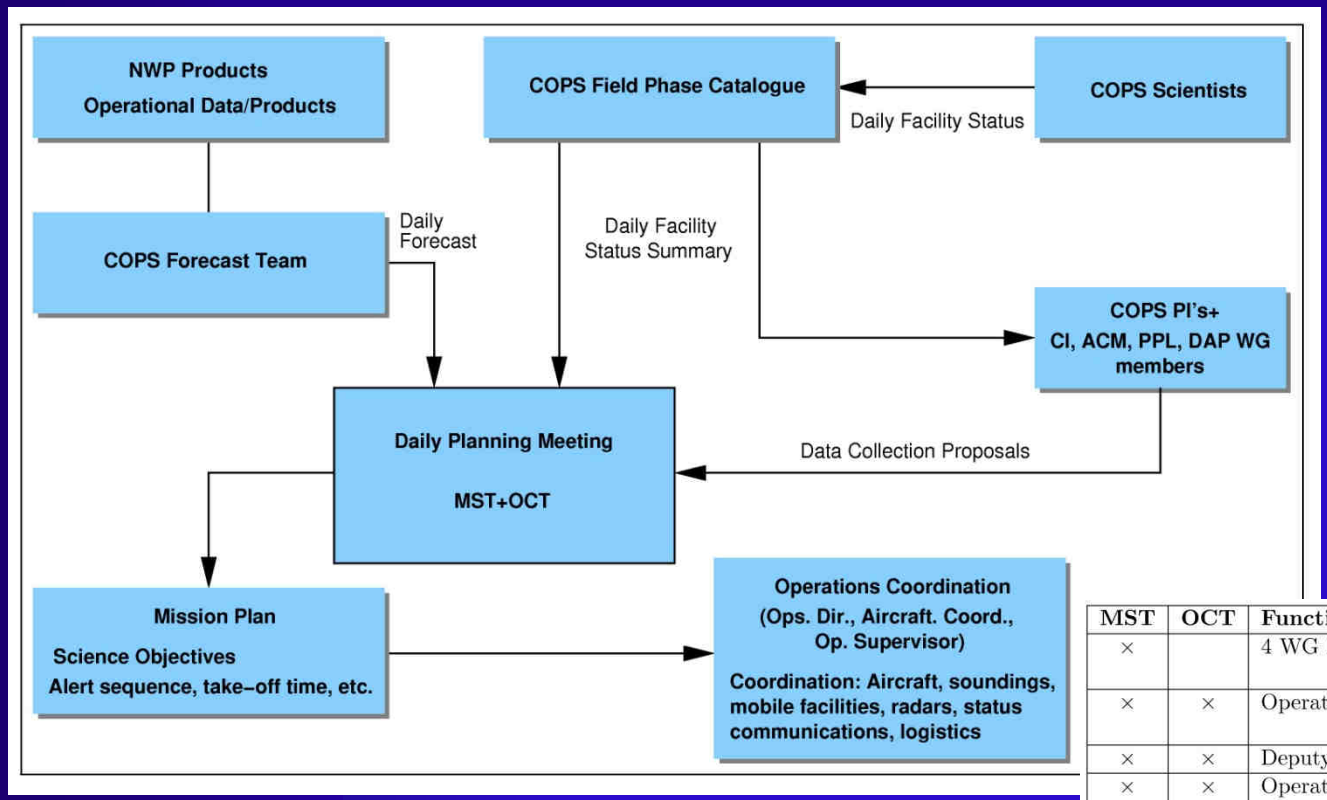
- Location: Baden Airpark (Christian Barthlott, FZK)
- Infrastructure: Control center with NINJO system
- Communication: Fast ethernet, direct satellite access
- Mission preparation: data products from models (D-PHASE), satellites (EUMETSAT), and nowcasting systems
- Mission guidance (real-time quicklooks from radar and satellites)
- Mission performance
- Field catalogue



One day in the COPS Operations Center

Now we zoom in the interior of the COPS Operations Center:
Here you see an ambitious team eager to select another mission.
I have no doubt that our Mission Selection and Operations Center Teams will be just as experienced and enthusiastic to explore the universe of atmospheric sciences like this well-known team.

