

AURA NEW INITIATIVES OFFICE

Site Characterization through the Use of Computational Fluid Dynamics

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Validation of computational method
- **Atacama plateau**
High altitude inland site
- **Representative coastal site**
Wind flow from ocean vs wind flow from inland



Boundary Conditions

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Surface: no slip, roughness height 0.01m

Inflow: velocity components and
turbulent intensity, mixing length

Outflow: normal derivatives vanish

Sides, Ceiling: free slip, normal velocity vanishes



Inflow/Initial Conditions

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Wind vertical profile: $V = 10 \left[\frac{Z - Z_0}{2500} \right]^{0.6}$

Isothermal flow

$\rho = 0.82 \text{ kg/m}^3$

$\mu = 1.65 \cdot 10^{-5} \text{ kg/m/s}$

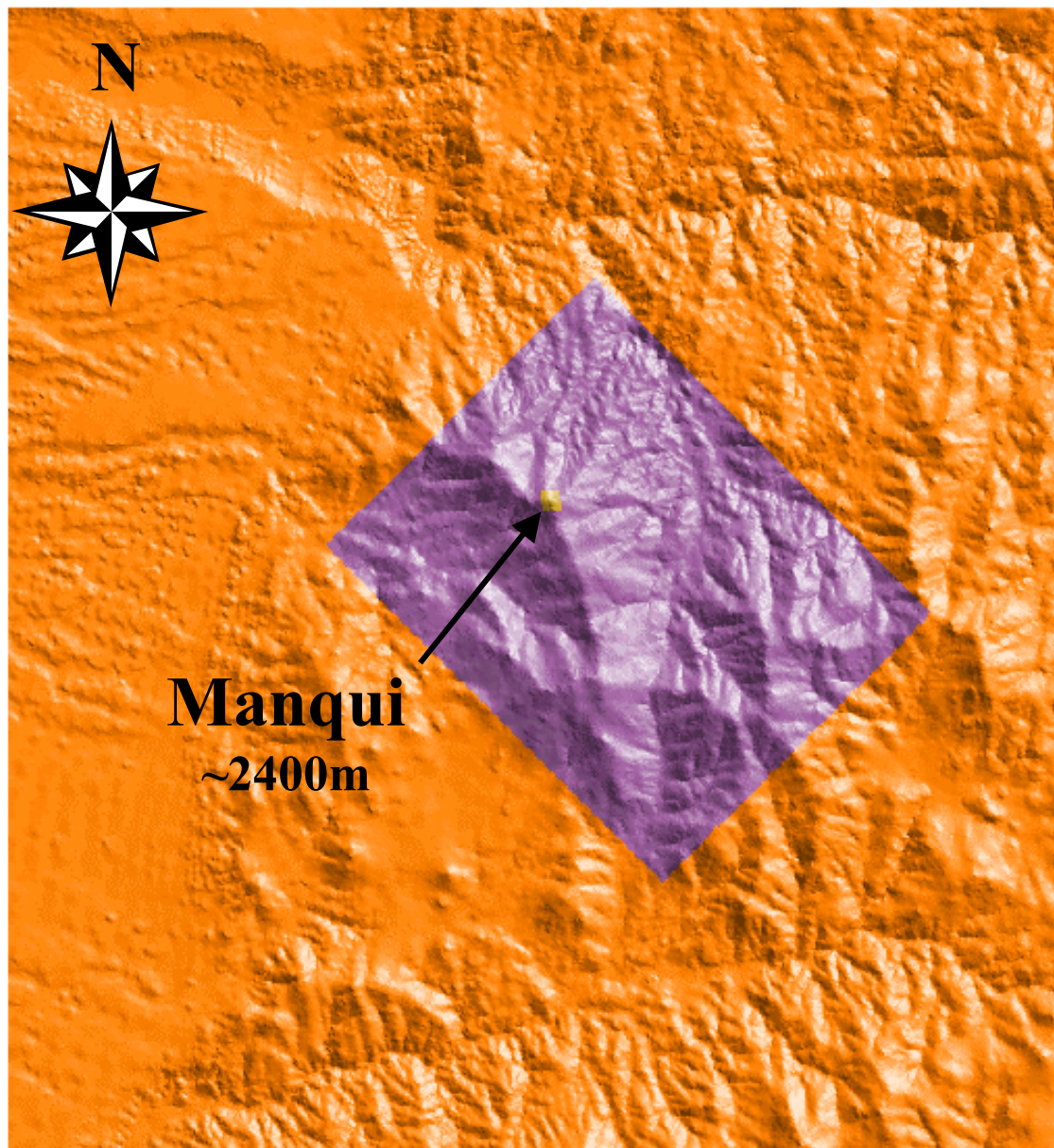
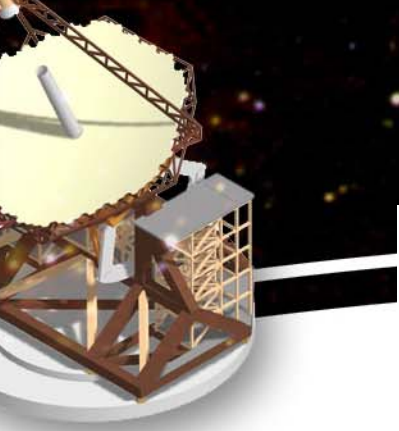
$p = 470 \text{ mb (6000m)}$