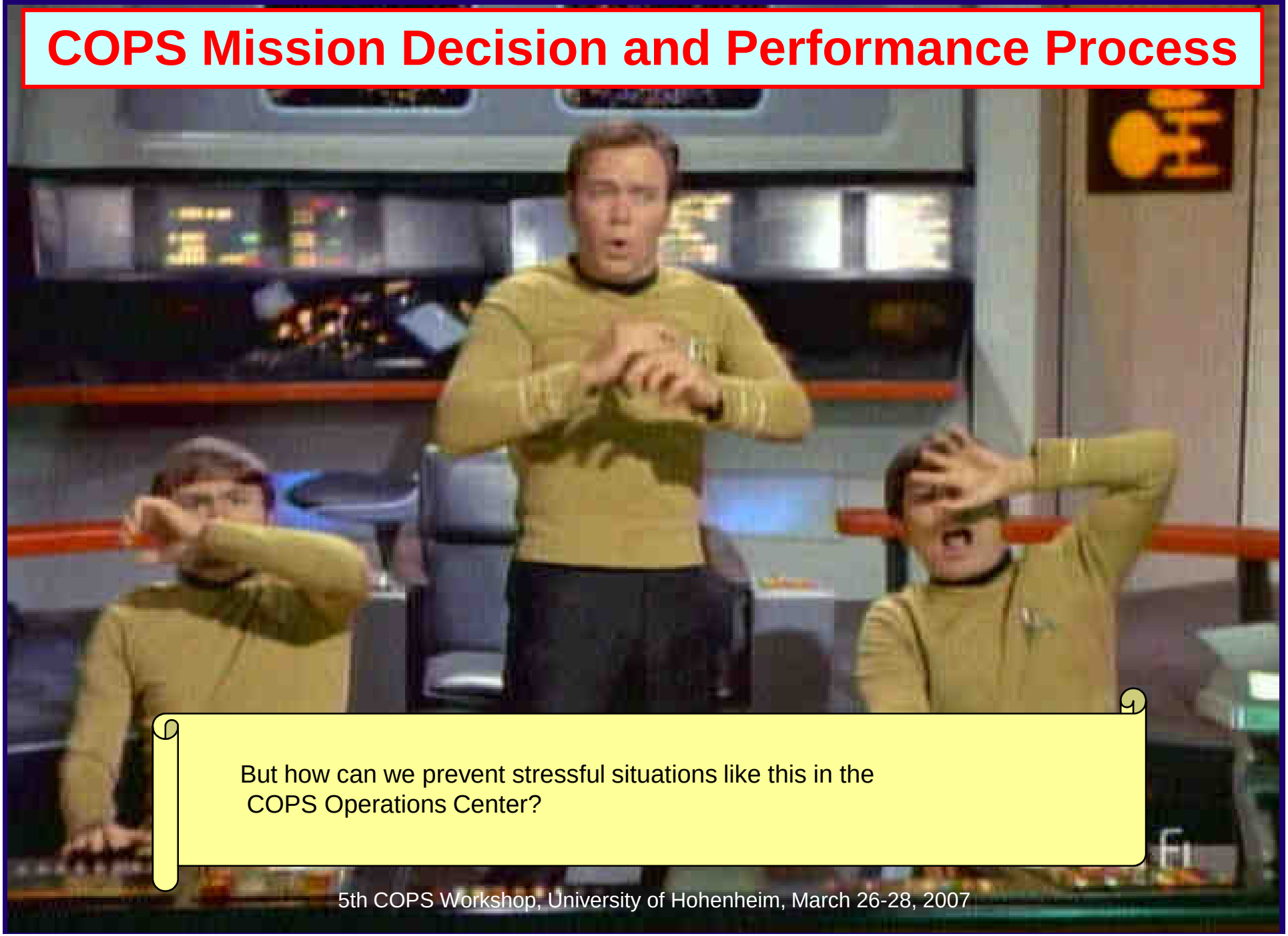
COPS Mission Decision and Performance Process



MST	OCT	Function	Candidates
×		4 WG Representatives	WG Representatives CI, ACM, PPL, DAP
×	×	Operations Director	Members of the ISSC, Wernli, Kalthoff, 2 DLR members
×	×	Deputy Ops. Dir.	〃
×	×	Operations Supervisor	Barthlott, Trentmann, Kunz, Kohler
	×	Aircraft Coordinator	COPS Air Crew (Aircraft PI's), 2 DLR members, Finkenzeller/Grillenbeck?
	×	Weather Forecaster 1	Mühr, Groenemeijer, Ehmann, 2 × MeteoFrance, NN
	×	Weather Forecaster 2	〃
	×	Communications/Networking Coordinator	Brückel, Klinck
	×	Helper	Ehmann, Vonderach, Maisenbacher

Action item: Decision process, MST and OCT for mission preparation and performance.