Turbulent Intensity: 5%

Mixing Length: 5m



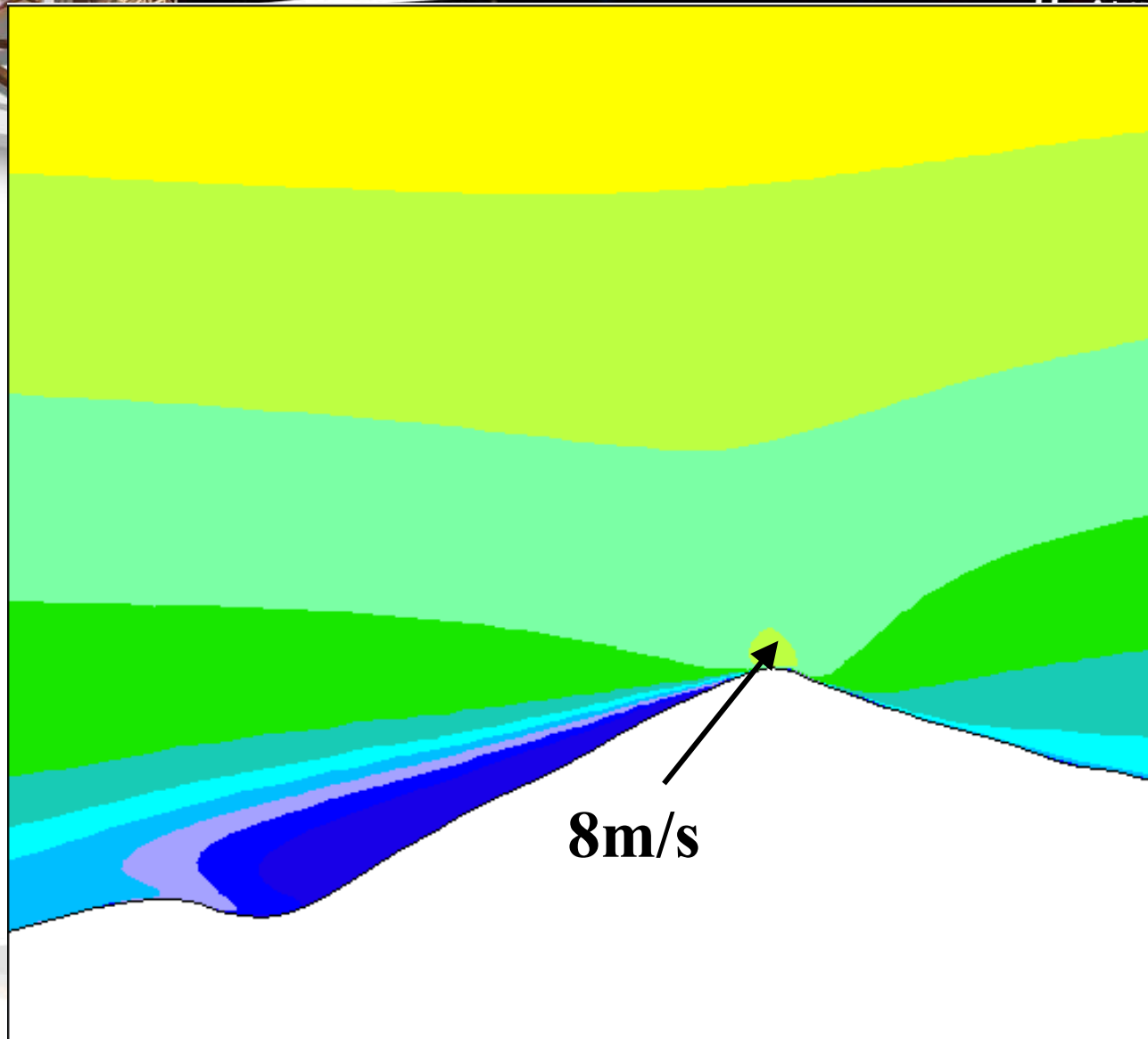
Las Campanas



INITIATIVES OFFICE

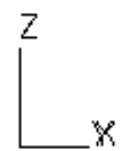
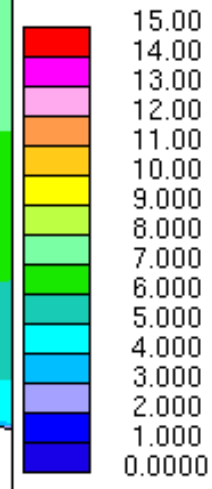


Wind velocity (m/s) 40m res NE (45°)