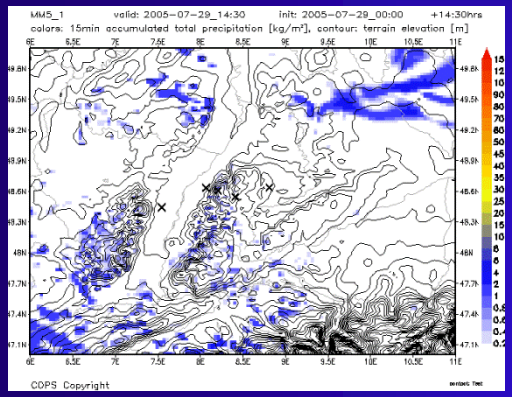
COPS Mission Decision and Performance Process



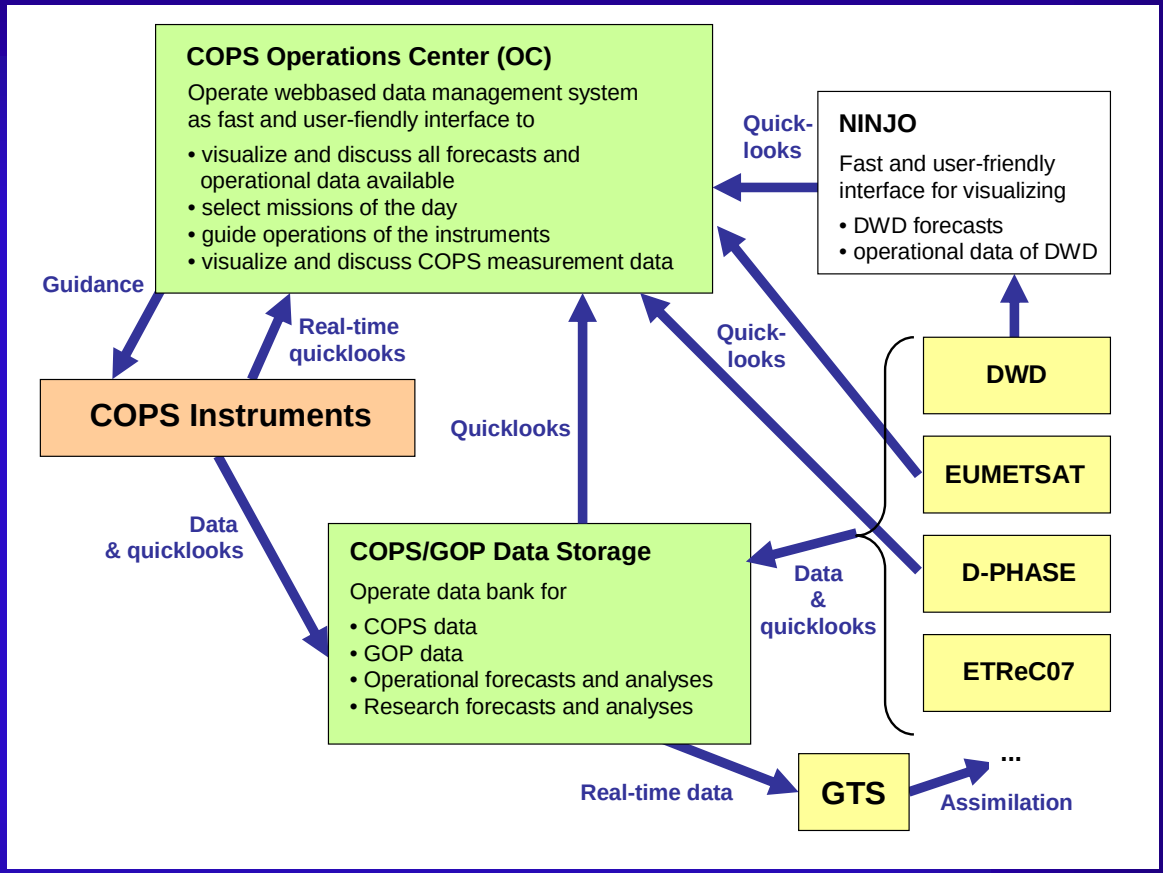
But how can we prevent stressful situations like this in the COPS Operations Center?

Mission Performance and Data Archiving Infrastructure

Visualization of D-PHASE TIGGE+ data set:

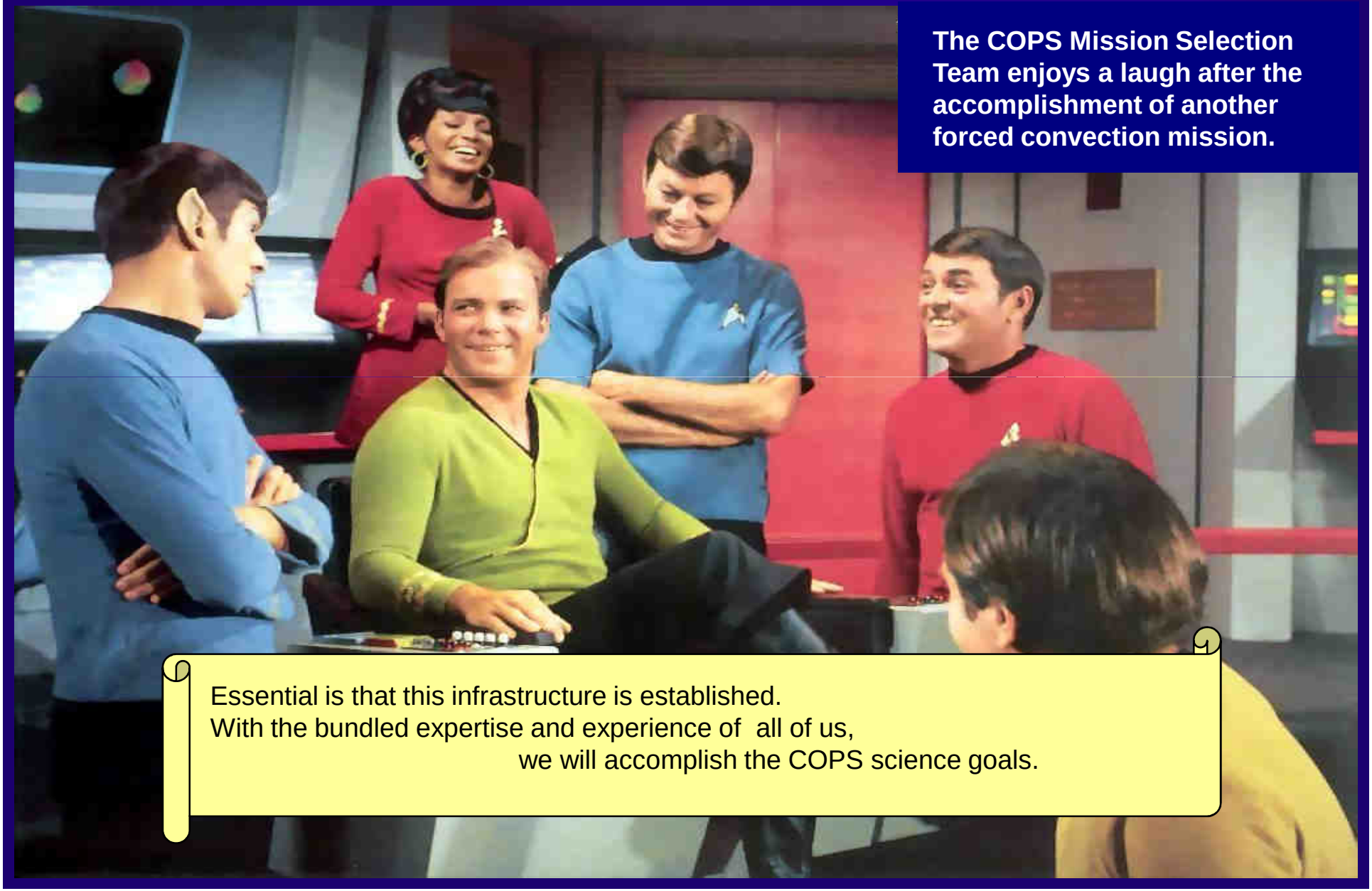


Matthias Grzeschik, IPM



Action item: Establish corresponding infrastructure (D-PHASE products, communication to PIs, data format, data transfer, etc.), real-time data assimilation.

Mission Performance and Data Archiving Infrastructure



The COPS Mission Selection Team enjoys a laugh after the accomplishment of another forced convection mission.

Essential is that this infrastructure is established.
With the bundled expertise and experience of all of us,
we will accomplish the COPS science goals.