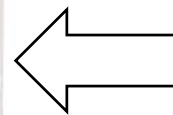


STAR
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PRO*AM 3.10

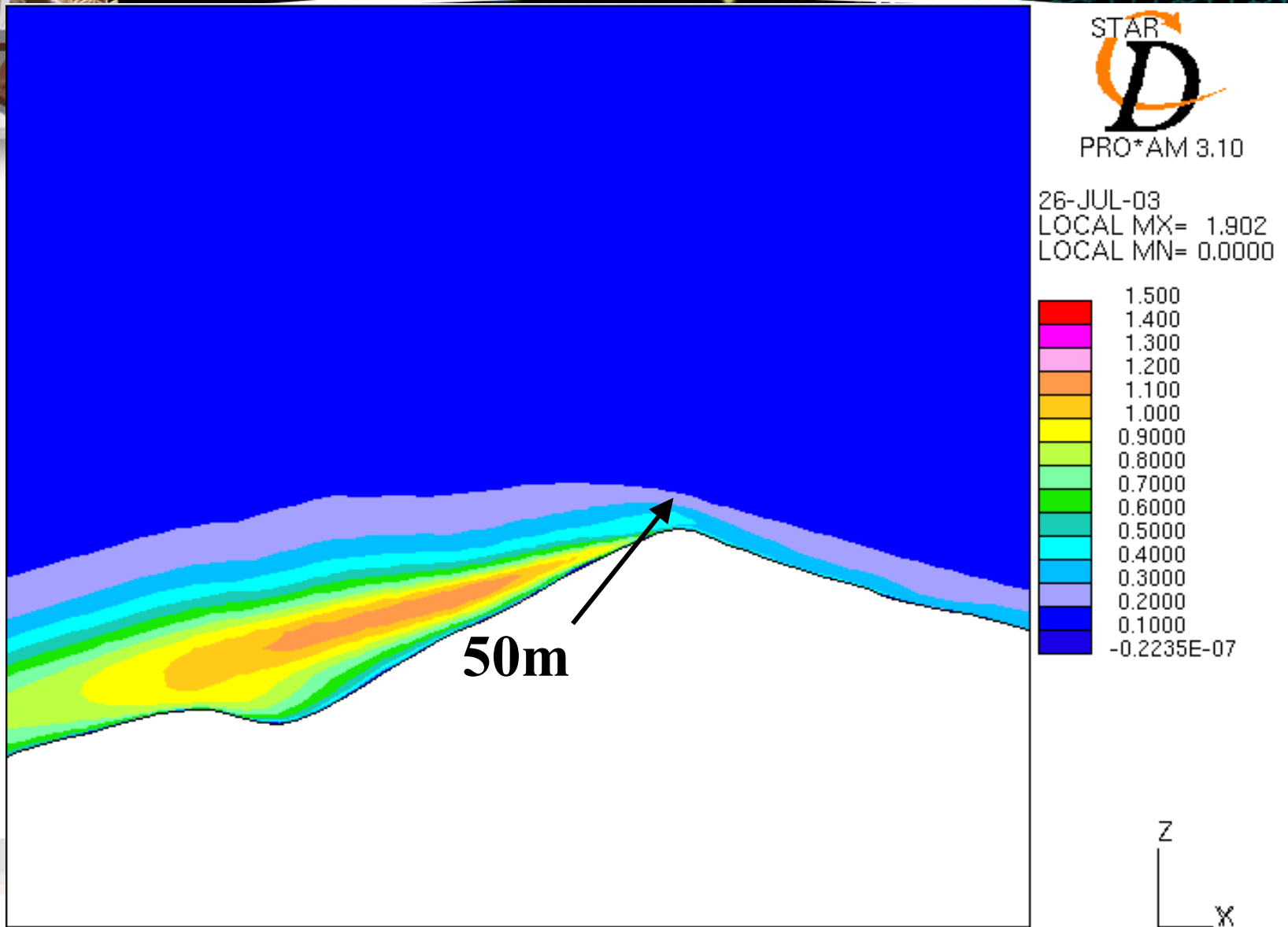
29-JUL-03
VELOCITY MAGNITUDE
M/S
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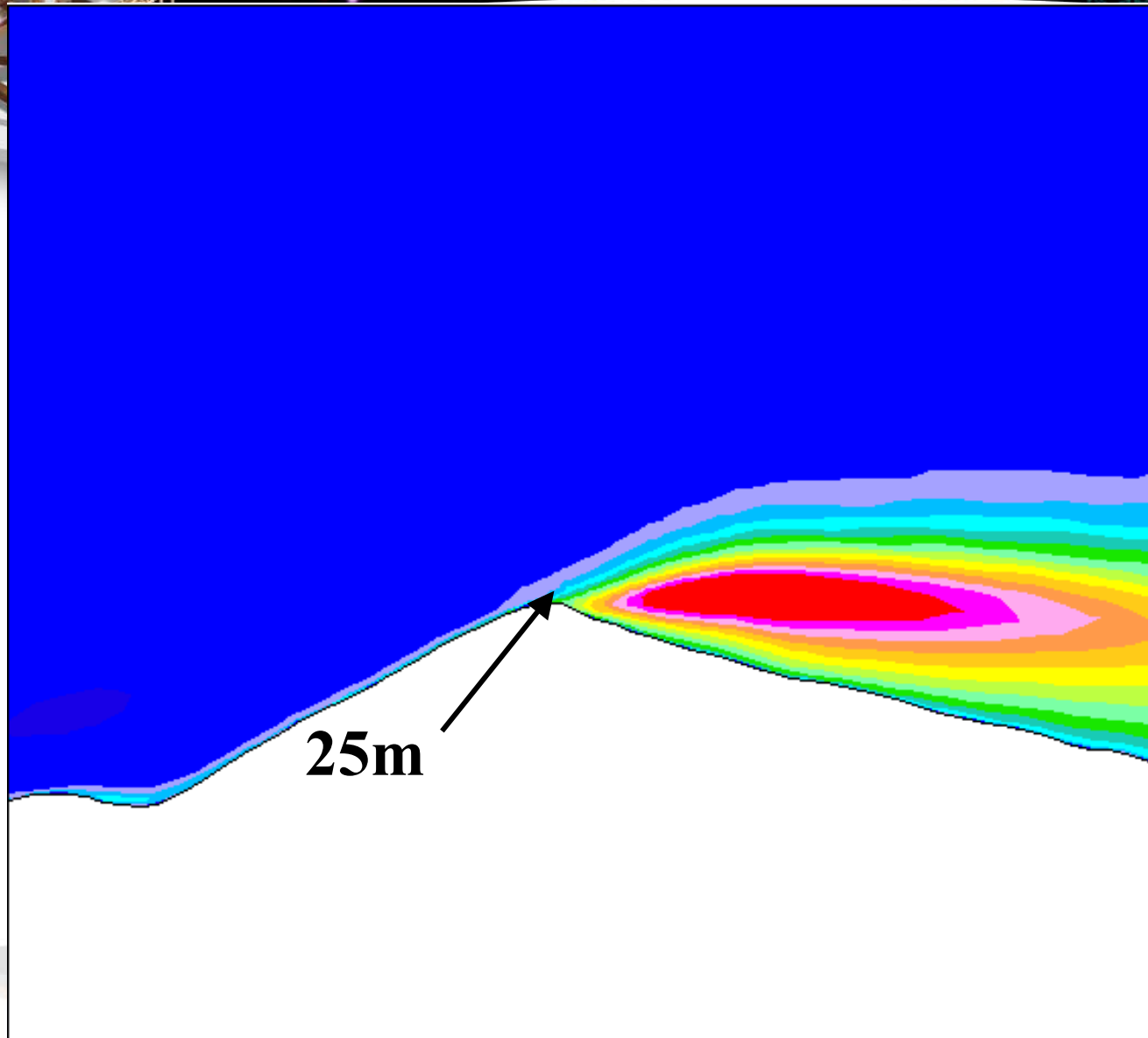


Wind velocity RMS (m/s) 40m res NE (45°)



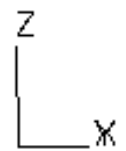
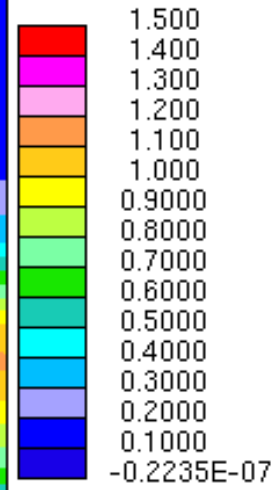
Wind velocity RMS (m/s)

40m res SW (225°)

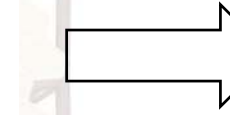


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D
PRO*AM 3.10

26-MAR-03
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DESIGN OFFICE



Atacama



Toco
5450m

Chajnantor
5600m

Negro
5100m

Chascon
5650m

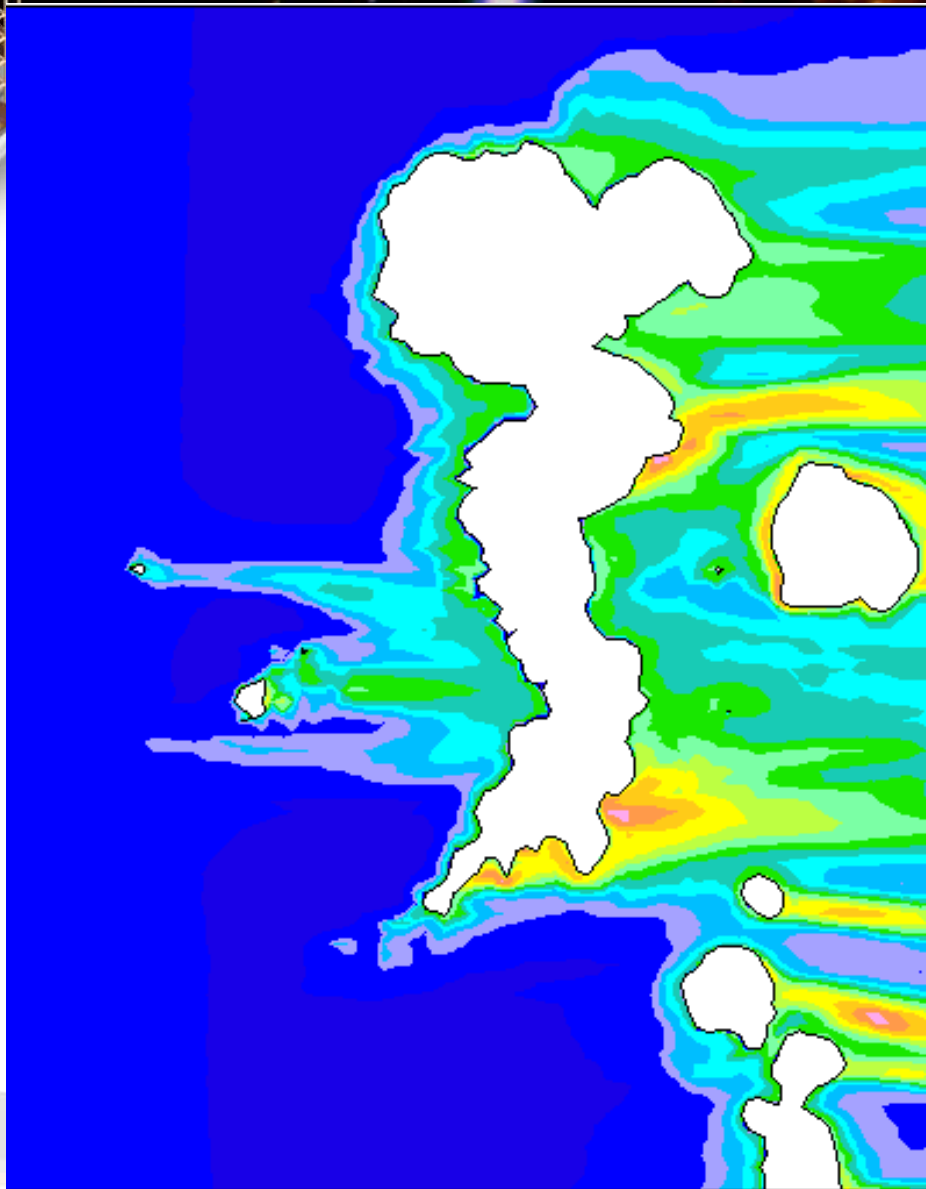
Honar
5400m

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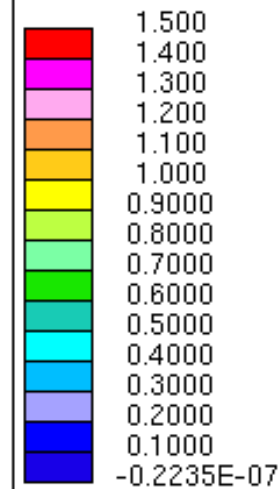
Wind velocity RMS (m/s)

240m res W (270°) 5000m



PRO*AM 3.10

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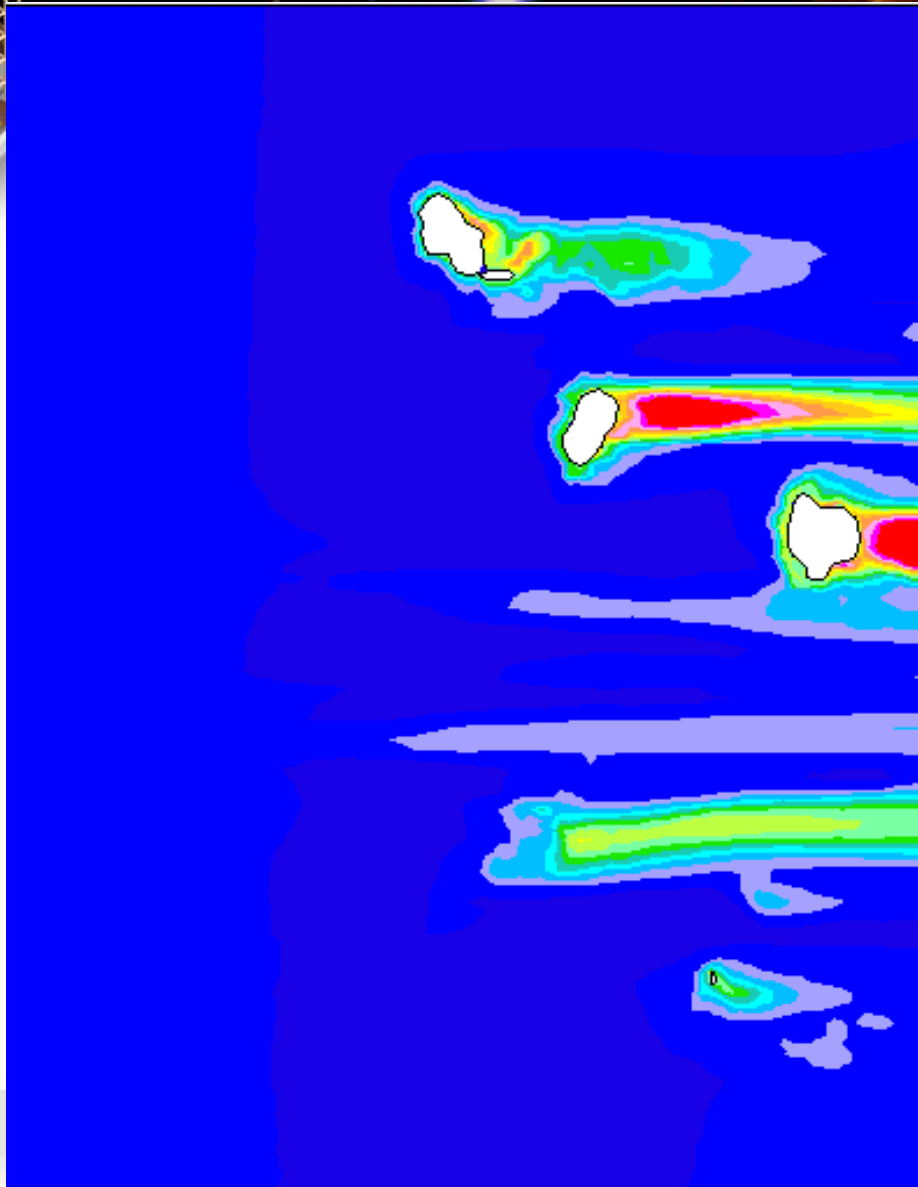
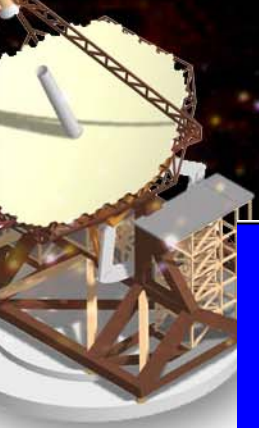


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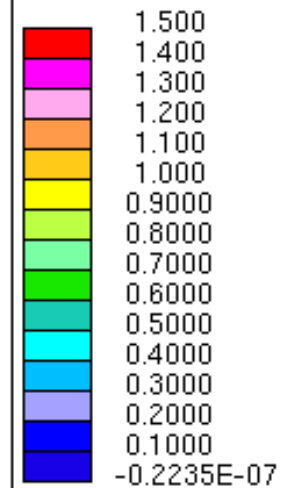
Wind velocity RMS (m/s)

240m res W (270°) 5400m



PRO*AM 3.10

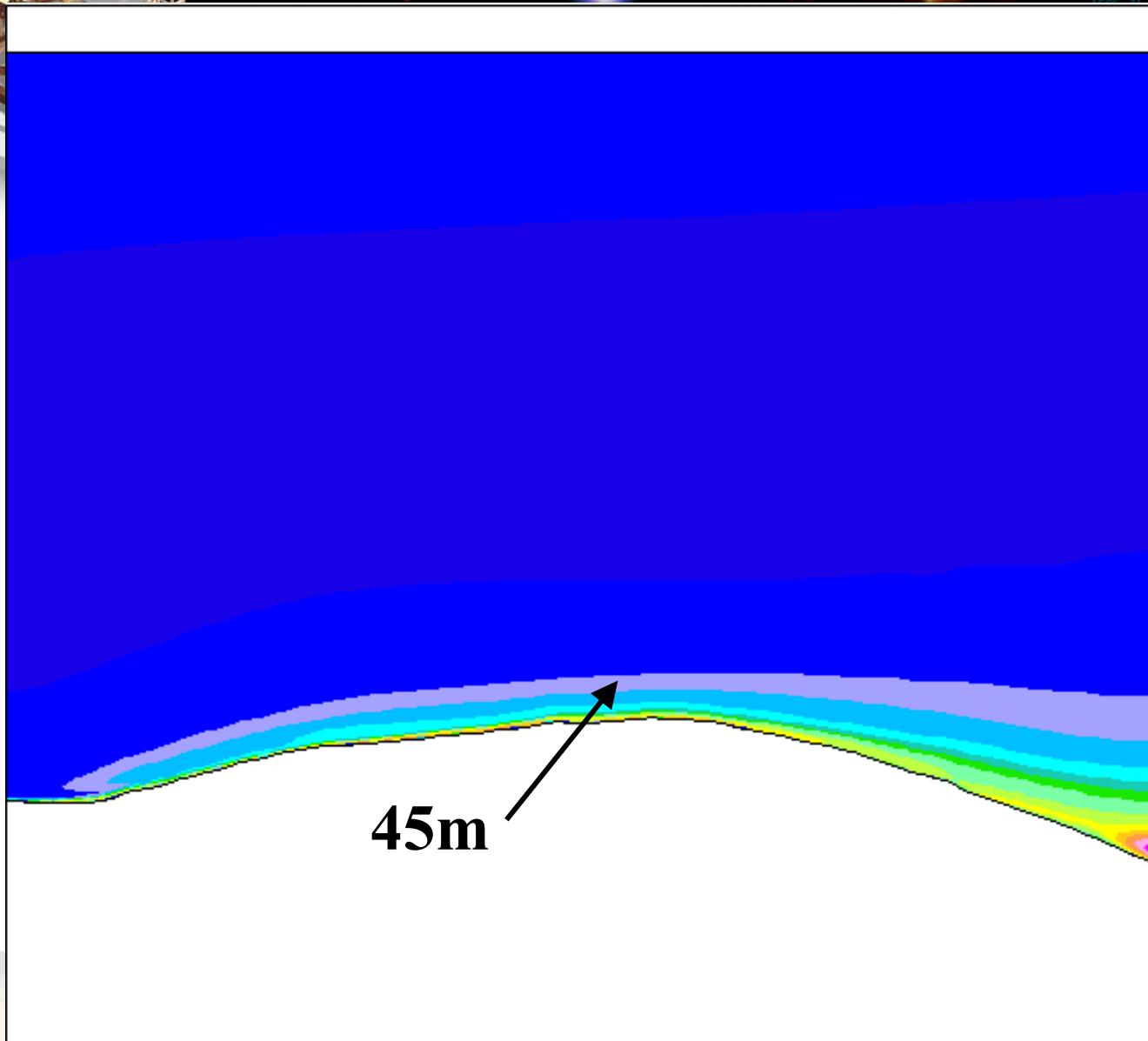
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ES OFFICE

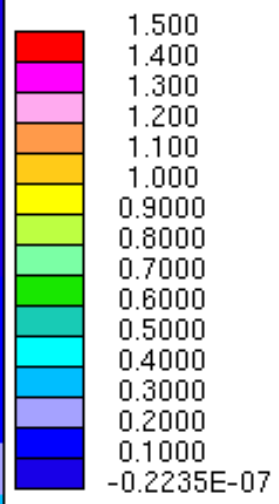


Wind velocity RMS (m/s) Honar 20m res W (270°)

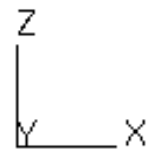


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PRO*AM 3.10

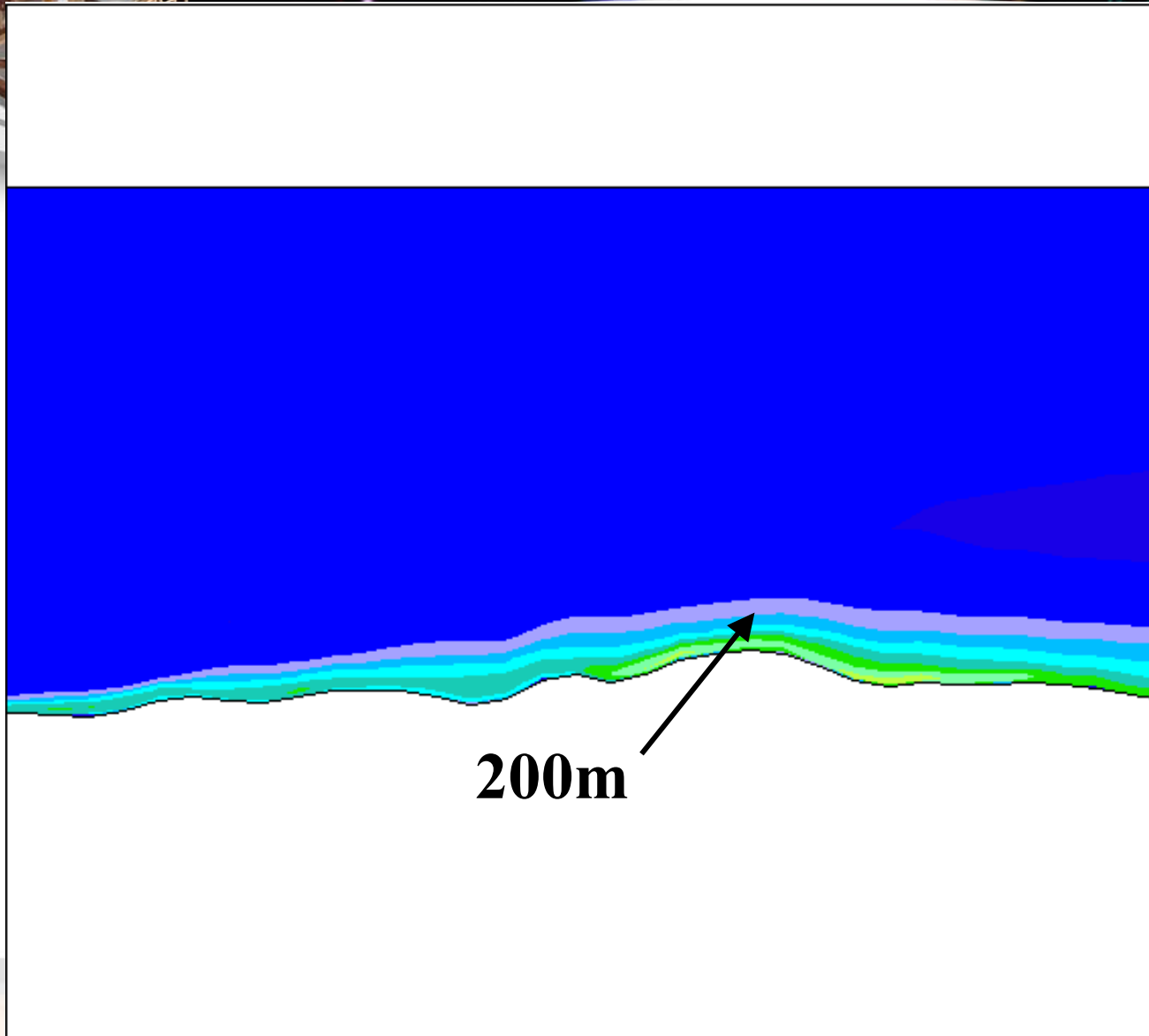
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S OFFICE

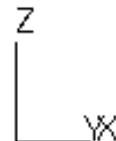
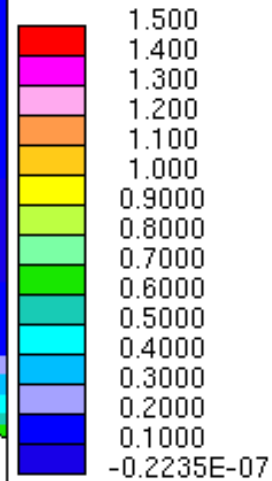


Wind velocity RMS (m/s) Honar 200m res SW (230°)



PRO*AM 3.10

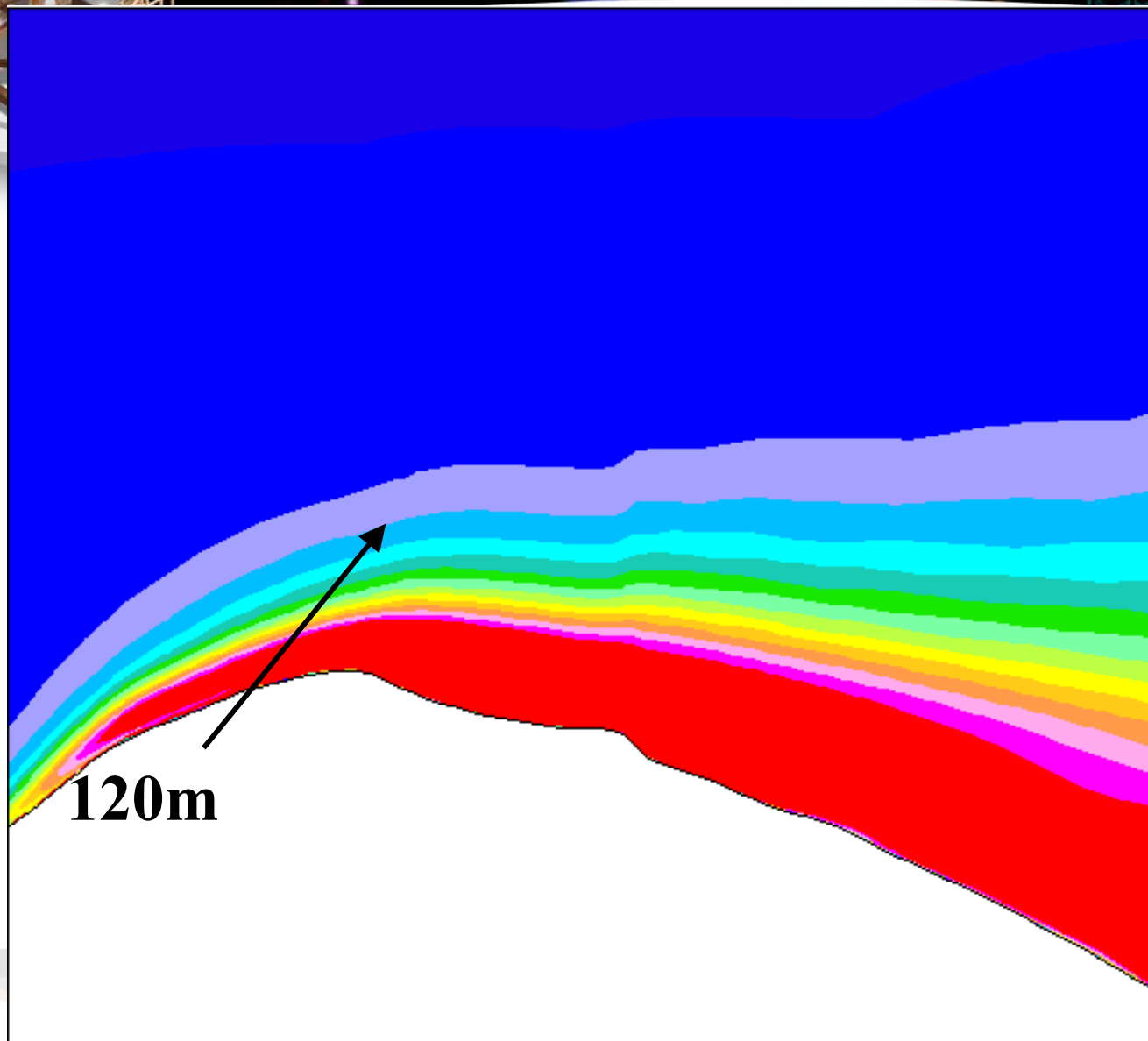
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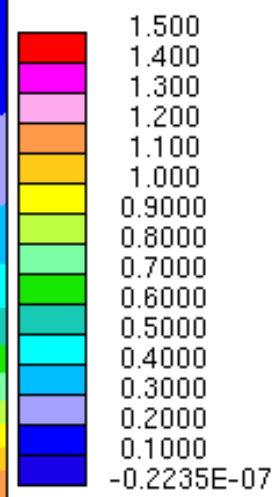
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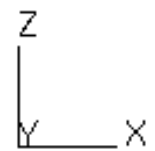
Wind velocity RMS (m/s) Chajnantor 10m res W (225°)



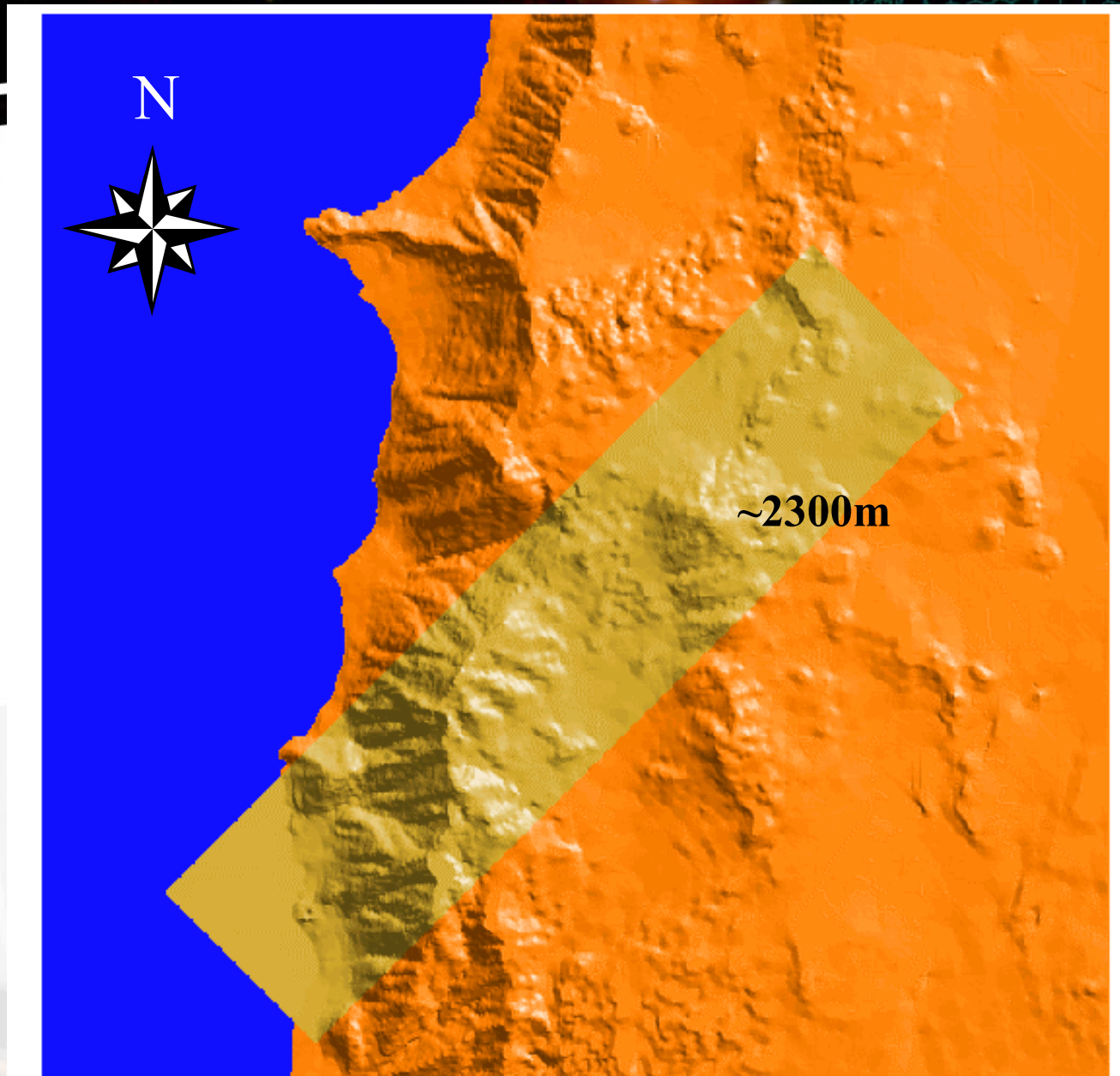
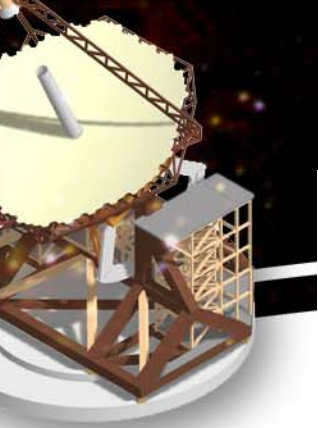
STAR
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29-JUL-03
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Coastal site



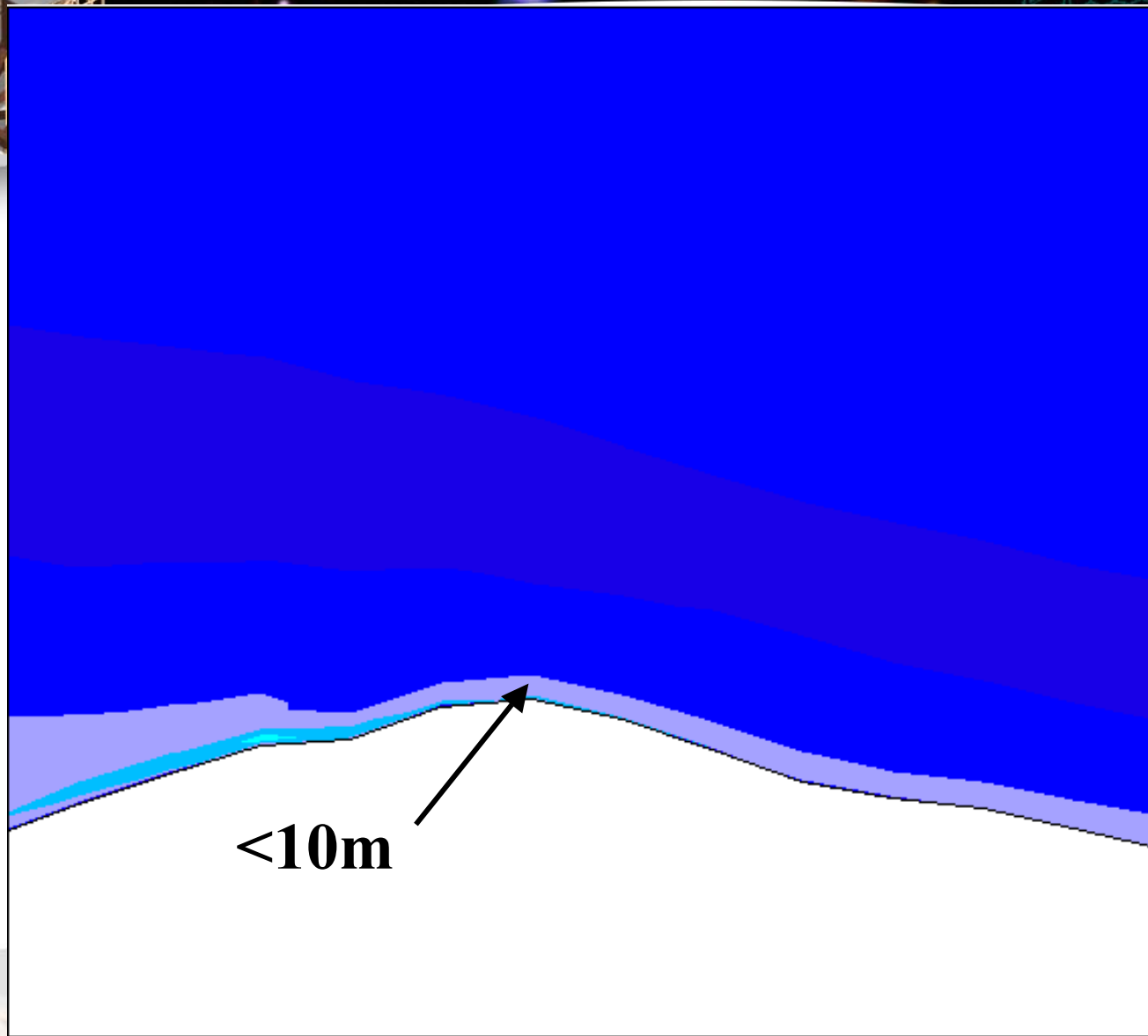
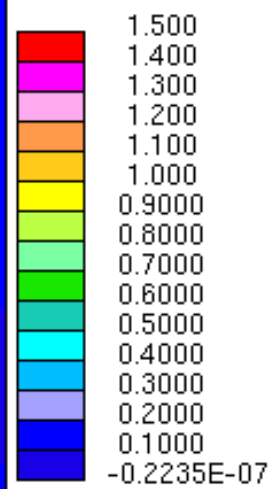
IVES OFFICE



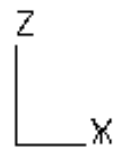
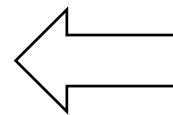
Wind velocity RMS (m/s) 200m res NE (45°)



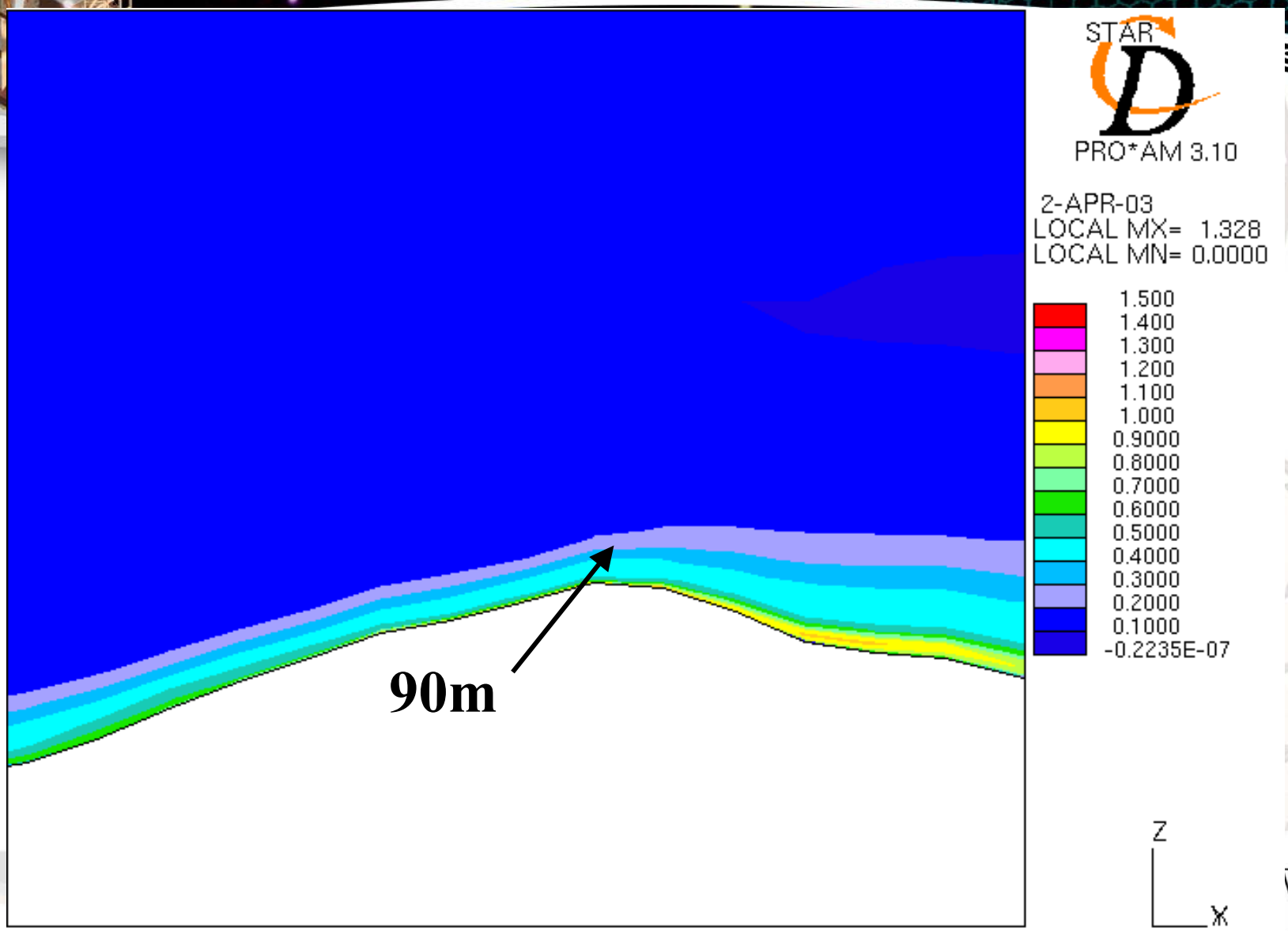
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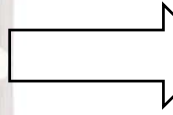
FFICE



Wind velocity RMS (m/s) 200m res SW (225°)



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Conclusions

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- **Validation still in progress**
**Las Campanas, Tololo, Paranal, Mauna Kea,
San Pedro de Martir**
- **CFD can provide useful information on key
environmental variables which help to assess
a particular site as a base for astronomical
observations**

